THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

"TO FACILITATE THE ACQUIREMENT AND INTERCHANGE OF PROFESSIONAL KNOWLEDGE AMONG ITS MEMBERS, TO PROMOTE THEIR PROFESSIONAL INTERESTS, TO ENCOURAGE ORIGINAL RESEARCH, TO DEVELOP AND MAINTAIN HIGH STANDARDS IN THE ENGINEERING PROFESSION AND TO ENHANCE THE USEFULNESS OF THE PROFESSION TO THE PUBLIC."

ANNUAL GENERAL MEETING AND PROFESSIONAL MEETING

MONTREAL, JANUARY 28th, OTTAWA, FEBRUARY 11th, 12th, 13th.

JANUARY 1919

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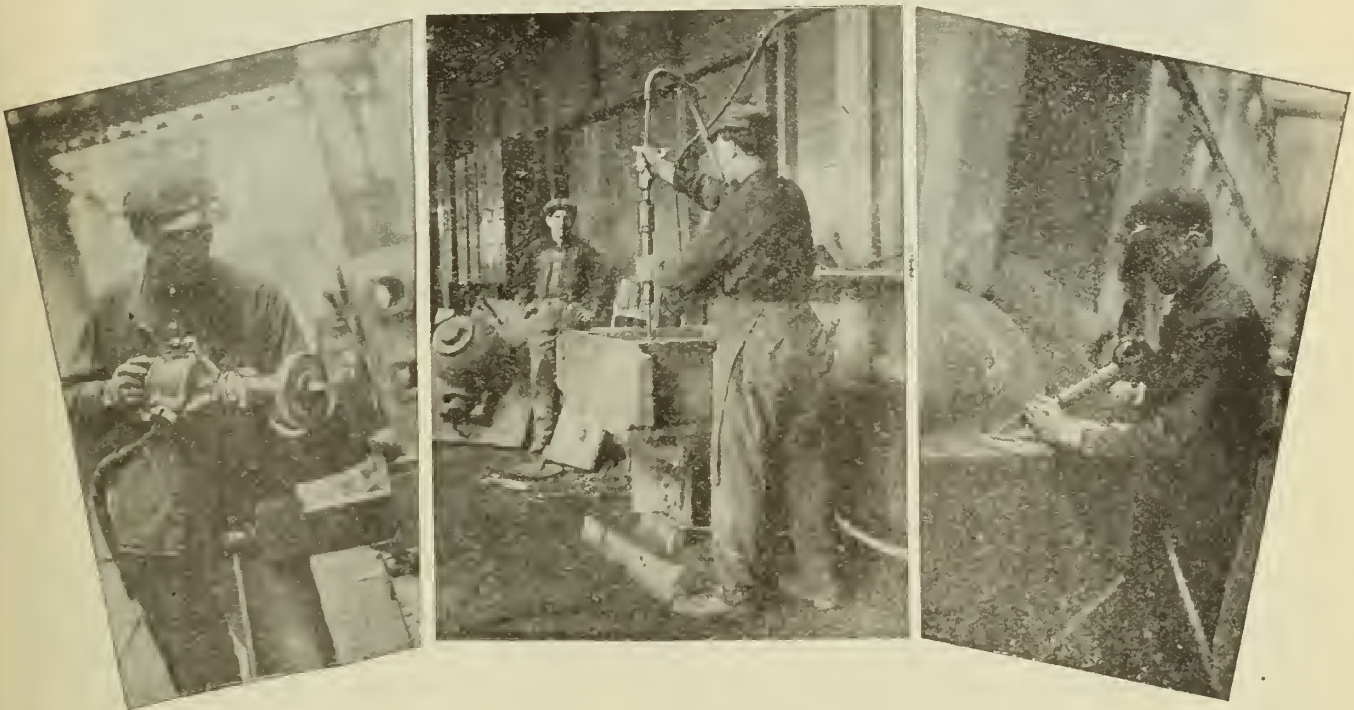

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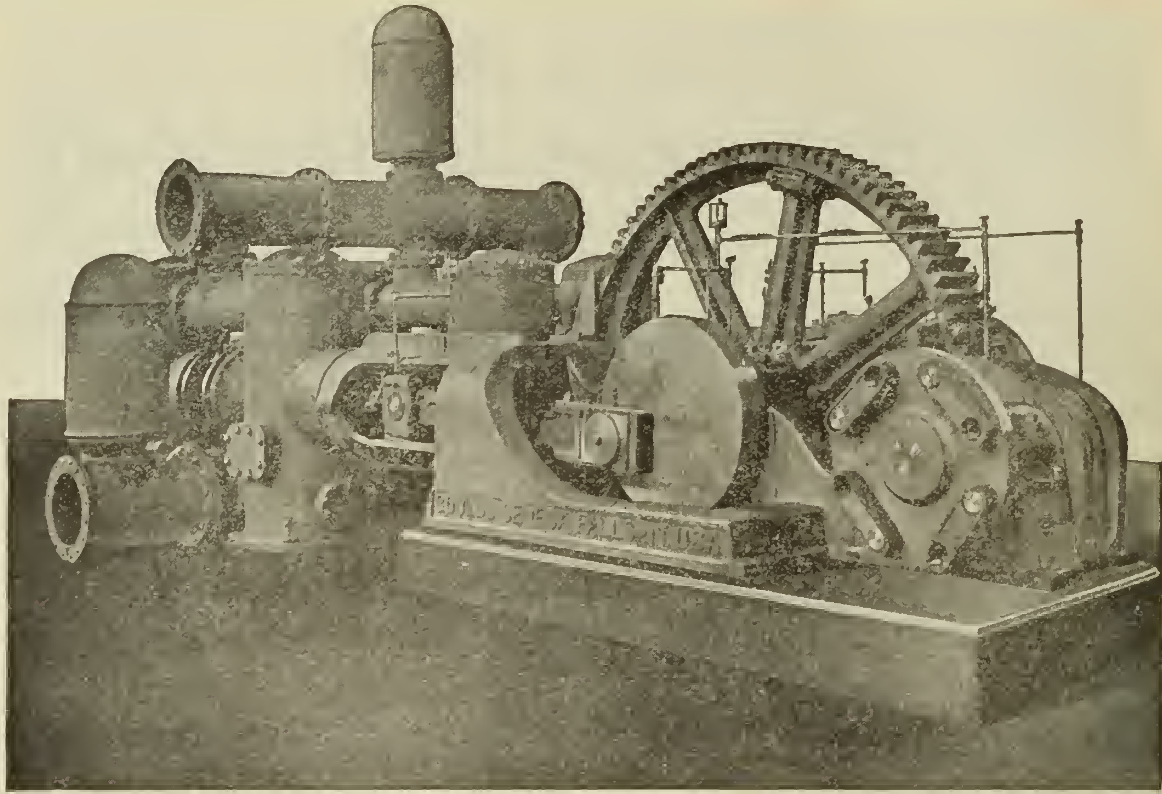

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

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THE ENGINEERING INSTITUTE OF CANADA

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Suggested Branch By-Laws

At the meeting of the Council held on December 17th, Branch By-Laws were submitted which were the result of several months' deliberation on the part of the Legislation Committee of the Council and a special committee of the Montreal Branch. These By-Laws have been submitted to the various Branches in the hope that they will receive consideration for adoption, unless there are local reasons why changes should be made.

Object

Section 1. The Branch shall promote the objects and interests of *The Institute* and shall encourage the preparation of papers and addresses on engineering subjects, or on subjects of scientific or engineering interest, both for presentation at meetings of the Branch and for publication by *The Institute*.

Membership

Section 2. (a) The members of the Branch shall consist of the Members of *The Institute* of all classes who reside within a distance of twenty-five miles of the headquarters of the Branch, and of those residing at a greater distance who, desiring to join the Branch, so notify the Secretary-Treasurer, who in turn shall notify the Secretary of *The Institute*.

The Branch may, at the option of the Executive Committee, admit persons, not members of *The Institute*, who shall be termed "Affiliates of the Branch."

(b) Any person interested in the engineering profession may become an "Affiliate of the Branch." Affiliates shall be elected by vote of the Executive Committee upon nomination by two corporate members of the Branch. The fee shall be five dollars per year, including the annual subscription of two dollars for the *Journal* of *The Institute*.

Affiliates may attend all meetings of the Branch but shall not discuss or vote upon any matter affecting the administration of the Branch.

Management

Section 3. The Branch shall be managed by an Executive Committee consisting of a Chairman and a Secretary-Treasurer, or a Secretary and a Treasurer, and six committee men, all of whom shall be elected by letter ballot of the corporate members of the Branch. A Vice-Chairman may be similarly elected at the option of the Executive Committee. The immediate Past Chairman of the Branch and the members of the Council of *The Institute* resident within the jurisdiction of the Branch, shall be ex-officio members of the Executive Committee. All members of the Executive Committee shall be corporate members of *The Institute*. Five members shall constitute a quorum.

Tenure of Office

Section 4. The Chairman, Vice-Chairman and Secretary-Treasurer shall hold office for one year. Other members of the Executive Committee shall hold office for two years, three being elected each year. Elections shall be held each year during the first two weeks of May and members so elected shall take office the first of June following.

Nominations for Executive Committee

Section 5. On or before the fifteenth day of March in each year, the corporate members of the Branch shall be called upon by the Secretary to nominate, by letter, candidates for the offices of Chairman, Vice-Chairman, Secretary-Treasurer and three Committee men. Each nomination shall be signed by at least five corporate members of the Branch, and shall reach the Secretary on or before the first day of April.

Letter Ballot for Executive Committee

Section 6. The Secretary shall mail to each Corporate Member of the Branch, before the end of April, a letter ballot stating the name and class of membership of each nominee. Instructions for voting shall be printed on the ballot, which shall be returned to the Secretary by a date fixed by the Executive Committee. All ballots shall be enclosed within two sealed envelopes. The outer envelope shall bear the signature of the voter, but the inner envelope containing the ballot shall have no identification mark upon it.

The ballot shall be counted by scrutineers appointed by the Executive Committee. All ballots which do not comply with the printed instructions shall be rejected.

The scrutineers shall report the result of the ballot to the Annual Meeting, and the nominee receiving the highest number of votes for any office shall be declared elected to that office. Should a tie result between two or more nominees for the same office, the corporate members present shall elect by ballot, the officer from those nominees. In case a tie again results, the Chairman of the Meeting shall give a casting vote.

The Chairman shall announce the names of the officers duly elected.

Sections of Branches

Section 7. At the request of ten corporate members of the Branch, made in writing to the Secretary and approved by the Executive Committee, sections of the Branch shall be established, corresponding to any of the generally recognized branches of the engineering profession, such as chemical, civil, electrical, mechanical, mining, industrial, etc.

The Chairman of the Branch shall be ex-officio the Chairman of each of the sections and each section shall have as executive officer, a Vice-Chairman, who shall be appointed by the Executive Committee at its first meeting after the Annual Meeting of the Branch, or on the authorization of any section of the Branch. He shall hold office until the thirty-first day of May following the date of his election.

Meetings of the Branch

Section 8. Ordinary meetings shall be held on alternate Thursdays from October to April inclusive, or on such other days as the Executive Committee may determine.

Special meetings may be called by the Secretary on resolution of the Executive Committee, or on the written request of seven corporate members, stating the objects of the meeting. The notice stating the object of the meeting shall be mailed at least five days before the date of the meeting.

The Chairman may call a special meeting without such formalities for any purpose other than the transaction of business.

Annual Meeting

Section 9. The Annual Meeting shall be held at the headquarters of the Branch on or before the second Tuesday in May, or on such other date in May as the Executive Committee may determine. Notice of the meeting shall be mailed to each member at least seven days before the date of the meeting. The Executive Committee shall submit a report of the operations of the Branch, and shall determine the order of business of the meeting.

Annual Report to the Institute

Section 10. The Branch shall submit an annual report of its proceedings and of its finances to the Secretary of *The Institute* who shall present it to the Annual General Meeting of *The Institute*. The report shall cover the operations of the calendar year and shall be approved by the Executive Committee and signed by the Chairman and Secretary-Treasurer of the Branch.

Alterations of By-Laws

Section 11. By-Laws may be adopted, amended or repealed by letter ballot only. Such alterations may be suggested either by the Executive Committee, or, in writing, by any ten corporate members, and the proposed alterations must reach the Secretary on or before the first day of April.

Alterations shall only be made at the Annual Meeting, and the ballot for such alterations shall be issued with the ballot for the elections of members of the Executive Committee. An affirmative vote of two-thirds of all valid ballots shall be necessary for the alteration of by-laws.

The votes shall be counted by the scrutineers appointed for the election of members of the Executive Committee.

General

Section 12. Where not otherwise provided for, the Branch shall conform in rules of order and general procedure to the methods and rules adopted by *The Institute*.

The Montreal Tunnel From an Economic Point of View*

By H. K. Wicksteed, B.A.Sc., M.E.I.C.

In response to your very kind invitation, I have come before you to-night to give you something of interest in connection with the history of the Montreal tunnel — What were the considerations which led up to it, and made it seem a practical scheme? As the Canadian Northern Passenger Department has put it in its window dressing "Why was the Tunnel built?" And I have given my dissertation the title of "The Montreal Tunnel from an Economic Point of View."

With the actual construction of the Tunnel I do not propose to deal with to any greater extent than is necessary to enable you to understand the problem,— not because there were not a great number of intensely interesting points about it, and not because I was not in the Tunnel a great many times during its progress,— but because the construction side has been dealt with very ably by my colleague Mr. Brown, and I believe is to be dealt with further by one of his assistants, Mr. Busfield, and they are both better posted in details of it than I. Mr. Brown has made tunnelling a specialty, and his whole soul was in his work, and I may say that it is a pretty large and comprehensive soul.

Economic Side of Engineering Problems

Both by temperament and training, it is the "economic" side of things which has always appealed to me most. Railways are commercial concerns, and the Tunnel is an essential part of a great railway. If it can not be justified in a commercial sense, if it can not pay interest on its cost, it has no right to exist.

This economic aspect of engineering works has come into great prominence of late years, and notably since the introduction of railways. Nearly all our great tunnels have been built to carry railways past or under obstructions of one kind or another, so that the history of tunnelling is almost altogether confined to the last 70 or 80 years, and most of the great tunnels are much younger than that.

Difference between English and American Roads

Railroad construction started on a large scale first in England, where population was already dense, and traffic was waiting to be carried in large volume. A railway once built even on what we should now consider very crude lines, was practically sure of paying its way from the very start, and the cost was a minor consideration as soon as the potentialities of the steam railway came to be understood.

It was when the building of railways extended to this continent of great distances and at the same time sparse population that it was found that not only were fixed charges a very heavy drain on railway earnings, but that capital was very hard to get in any case, and had to be brought in from outside, hence the difference in cost between the early American roads and the English ones, and the expedients of sharp curvature, heavy grades, and cheap construction, which were used to reducé the capital cost; and hence the fact that so much English capital went into American roads.

*Read before Toronto Branch, December 3rd, 1918.

Effect of Competition

As time went on, and the traffic became heavier, and as, too, other lines were built between the same termini and competition became keen, there came the era when the balancing of cost against more perfect location and construction began to be a regular study, and while I think a good many of the earlier engineers, Latrobe for instance, had thought a good deal about these matters (their works shewed that they did) it was Wellington who first committed his ideas to paper and his writings are still useful as well as monumental.

Classification of Tunnels

The element of location which conduces more than any other to reduce the cost of haul is, of course, that of gradients, and in reducing gradients in rough country there is very often a strong temptation, less often an absolute necessity, to resort to tunnelling. Hence nearly all our tunnels are in the two great mountain ranges of the continent, one east and the other west of the Mississippi River. There are a few, however, on this continent, for the construction of which there are other or contributing causes; and a great many on the other side of the Atlantic — cases where property damage was to be avoided at almost any cost, or where navigation interests were paramount, and a tunnel was more practicable than a high level bridge. The Detroit-Sarnia and Hudson River Tunnels are instances of the latter class, and the Baltimore & Washington tunnels are instances of the former, and to this class our own Montreal Tunnel also properly belongs.

Canadian Northern Location Considerations

Towards the close of 1906, more than twelve years ago, I was instructed to commence surveys and location for the Canadian Northern Railway from Montreal westward, primarily to the Georgian Bay and eventually, as it turned out, to Port Arthur to connect with the western system which had already developed to very considerable proportions. My headquarters were at that time in Montreal, so that it was natural that a great deal of my spare time was devoted to what was in any case the problem of greatest interest and best worth studying out. Montreal and its problems and growth were not a new matter to me, for I had spent three years of my earlier life at McGill, had geologized on Montreal Mountain with Sir William Dawson, and one of my closest friends was a prominent business man and an ex-mayor of Westmount.

Acquired Roads

The Canadian Northern two or three years before had purchased and completed the Chateaugay & Northern Railway from Hochelaga to Joliette, and about the same time the Great Northern Railway of Canada, extending from Hawkesbury to Rivière à Pierre on the Quebec & Lake St. John, which constituted a sort of overflow system by which part of the grain brought from Parry Sound by the Canada Atlantic found its way to an elevator in Quebec.

Ocean Terminal

The superintendent of this Eastern System was offered one of the farms near Longue Pointe and we combined to purchase this for the railway, and by this means secured an approach to the river front, and within a very short time thereafter, a connection with the Harbor Commissioners' tracks.

Freight Entry

This had already secured for the road an ocean terminal, and it developed later that from this farm, now the Longue Pointe Yard (and a very busy yard indeed), there extended a very marked depression clear across the Island to the Rivière des Prairies, and the only one of its kind between Lachine and Bout de l'Ile. Everywhere else there was a high broad-backed ridge of limestone to the north of the Mountain itself, and to the south a long talus slope of sand and glacial drift.

The Northern Colonization, afterwards Quebec Montreal & Occidental, and now C. P. R., climbed over the top of the limestone at Mile End at an elevation of 200 feet above the River and down again with a very strenuous grade of 90 feet to the mile, to Hochelaga. The Ontario & Quebec, the C. P. R.'s entry from the southwest, climbed over the talus debris and dropped similarly although not so viciously, to the Windsor Station.

Our discovery gave us an entry somewhat circuitous, it is true, but with a short maximum grade of 30 feet to the mile.

Development of Transcontinental Route

This then was the obvious route for a freight line from the West to the harbour of Montreal, and it must be remembered that the C. N. R. was at that time purely a granger road and interested almost exclusively in the hauling of wheat to the seaboard. Here, therefore, was the starting point of the survey to Port Arthur, and we still hope to see this line built at a very early date. The surveys West shewed that an excellent line could be had north of the Great Lakes to Port Arthur at moderate cost; in proportion to cost probably the best long distance line in the world. The Pacific coast extension also gave wonderful results, and the System promised to be easily the best of all the Transcontinental lines on this continent or any other.

Terminal

While, however, this arrangement was entirely satisfactory as regards through freight traffic to and from the West, it did not meet the requirements of the local traffic, both passenger and freight, of the City itself. Moreover, a transcontinental such as that described must of necessity have a suitable terminal in the Eastern Metropolis to make it complete and well-balanced, and this became the new study of the location staff.

Montreal Topographically

Montreal proper, as everyone knows and many have said, is wedged in between the River and the Mountain on a narrow strip of territory consisting first of a river flat half a mile wide, and farther back a terrace 70 feet higher, and of about the same width, extending to the Mountain Slope.

Up to thirty years ago the site was an ideal one for a city of moderate size although even then it was remarkable among American cities for its density of population. While Toronto was building up with detached houses with lawns and gardens, Montreal adhered to long terraces of houses of gray limestone built right up to the street, and extending for miles almost without a break. Only on the slopes of the Mountain the "Seats of the Mighty" of the Allans, the Redpaths, the Angus, and other merchant princes shewed more attractive surroundings, even if built on a sharp slope. Westmount was then in its infancy and was deterred in its growth by the long distances from the commercial centre of the City.

Growth due to C. P. R. Entry

Thirty years ago was marked by the advent of the C. P. R. and the selection of Montreal as its headquarters. Montreal began to grow very rapidly indeed, and is said to be increasing in population nearly 10% per annum, and has now a population of over 800,000.

Congestion

Montreal a few years ago had an area of 19 square miles, and a population of 580,000. Cleveland, with about the same population occupied 45 square miles, Boston with 670,000 — 43 square miles. Between 1900 and 1910 Montreal added 10,000 people to each square mile. New York only 4,000 and Chicago only 2,500.

Montreal, to use the words of a writer in an American paper was "choking to death for want of room". In its efforts to find this it has extended down the River almost to Bout de l'Ile, and upwards almost to Lachine, and answers much more closely even than Duluth itself to the Eastern Yankee's description of that City as being "25 miles long, 1 mile wide, and pretty nearly one mile high."

Schemes for Expansion

The long-sighted men, my business friend for one and Sir William Van Horne for another, had repeatly cast wistful and prophetic eyes towards the "hinterland" "the Great Beyond" on the other side of the Mountain. The Montreal Tramways built a line around it and Sir William suggested a tunnel of about 1,000 feet to reduce the extreme summit of the Cote des Neiges Hill. Only at one point had any actual expansion taken place, and this was largely due to the C. P. R. Mile End Station and the Tramways' extensions to it. This was along the extensions of St. Lawrence Main, St. Denis and later of Park Avenue.

This question of city expansion was one consideration which led to the conception and inception of the Montreal Tunnel, but it was not by any means the only, or the principal one.

Topography

To most Canadians the mention of the St. Lawrence suggests a river running east and west. It carries east and west commerce, and Sault Ste. Marie is pretty nearly due west of Montreal, and Port Arthur only three degrees further north; but the St. Lawrence proper from Lake Ontario to the sea flows northeast, and at Montreal it runs almost due north and south.

It is the Ottawa which is the east and west river, and it is the Ottawa Valley which has been in the past the great highway of commerce, and which has resumed its place as the route of the two transcontinental roads. The result is that the direct route from the heart of Montreal to the West lies directly through the Mountain, and almost at right angles to the River and the great thoroughfares of St. Catherine, St. James and Notre Dame, which parallel it. As grade separation was an essential feature of any terminal scheme this was a very important consideration.

Existing Railways

Three railways had already entered Montreal from the West.

The Grand Trunk had entered it when the problem was a comparatively simple one. The Victoria Bridge was located at what was considered the best point for a bridge, as was the St. Anne's Bridge over the Ottawa. The intermediate line was built as directly as possible between them, and one of the pioneer roads of Canada, the Lachine Portage Railway, was used as an approach to a dead end station in the outskirts of the city at that time. The main line did not touch Montreal as it then existed.

Thirty years later the Northern Colonization was built from Ottawa, and it climbed over the northern toe of the Mountain as already described, and entered the extreme northern end of the city, and after absorption by the C. P. R., the Place Viger Station.

Ten years later still came the Ontario & Quebec, which paralleled the Grand Trunk from Vaudreuil to Dorval, and then rose over the terrace and followed along its edge to the present Windsor Street Station. What the governing ideas were in selecting this location I can only guess, having never met the designer, but a desire to eliminate property damages and grade crossings as far as possible is evident, and the solution has been accomplished in a very clever way. It is on the whole a very satisfactory entry, but the C. P. R. is under the disadvantage, with the double approach, of having to keep up two separate terminals and a great number of passengers have to travel across town from one to the other — in coming, for example, from Quebec to Toronto. It may almost be said that there are three terminals for the Mile End Station is getting to be very popular with short distance passengers to and from the north and west. The Windsor Street approach is very interesting not only as a very good piece of work, but as shewing the development of railway ideals, and the demands of the Public in respect of abolition of crossings and concealment and suppression of smoke and noise.

Advent of C. N. R.

Nearly thirty years after the C. P. R. comes the Canadian Northern. Thirty years makes a great difference in a problem of this kind. Land values have grown prodigiously in the meantime due to the ever increasing congestion. And the education of the Public assisted by a Railway Commission anxious to please it has gone on apace. Grade separation has become absolutely essential and the absolute abolition of smoke and noise almost so.

At the same time, and from the railway point of view, passenger trains have become longer and heavier and harder to haul, so that grades must be flattened to the utmost, especially in regard to starting and stopping. Maintenance of way and operating expenses have been increasing in a much faster ratio than the corresponding passenger rates and receipts. Only the increasing volume of traffic offsetted the growing discrepancy and served to stave off the bankruptcy of the railways.

Local Freight

The passenger business alone was not the only thing to be considered. The Grand Trunk during its 60 years of occupancy, and the C. P. R. during its shorter term of existence had surrounded and honey-combed Montreal with a network of industrial spurs, sidings, and yards, in every direction. The Canadian Northern had only one small yard in the extreme north end, and its connection on the same terms as the other lines with the Harbour Commissioners' tracks for overseas business. But business to and from the local industries, the wholesale houses, cold storage plants, etc., etc., has to be hauled from three to five miles by motor trucks to Moreau Street. The handicap is altogether too great. In the district bounded by McGill Street, the Lachine Canal, Windsor Street produced, and Lagauchetière St. alone there are something like 150 of these smaller industries and plants, and a great many more within a mile radius of the Haymarket Square.

Passenger business may perhaps be described as the spiritual and intellectual function of the railway body coporate, but freight is the wholesome and nourishing food which enables it to do its work and carry on its functions. The passenger service is the side which appeals to the ordinary layman passenger just as a man's face and bearing does to a new acquaintance, but he can't keep up the prepossessing appearance unless he has his stomach full, and some little money in his pocket.

Financial

We have here a number of essentials to be provided for and a still greater number of desiderata, also many things to avoid. The most important necessity of all at the moment perhaps was the finding of the necessary capital.

Railway terminals are expensive things at the best, and this was an era of extravagance in this respect. The Pennsylvania had spent all kinds of millions on its New York entry. The New York Central was following suit with a magnificent scheme, better balanced financially, but still enormously expensive. Kansas City was building a joint 45-million terminal, and St. Paul was considering a scheme which involved encroachment on the rights of its very respectable and oldest citizen, the Mississippi River — almost as old and respectable as the Montreal Mountain itself although somewhat dirtier.

But these were all in connection with roads of long standing and financial strength. They were improvements and consolidations rather than new schemes.

The Canadian Northern while it had been earning at a great rate was also extending and building equally fast, and had largely discounted its future in its borrowings. Even in a growing North West it takes some months before a new piece of road can earn its own living, and some of the C. N. R. construction was of a nature and through such country as could not be expected to yield any adequate income except as part of the completed system.

Selection of Route

The most obvious route was to parallel the two older roads and it was very seriously proposed, but the writer for one never took to the proposition. It was neither the inexpensive route of the older Grand Trunk, nor could the very neat grade separations which the C. P. effected thirty years ago be repeated and duplicated.

The line of the C. P. had been badly bent in order to effect its entry. Everything pointed to the north instead of the south shore of the Ottawa as being the proper route of the Canadian Northern, and in this case the bend would become a right angle elbow. The right-of-way would be absolute destruction for two miles or more, and grade separation could be effected only by a continuous track elevation for the same distance. It would have been plagiarism of the worst and most expensive type.

It was proposed to join the Grand Trunk but this would merely have mitigated some of the evils of parallelism, not removed them, and the C. N. would have lost its identity and its independence at a most important point, and neither of these propositions would have been any solution of the freight problem.

Tunnel the Obvious Solution

The Tunnel was the obvious solution of the whole question, and it was adopted by the writer at a very early stage, but how was the money to be found?

The Model City

Here came in the question of expansion, of a Greater Montreal. The piercing of the Mountain, the inauguration of a fast and frequent electric service through it, would vastly enhance the value of the inaccessible lands beyond. Thousands of acres sloping gently towards the Back River were available, if they were once brought within easy reach of the business and shopping district.

As soon as the programme was announced real estate men would quickly absorb all the available land, subdivide it and sell at enormous profit. Why should not a syndicate be formed which would take this part of the business out of the hands of the real estate men, buy up the land and out of the prospective profits finance the construction of the Tunnel?

The idea once suggested took root, and some of the great financiers of the world became directly interested in it, and the idea of the tunnel entrance became an established one.

Construction Considerations

But this merely fixed the *principle* of the Tunnel, not the *line* of it, and there were several lines suggested other than that adopted. A line just south of Park Avenue was strongly advocated, the reason given being that it would be closer to the surface and much of it could be built by the cut-and-cover method.

It was pointed out in rebuttal that this would disorganize all the underground economy of the district, sewers, water pipes, and gas, and that the streets would be impassable and the abutting property uninhabitable during the whole time of construction, unless the enormously costly methods of the New York Subways were adopted. So far from being an extravagance, the bold line under the highest part of the Mountain was the cheapest in that it avoided all property damage except for a couple of thousand feet on the City end.

Selection of Western Portal

This argument prevailed finally and the bolder line was adopted, but there was still a good deal of latitude in the choice of line.

At the West end a long strip of property was offered reaching nearly to the Back Rvier. It so happened that on this property was the best point at which to cross the C.P.R.'s Atlantic and North Western line, so this end was promptly and satisfactorily settled.

Selection of Eastern Portal

The east end was the subject of longer debate and some warmth of argument. Most English-speaking people think of Montreal as extending from the Mountain to Dorchester, and from Park Avenue to the confines of Westmount, with an addition for business purposes extending east and south for half a mile from the Place D'Armes, and of St. Catherine Street as being the main and only important artery. This is only a small part of Montreal in reality but the conviction in the Anglo-Saxon mind that this is Montreal, the whole of Montreal, and nothing but Montreal is almost as fixed and ineradicable as the Englishmen's idea that the whole world is centred about his own tight little island.

As a result of this obsession, it was difficult to get any site off of St. Catherine Street even seriously considered. A line near University Street was actually adopted and abandoned only when it was shewn that this was of no use except for purely passenger business, that there was no chance for extension eatward, and that it must for all time to come remain a dead end branch 6 miles in length, and worse in this respect than either the C. P. R. or the Grand Trunk.

Connection with Harbor Tracks

Finally, the present line was adopted mainly for the reasons that it gave a continuous line from the Mountain to the water front with opportunity to connect with the Harbor Commissioners' tracks, and through them with the system extending to Quebec and Chicoutimi; that in doing this it passed through some of the best freight producing district in Montreal, and that it did all this with a minimum of property damage and with an absolute avoidance of grade crossings or even distortion of street grades.

There is, further, an avowed intention on the part of the Commission to build a dam across the River to St. Helen's and a bridge from it to the east shore which will furnish a route for such roadways and railways as care to avail themselves of it. It is more than probable that the Quebec Montreal & Southern and the Intercolonial will avail themselves of the chance, for the Grand Trunk's great bridge is already congested and overcrowded, but this is a matter for the future.

Station Site

The choice of a station site on this route was another matter of debate, which it is somewhat irrelevant to go into now. The choice for the present at any rate is that I am shewing you on Lagauchetière, within easy reach of Dorchester, but not so far below the surface as the latter.

Grades Through Tunnel

Closely allied to the question of alignment and in some respects even more important is that of grades. I have already alluded to the increasing length and weight of passenger trains. The C. P. standard transcontinental train averages 11 coaches, and with this their Pacific type engines get over the 1% grades of the Lake Superior division with reasonable ease. An extra car is liable to make them lose time. On the other hand, if the grade is flattened too much, on a long tunnel and approach such as this, trouble with drainage is apt to occur, expecially in winter.

The grade through the tunnel is 6/10 of 1%, or 32 feet per mile, and is continuous from end to end; the West Portal being thus 100 feet higher than the East.

From the West Portal the same rate of grade carries us down through the Model City for nearly the same distance. The long cutting on the west approach was introduced with a purpose, viz.: to allow the civic expansion to go on overhead without too much distortion of street grades.

Headroom

In consideration of the electrical operation the headroom required under the bridges was reduced from the regulation 22½ feet to 16½ feet, and the problem of grade separation rendered so much the easier of accomplishment.

Near Cartierville the Park & Island Railway and a mainroad alongside it have been carried underneath.

Absolute grade separation is thus secured, not only through the City itself and its transmontane annex, but for the entire length of the electric zone, nearly 9 miles, and Cartierville, a promising suburban settlement on the bank of the Rivière des Prairies, is now brought within 18 or 20 minutes of the heart of the City.

Description of Tunnel

The Tunnel itself is a very interesting one and ranks among the great tunnels of the world, being 3.25 miles in length. Only the three great Alpine Tunnels, the Mount Cenis, the St. Gothard and the Simplon, completely eclipse it in length, and there is only one in Canada which is longer, the Rogers Pass Tunnel of the Canadian Pacific.

Difficulties

It was predicted beforehand that the difficulties would be comparatively few, and so it turned out.

Very little water was met with, and this where it was expected, near the West Portal at the contact between the limestone and the older rocks on which it rests unconformably.

The core of the Mountain was almost exclusively Essexite a basaltic volcanic rock, somewhat hardtodrill, but otherwise quite unobjectionable.

Lining

It was at first thought that most of it would not require lining, and had it been a steam operated road in the open country, it is still probable that very little lining would have been put in, but its nearness to the terminal and the adoption of the trolley system, which meant support from the roof, made even a small fall a very serious matter, as it would both delay and endanger the traffic. Some little seaminess and disintegration shewed itself after exposure to the air, and in the end it was all lined with a thin sheeting of concrete, except for about 1,000 feet. This applies to the rock section.

Use of Shield

For something over half a mile at the City or East end, the roof ran into clay, although the bottom and most of the wall remained in limestone. This clay was known beforehand to exist, and it is of a very plastic and semifluid formation and contains numerous shells such as now exist in Northern seas. On account of its semi-fluid nature, and because this section led under streets and close to the foundations of buildings, it was decided to take this out under a shield protection, the shield being followed up with an arch of concrete blocks pre-cast in voussoir shape.

Practically no leakage even of water was ever visible during the progress of the work, and yet considerable settlement of the street overhead took place. Probably the moisture evaporated and escaped as invisible vapour. A great many of the houses had been set down on this soft clay and had suffered from settlement before the work was started; the further settlement was therefore of less consequence than it would otherwise have been.

Separate Tunnels

Through this section the individual tracks are carried in separate tunnels with a thin wall between them. The same is true of a few hundred feet at the West Portal. but the body of the tube is a single opening.

Heading and Speed

The heading was a " bottom " one 8′ x 12′ and was put through with very good speed. For a time in fact the American record for hard rock tunnelling was broken by an average advance of 26 ft. per day for a whole month.

As soon as a sufficient advance had been made the enlargement to full section was commenced. the arch being taken out first, and the two " benches " afterwards.

As the east end was in the City and there was no means of getting rid of large quantities of material except by means of teaming for several miles, this work had to be done from the West end, and for this reason the heading was driven faster from this end and this meant working down hill. Under these circumstances the small flow of water was particularly fortunate as the amount of pumping was small.

Shafts

In order to expedite the work a shaft was sunk 250 ft. one mile from the west end. This made it possible to follow up with the enlargement on the westerly mile without interference from the heading from the shaft, but as a matter of fact the rapid progress of the heading was to a large extent wasted because the war intervened and work on the enlargement was impeded by the difficulty in finding the necessary capital to carry it on.

Instrumental Work

The shaft was, however, designed to carry an elevator in the future to a substation at its foot, and with this in view was sunk to one side of the centre line of the tunnel. This, as may be imagined, greatly increased the difficulty of alignment of the tunnel. To offset a line on the surface to two plumb lines only some 12 feet apart and 250 feet long, and then offset this line again at the bottom of the shaft, was an operation requiring care and patience, but it was accomplished without appreciable error by H. T. Fisher and his staff.

Other Shafts

A second shaft was sunk some 70 feet just to the north of Sherbrooke Street and at the bottom of this the shield was put together.

A third shaft was projected at Pine Avenue but considerable opposition was met with from the wealthy residents of the neighbourhood and it was abandoned, and undoubtedly to advantage for it would merely have expedited the driving of the heading, not of the completed tunnel.

A fourth shaft was sunk on Dorchester Street and it was from this that a large quantity of material was removed because there happened to be a very large and almost vacant piece of property at this point on which material could be wasted for the time being, until the Tunnel became available for hauling it away.

Reasons for Electrification

As mentioned above, the Tunnel was planned from the beginning for electric traction. No effort was made to avoid the inevitable in this respect. It was felt that while very much cheaper in initial cost, a steam service through such a long tunnel would not be popular with the Public, and there would have to be installed fans and artificial ventilation, and that even outside the tunnel, on the City end, there would be a strong opposition to steam operation over the streets, and justly so, for Montreal is already more saturated with coal smoke than even Toronto.

Some of you will remember the fatal disaster in the St. Clair Tunnel when it was operated by steam locomotives, although this is not much more than one-third the length of the Montreal one. Some minor mishap necessitated a stop at the lowest point in the tunnel, and some of the train hands were asphyxiated by the waste gases from the locomotive before help could be got to them. Even on a passenger train, although the trip lasted a very few minutes, there was a certain sense of suffocation and a feeling of relief when the trip was over.

This accident precipitated the inevitable change to electric traction and in the case of the Pennsylvania and Detroit tunnels, electricity was installed from the very first.

Air Current in Montreal Tunnel

In the Montreal Tunnel, in actual experience, the air is just as fresh as it is outside and there is quite a marked natural circulation through it. The air at the City end is nearly always warmer than that at the West or country end, and rises from the terminal excavation, causing a strong draught of cool air from west to east. With the West end warmed up by a westerly sun, while the East is in shadow, the current will very probaly be reversed, but the normal conditions seem to be as above.

The electrification work is a very interesting study in itself, and was under the very able charge of W. A. Lancaster.

POWER

St. Ursule Falls

A study was made for developing power at St. Ursule Falls on the Canadian Northern line some 60 miles east of Montreal, and transmitting to Montreal, but the power was not very reliable and to make it so meant a lot of interference with vested rights and privileges which threatened to raise the capital cost and resultant interest charges to a point which meant that it would cost more per H. P. than it could be obtained for from the Montreal Light Heat & Power, and an arrangement was made with them to supply the necessary power.

Description of System

The system is a direct current of 2,400 volts, much higher than we have been accustomed to up to the present. The locomotives take the current by means of a pentagraph from a trolley wire, and weigh eighty tons.

The third rail system was considered but on account of the heavy snowfall about Montreal and occasional accumulations of ice, it was not considered desirable.

In actual test these locomotives haul a seven or eight car train against the adverse 6/10% grade through the Tunnel in 7 minutes, or practically thirty miles per hour.

Electric Zone

The electric zone extends at present only to Cartierville, which on account of its being a convenient point at which to establish a divisional yard with engine house and shops, was considered the best point at which to make the change.

Extension and Route to Ottawa

It is altogether probable that as the intermediate country gets settled up with suburban residences, a movement which has already commenced, it will be extended to St. Eustache, a very prosperous town with beautiful surroundings, and we hope eventually to Ottawa. Only the heavy cost of installation prevented this being done in the first place.

The route to Ottawa lying as it does along the banks of the River, and generally within sight of it and of the Laurentian Hills beyond, is quite the most attractive of the four existing ones, and within a mile of being the shortest. It has already made a good start in popularity, and with the additional attraction of electric traction, it should pretty nearly monopolize this business.

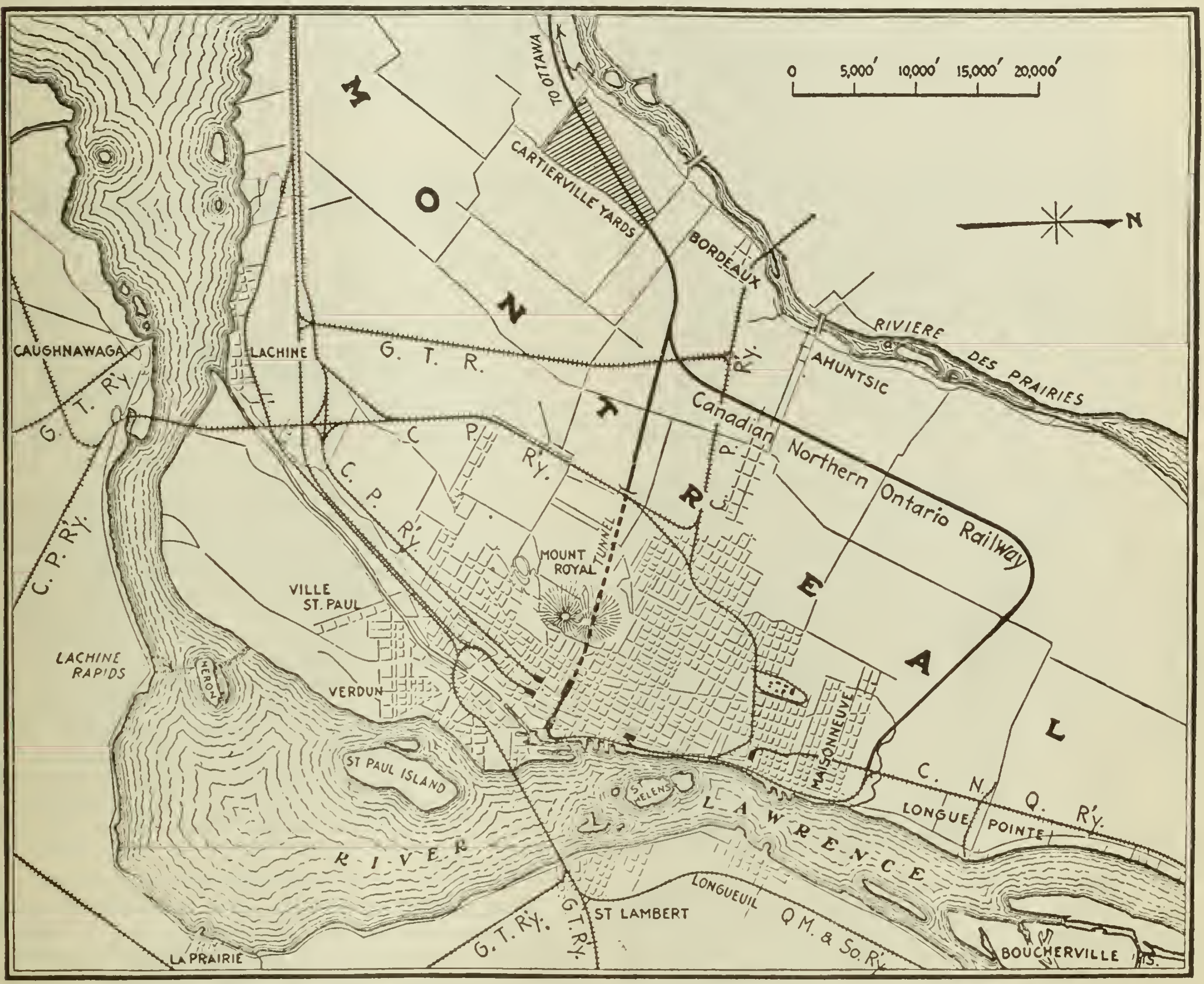


Fig. 3.—Canadian Northern Railway Terminal Lines in Montreal, with Tunnel under Mount Royal to Central Passenger Station.

Remarks Regarding Rural Roads*

By J. N. deStein, M.E.I.C.

You may have noticed that the Manitoba Motor League intend to petition the government of their province to take over the control of main highways, and a Manitoba weekly expresses itself in this connection as follows:

> "The present system of municipal roads is a howling farce. The great majority of rural councils know even less about building and maintaining roads than the daily press of Toronto knows about farming in Manitoba."

I thought it unfortunate that a man likely without any engineering qualifications, as the editor of said weekly, should express an opinion, which properly should have originated in some engineering body.

We are leaning back in our chairs and enlarging at length upon small theoretical points, perhaps how many inches to crown our main roads or whether to use eight or ten percent maximum grades, while annually tens, yes even hundreds of thousands of dollars of public monies are wasted through the present faulty system of supervision of our rural roads. Our duty — it seems — should be first to devise a proper organization in this connection.

There are plans on foot for provincial highways, linking up the various cities and towns of importance in our province, and even a possible federal interprovincial highway is being contemplated — but our rural travel will still use mainly our market roads, as heretofore under the supervision of the rural councils.

Just a few words about the present organization. Our municipalities comprise as a rule from nine to twelve townships and are governed by a reeve (elected annually) and six councillors (elected by a ward system), three councillors retiring every year, keeping thereby the individual councillor in office for two years. The councillor has the immediate supervision over the roads in his ward (1½ to 2 townships), which consists of about 80 to 110 miles of road. The annual portion of the taxes devoted to road purposes is divided amongst the councillors and forms the appropriation at their disposition for road construction and maintenance in their respective wards, usually called divisions.

The trouble seems to be firstly in the continuous change of officials. Our aim should be to devise some more permanent form of rural government, after the commission form in our cities or in the form of a municipal manager, aided by an elected reeve and council. All executive work, especially in connection with road planning, construction and maintenance should be left in the commissioner's or manager's hands.

There might be an objection raised on account of the increased financial outlay in salaries etc., but the ratepaying farmer would soon realize that their "investment" is not only earning a very high rate of interest indeed, but probably showing a considerable saving on Capital account.

The second remedy should be a change in our Municipal Act, whereby a more adequate remuneration should be allowed for municipal reeves and councillors. The honors are all theirs — but that is about all! — We find a large number of public spirited men in our rural communities, who devote their time in the best interests of their electors — but let us admit the fact: are not quite a few tempted to seek an adequate remuneration for their services in improving the roads in the vicinity of their farms, sometimes even beyond the importance of such road.

Even the small rural division is again split into districts. One year the south end are trying to get their man in, another year the north end, mainly in order to get roads. "Roads" is the issue in the campaign! Every councillor looks in many instances upon his division as a little kingdom of its own. I could mention instances where some councillor in the past developed, in a very remote portion of the municipality, a splendid net-work of roads, but only a few miles in the immediate vicinity of his farm and entirely disconnected with any market road. In the future they are left without necessary upkeep, as the next councillor refuses to spend any more money in that corner, with the result that the original, often large, expenditure is wasted eventually.

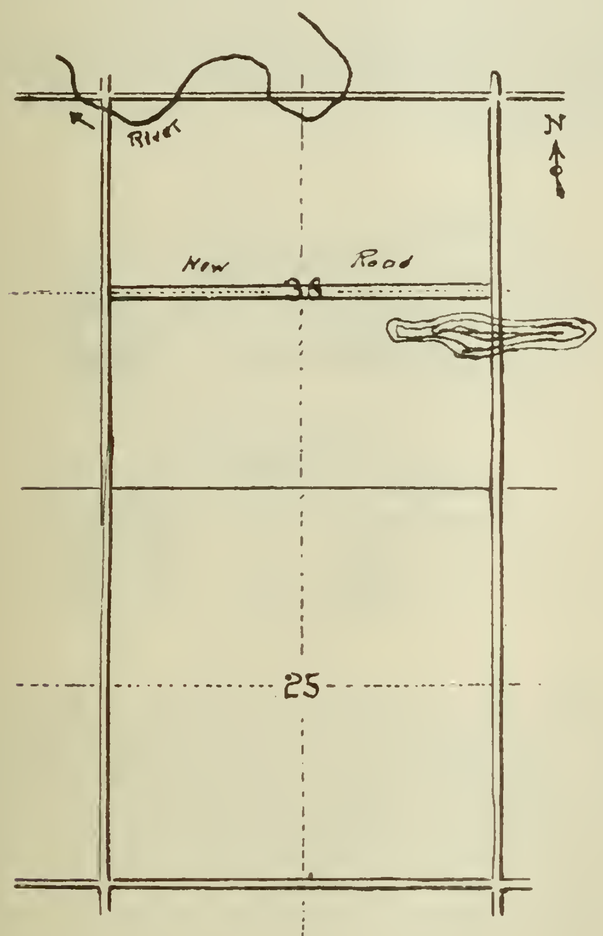
Recently our provincial government is requesting the rural municipalities to submit plans showing a proper system of main roads. Some very queer documents must reach our highway department in this connection. I know of some intances, where in one division nearly every road was shown as a main road, in another division a main road was contemplated — to suit the requirements of the councillor in question — every mile of which involved an outlay of about one thousand dollars for earthwork alone, besides being topographically entirely unsuitable for its purpose. The main road system as at present is a variable item, directly proportionate to the council, that is with every change of council the main road system used to change as a rule. It should therefore be our duty to compel the municipalities legally, not only to adopt a comprehensive system of main roads, but to adhere to it!

What difficulties does the local councillor encounter in this respect? Mainly the objection of the ignorant rate payer, who figures that his taxes should be expended on the piece of road immediately adjacent to his property. He seems to loose sight of the fact, that he travels sometimes many miles over expensively constructed road, upon which the expenditure of a frontage tax, sometimes even on maintenance alone, would result in an entirely impassable roadway. He overlooks the fact, that the heaviest tax he has to pay, which never shows up in his tax notice is the "Poor Road Tax" which however takes its heavy toll in depreciation of implements, waggons, cars and more especially in loss of valuable time. Perhaps a main road assessment could be worked out, similar to drainage assessments, taxing the direct benefits.

*Read before Saskatchewan Branch, E.I.C., December 12th.

This might overcome some of the objections. Amongst others a wheel tax has been suggested, which would most adequately distribute the expense.

I found an instance, where a municipality intends to try and set aside annually a certain sum for the development of their market roads. But there again the divisional method of road supervision has its great disadvantages. Perhaps a contemplated market road is situated right on the boundary between two divisions, and one councillor fails to understand why he should spend some of his appropriation on a road used by rate payers living in another division. May I cite an example of this kind on the hand of a sketch.



The councillor in the west division did not want to incur the expense necessary in order to open up a new road through Section 36. The main road had to go to the north and was coming from the south, west of Section 25, but had to jog a mile east, before continuing to the north. The west councillor suggested to jog it east on the south side of Section 25, thence to carry it north, there being no river crossing provided. He reckoned, this would give him 1½ miles of mainroad less to build or maintain at the expense of the councillor to the east of him. His suggestion would have necessitated the crossing of a large slough, the cost of which alone was estimated at about $1,000, while the total expense in connection with opening up the new road through Section 36 was about $350 (including necessary right-of-way), besides giving topographically a road much superior to the other solution.

The municipality in question, like several others, adopted the form of road committee, in order to overcome the autocratic tendencies of some councillors and to consult with the individual councillor on road questions. That is, the reeve has the power to call upon any councillor to form a committee in each individual division to decide upon questions of policy and expenditures in connection with road work, the decision of which committee is binding upon the councillor.

A worse case even is the boundary between two municipalities, where often the settlers in one municipality can hardly reach the market town, if the market road is situated on the boundary between the two municipalities and is under the supervision of the other municipality, the ratepayers of which do not use it at all.

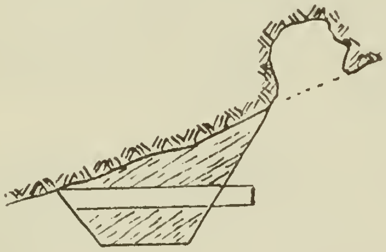
I pointed out already that unfortunately sometimes the councillor in deciding upon his road work is governed by anything but altruistic motives. I can however mention one instance where it was the custom of the councillor to call annually a meeting of his divisional ratepayers and let them decide on a road program, which he tried to execute to his best ability with the means at his disposition.

Let us turn now from mistakes in road policy in the present form of administration of rural roads to engineering errors made in this connection. H. R. Mackenzie very ably showed in a preceeding paper the necessity for engineering supervision in this connection. May I be permitted to add a few examples picked at random, even the work of a common road grading machine requires some knowledge and judgement, especially as to the necessary width of road. An instance came to my notice where a councillor personally operated the grader over several miles of mainroad, spending considerable time going up and down. Fortunately the road allowance is only 66 feet wide, so that his activity had to reach a limit. He made a regular boulevard without crown and in very poor shape, at double the expense necessary.

Running the grader continuously through cuts and over-fills, as it is sometimes done, creates a grave danger to the surface of the fill. The cut ditch is being continued unto the fill, instead of being turned off at the mouth of the cut. This means that the water, accumulated in the cut, is being drained right unto the fill. Mostly however the cut ditch is conspicuous through its absence, creating as much danger as in the former case.

Why should a councillor, who might be a very successful farmer, have to decide on engineering questions for which a special training is required. Naturally errors involving the loss of considerable money will often occur.

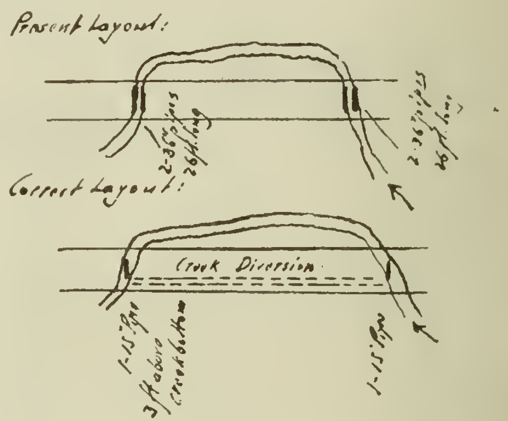
I would call your attention to sketch No. 2, depicting a section on a creek crossing east of Regina. The fill on the upper side was about ten feet, on the lower side about 18 feet. A 36″ pipe about 24 feet long was stuck through the fill as indicated. What happened last spring? Half of the fill washed out with the spring freshet and when inspected by the writer the damage to the road bed had been repaired, but a large hole had been created at the foot of the lower slope. A 36″ stream of water dropping about 8 feet has naturally some force. What remedy did the councillor suggest? He reckoned that by placing another 36″ pipe of the same length at the same elevation, he should be able to improve conditions. What would have happened? Two 36″ streams dropping without an apron straight down would have at least doubled the cavity at the lower end, besides still creating a considerable head of water in the spring. From information gathered I judged that about 45 sq. feet of area were required to carry the spring flow, while provision would have been made for only 14 sq. feet. Another washout with a likely damage to the pipes would have occurred and the hole at the bottom would have gained such dimensions, that the whole crossing might have had to be shifted. Fortunately I persuaded the councillor to desist from placing the additional pipe and after taking out the pipe he had in at present, we constructed a small wooden bridge, about 10 feet wide and 6 feet high, leaving enough room inside of this



structure for a permanent concrete culvert of the necessary water carrying capacity.

In my sketch No. 3 I show a piece of an east-west road allowance which a coulee crosses twice in about 600 feet. What had been the solution in this case? Two 36″ pipes had been placed at each crossing, necessitating an outlay of nearly 700 dollars. The whole piece of road allowance was low and had been filled about 4 feet high, the material being taken from the west end. What should have been done? The coulee should have been diverted and kept on the south side of the road allowance entirely. The proposed diversion would not have involved any additional expenditures, as the material from same would have made the adjacent fill. An objection was raised, that the water would have been shut off from the settler north of the road, who used his land for pasture. A remedy could have been easily provided by placing a 15″ pipe at the bottom end of the stream (Point A) and another 15″ pipe about 3 feet above the lower end (Point B), thereby creating a reservoir for the landowner and supplying him with more water, than he ever had before, as at the time of my inspection — about July — the creek was dry. The total expenditure for pipes in this connection should have been about 120 dollars, as against 700 dollars actually spent.

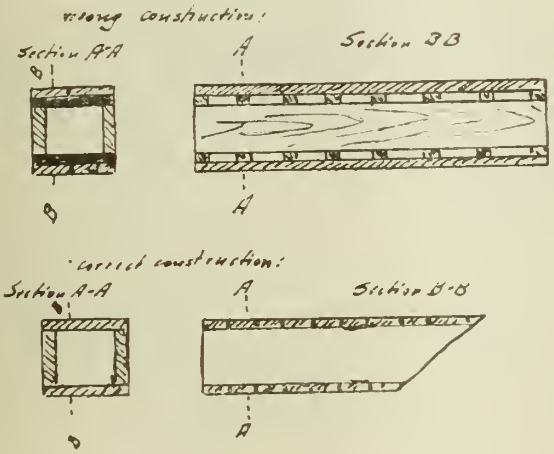
Time after time a councillor will insist on opening up a market road on the road allowance, where topography would only permit the construction of a fairly good pack trail. After spending considerable time and money on this impossible problem, it is eventually abandoned and a road diversion substituted. But on the other hand there are numerous instances, where the road should have been kept on the road allowance but a diversion made instead. The councillor seems to dread to have to build a grade through water, no matter how small a pool he encounters. The rate-payer's horseflesh is likely unwilling to tackle this moist problem. This consideration of having to do the work by day labor calls often for execution against all proper rules of earthwork construction. As already pointed out by me at out Saskatoon meeting: "As long as we do not abolish day-labor, as long we shall cause the taxpayer's money to be wasted without providing roads." A large number of municipalities are already doing contract work, though in most cases the work is laid out by the contractor himself and measured by the councillor with results far from correct and satsifactory.



Most sins are however committed in connection with bridges and culverts. It is nearly criminal how little consideration is paid to the required size of the opening. We find streams in which originally only a 12″ pipe was placed, because it might have happened to have been on hand. Let the next man take care of it is often the rule. In the spring after that a 48″ pipe was placed on top of it, the year after another large pipe was put in a couple of hundred feet away at a place over which the spring flow had gone, because as very often happens the fill at the bridge or culvert is considerably higher than the rest of the grade. Creek diversions or corrections are mostly unknown. No matter how little work is necessary to straighten a run so as to bring it at right angles to the road and save length of structure and damage to the fill, invariably the culvert or bridge are placed at an angle. Some of our roadbuilders got so used to this way of placing pipes or boxes, that I found several cases where pipes in sloughs had been placed at an angle without any reason whatsoever.

For structural errors let me call your attention to the simplest possible instance, the small wooden box, which you see on my sketch No. 4. The top is nearly always placed at right angles to the road. Taking a 12″ plank of 3″ stuff (the dimension which should be recommended for this class of work) a maximum width of only 6 inches can be obtained this way. Where an increased width was necessary, the roadbuilder tried to overcome the difficulty by nailing strips across the top. I looked at a newly built culvert placed about two weeks prior to my inspection. The same was already half full of earth coming in naturally through the large holes. The most natural solution would be to lay the top of bottom pieces parallel to the road, enabling the use of a span up to about 20 inches without any bottom support, besides meaning a considerable saving in maintenance. by having to renew only the few short pieces generally worn in the line of the rut.

But when it comes to larger culverts and bridges, it is certainly astonishing what structures a lay-mind will produce in this connection. Our Highwgy Department has prepared a set of standard plans, covering various



openings and though — especially their plan for wooden bridges — is not entirely above criticism, yet, if their standards were adhered to, some useful structures might result. The necessity for mudsills, the importance of obstructing the watercourse as little as possible, the fact that wood will not stick together by mere friction, the building of the structure with a view for easy inspection and maintenance are nearly always overlooked. I could cite numerous examples of not only faulty construction, but of actual waste of monies spent for this purpose by building culverts and bridges entirely unfit to serve their purpose and which will require a very early renewal, besides calling for continuous maintenance expenditures. Even the lack of expert inspection of bridges and culverts built in the past by the municipalities or the government will necessitate early renewals where a comparatively small sum spent at present might prolong the life of the structure considerably.

Several municipalities have experimented in the past with concrete structures. I found archculverts the generous dimensions of which would have made me think they were some old Cyclopean walls, if I had not been assured that they were built in our generation. One type of structure we should recommend however, which is more permanent, easily built and maintained if properly designed and constructed, that is culverts and small bridges with concrete abutments and timber deck, which concrete abutments should only be recommended when there is no sign of alkali in the soil. Any carpenter can make the necessary forms for the abutments. In the last few years this type of structure is gaining popularity, but again the layman makes gross errors, mainly putting in a centre supporting pier, when his stringers would have carried the entire length between abutments, bedding his wooden stringers solid in the concrete, keeping his abutments straight, never thinking of reinforcements, not providing enough foundation area, etc. I saw even concrete abutments resting on a pile of fairly large, but loose boulders over two feet high above the ground.

I could enlarge upon this subject *ad libitum*, but think it is time to summarize some of my statements.

Firstly: The executive organization of our rural municipalities especially as far as the road planning, construction and maintenance are concerned should be placed on a more permanent basis. It should further be more centralized than the divisional work is at present. The rural municipality is a small enough unit!

Secondly: Road engineering is a recognized branch of our great profession, requiring considerable training and education. Why let the ratepayer's money be wasted by amateur attempts at road-building. Make it independent of local petty politics and put it in the hands of an engineer Many councillors in rural municipalities agree with the engineer most heartily in this respect.

Thirdly: Make the position of reeve and councillor more attractive, especially in reimbursing them more adequately for the time spent on their public duties, of which the superintendence of the road-work, as at present, is the most strenuous. You will receive more cheerful attention and less resignations.

Fourthly: Abolish the entirely unsatisfactory day-labor system by substituting contract work

In conclusion I might state, that it was my aim in this paper to show the fallacy of our present system in letting the rural councils, with their continuous change in policy and composed mostly of lay men in our profession, handle the important problem of providing rural roads. I hope that our road-committee and more especially our representative on the road-committee of western branches of our *Institute* will work out some organization in this respect to be embodied in our Highway Act.

If my modest contribution has furnished even one of the small pebbles of the future foundation of this structure, I shall be more than satisfied with my work in this connection.

Doubly Reinforced Beams

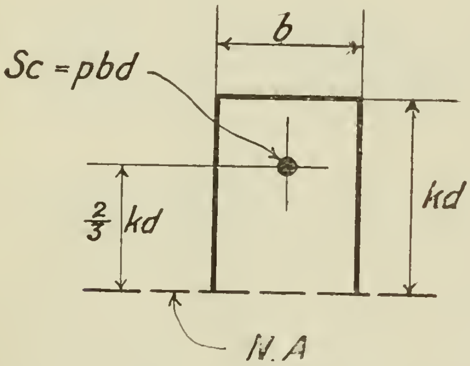
By E. G. W. Montgomery, A.M.E.I.C., Saskatchewan Branch.

There is at present no simple method of analysis by which the requisite section of a doubly reinforced concrete beam can be determined, and it has occurred to the writer that a method used by him might prove of use to others.

If the position of the centre of compression in a concrete section, having compression reinforcement, be known, the analysis of such a section is simple. The obvious thing therefore is to know where the centre of compression falls.

The figure shows the compression area of a beam having steel in compression. If the centre of gravity of the steel be placed at $\frac{2}{3}$ kd above the neutral axis, the centre of compression will also lie at that height. For the height of the Centre of Compression above the N.A. =

$$\frac{\frac{b\,(kd)^3}{3} + nSc\,\frac{(2\,kd)^2}{3}}{\frac{b\,(kd)^2}{2} + nSc\,\frac{(2\,kd)}{3}} = \frac{2}{3}\,kd$$



By thus placing the compression steel, the length of the couple arm is the same as for beams with single reinforcement, and the percentages of compression and tension reinforcement are easily determined for any given working stresses.

Consider stresses of 600 and 15,000 with n = 15.

$$\frac{\text{Ht. of section above N.A.}}{\text{Depth of section below N.A.}} = \frac{nfc}{fs} = \frac{600 \times 15}{15{,}000} = \frac{3}{5}$$

$$\frac{\text{Distance of compression steel from N.A.}}{\text{Distance of tension steel from N.A.}} = \frac{2}{5}$$

$\therefore \frac{Sc}{S_{tl}} = \frac{2}{5}$; S_{tl} being the excess steel in tension required to balance the steel in compression.

The percentage value of St (ordinary tension reinforcement) required for the given stresses =

$$\frac{kfc}{2fs} = \frac{3}{8} \times \frac{600}{30000} = .0075$$

and the total tension reinforcement required viz.,

$$S_T = St + S_{tl}$$

If now any percentage value, say, .0075, be assigned to Sc then

$S_{tl}\ \% = \frac{2}{5}\,Sc\% = .003\%$; and $S_T\% = (.0075 + .003)\% = .0105\%$.

It is known, and will appear from a preceding result, that, $k = \frac{3}{8}$ and $\therefore\ j = \frac{7}{8}$, and as this completes all the data required,

$$\text{B.M.} = S_T \times 15000 \times j\,d = .0105\,bd \times 15000 \times \frac{7}{8}\,d$$

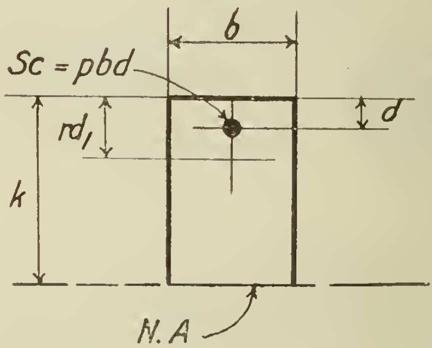
$$\therefore d = 0.0852\sqrt{\frac{\text{B.M.}}{b}}$$

This determines the concrete section and the areas of tension and compression steel required are obtained from percentages above stated.

The reader will notice that the values for k, j, and St are the same as for beams having tension reinforcement only; while the value for S_T varies with the choice of a value for Sc as does the equation to d. It is therefore, a matter of current practice as to what percentage value shall be assigned to Sc and therefore as to what the equation to d shall be. The writer's purpose is only to show how simply, percentage values and an equation to d (or b) can be obtained, for any assigned stresses.

It might be urged against this method that it sets the compression steel too low in the section and is therefore extravagant. Such an objection would be debatable, but it can be met by showing that the centre of compression can be set at any point in a section and percentage values and an equation to d be derived therefor.

The figure shows the compression area of a beam containing steel.



If k denotes the depth of concrete in compression, and the modular ratio is assumed to be 15, and if rd_1 = depth to centre of compression, it can be shown that $k^2 = \frac{k - d_1}{k - 3rd_1} \times 90\,pd \times (rd_1 - d_1)$. Then if $d_1 = \frac{1}{4}\,k$ and $rd_1 = \frac{5}{16}\,k$, $k^2 = \frac{k\,(1-\frac{1}{4})}{k\,(1-\frac{15}{16})} \times 90\,pd \times \frac{k}{16}$ $\therefore\ k = \frac{135\,pd}{2}$

For any given stresses k (the usual kd) is known in terms of d. Thus for stresses of 600 and 15000 in concrete and steel respectively $k = \frac{3}{8}\,d\ \therefore\ \frac{3}{8}\,d = \frac{135\,pd}{2}$

$\therefore$ p (percentage value of Sc) = .0055; like value for $S_{tl} = \frac{3}{4} \times \frac{3}{5} \times .0055 = .0025$ $\therefore$ percentage value for $S_T = .0075 + .0025 = .01$.

$$j = \left(1 - \frac{5}{16} \times \frac{3}{8}\right) = .883 \text{ and } d = .0869\sqrt{\frac{\text{B.M.}}{b}}$$

In conclusion it might be said that doubly reinforced T beams can be as simply analysed as rectangular beams.

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Nineteen Hundred and Nineteen opens a new year on the calendar, a new epoch in the history of the world and a new hope in the hearts of mankind. In this new era towards which we look forward with confidence, let us resolve that as members of a great profession, we will do all in our power to bring the profession to its rightful exalted position.

May the members of this Institute enjoy during the coming year, a period of blessing greater than any in the past, with health, happiness and prosperity in full measure.

Annual General Meeting

Remember the dates of the Annual General Meeting and the General Professional Meeting. On January 28th, the Annual Meeting will be held in Montreal, at which time auditors will be appointed and scrutineers named to count the ballots, after which adjournment will take place to meet at the Chateau Laurier, Ottawa, on February 11th. The General Professional Meeting will continue February 12th and 13th.

Canada's Need

Under the above heading, Julian C. Smith, M.E.I.C., member of Council, whose established position places him in a position of authority, has written a symposium of the situation in Canada in relation to requirements for the future. After speaking of the heavy debt, he outlines what it is desirable to accomplish, as follows:—

1. We desire that all the industries of this country as nearly as may be, shall operate successfully, and that all workers in Canada shall have work to do, and proper recompense therefor.

2. We desire to accomplish the first item without increasing the burden of our own country, and passing along a greater debt to our successors.

3. In order to accomplish the two conditions above, we desire that the taxation levied by the Dominion, Provincial and Municipal Governments shall be kept to the minimum requirements, and yet shall be sufficient so that proper sinking funds may be established to the end that within a reasonable time the debts which have accrued may be substantially reduced.

4. The above points all resolve themselves into the problem of increasing the available wealth of this country as rapidly as possible.

Following a discussion of the question of increasing wealth by economy, he states that the most important increase of wealth is by means of agriculture which should be increased in every way possible. Mining also should be developed with a view to encouraging the production of minerals so that the burden of mining companies may be kept within reasonable bounds.

This would lead to an increase of the export and the sale of mineral products. The policy should be pursued and the encouragement of such industries as that of paper and pulp and the development of water power. In connection with this important matter Mr. Smith says:

Canada is fortunate in possessing a large number of valuable waterpowers. It is unfortunate in possessing apparently a large number of people who are anxious to prevent the development of these waterpowers.

Although in the muck-raking literature of the last ten years, the development of waterpowers has come in for an undue share of attention, few people realize that after all some 90 per cent of the total amount of power utilized on the continent of North America is developed from coal by means of steam plants, and that only about 10 per cent is developed from waterpower.

This overwhelming use of steam power, as against waterpower, is due altogether to the economic reason that it was cheaper to put in the steam plants and operate them, than to develop waterpowers under the conditions surrounding the development of these waterpowers.

Waterpowers have important uses. The principal economic use of waterpowers to-day is to serve these industrial purposes where the load is practically continuous. Such loads include the grinding of wood pulp, the operation of large industrial plants which operate continuously, and principally the operation of electric furnaces where, combined with the continuous use of power, is to be had a further advantage in the high temperature of the electric arc.

Canada is similar to some other northern countries, such as Norway, in having waterpowers. The coal which Canada possesses is limited and located in the extreme East and West of the country, so that the expense of getting the coal is now, and probably will be higher than in countries like England and the United States. It is therefore essential that the waterpowers be utilized to the maximum extent possible, so as to decrease the amount of coal which is purchased from abroad. By using one of our own resources instead of buying the material outside the country, a distinct economic gain accrues, always provided that the expenditure for the waterpower itself, the method of development etc., are undertaken and carried through in such a fashion that there really be a saving by its operation.

The total amount of energy used for lighting purposes, and for the small user, that is the home user or the minor factory, does not exceed 25 per cent of the total energy developed for electric power purposes. The other 75 per cent is used for industrial purposes by a relatively small number of consumers, namely — the capitalists who have been held in such scorn.

The Dominion of Canada, and particularly the Province of Quebec, has a great opportunity in the next few years of establishing a vast series of waterpower developments. Such developments will lead to the investment of large amounts of money, the employment of many men during the construction period, and the establishment of huge industries to use the electric power when developed.

With the creation of these industries will come the ability to export from this country the products made with electric power; and we will thus be turning into money natural resources which are now being wasted, and bringing that money back into this country to add to our wealth.

From this brief summary of the conditions which are going to face us, it seems obvious that those natural resources which exist in this country should not be kept for our distant successors. We will find the natural conditions such, that however great may be our haste, the development of our resources must take much time, so that we need not worry over their too rapid exhaustions.

We have in Canada the best sources of wealth in the shipping of our agricultural products, our mining products, and the possibility of obtaining products from our waterpowers. We are rich in potential things, and we must convert these potentialities into actualities. A policy of expansion and development of such resources must be carried out, and it must be recognized that in order to carry out such a policy, the promoters of the desired enterprises must be granted proper compensation for their efforts. The cry for conservation of our resources which one has heard so much for the last few years, should be toned down, until it means for the greatest benefit of Canada, an immediate development of all of our available resources so that we can become more powerful, more wealthy and pay the debts we have incurred.

Canada's Maps Catalogued

Engineers will learn with interest that a catalogue of maps has been published by the Geographic Board of Canada by which it is possible to tell at a glance whether a certain area of the Dominion has been mapped, what the maps of this area are and by whom published.

A map is the representation of surveys; usually, it originates in a survey department. The survey may be an elaborate topographical survey or a more or less superficial one; hence there are maps of many different kinds.

In Great Britain, a detailed topographical survey of the whole country has been executed by one organization, the Ordnance Survey. The results are published in a few series of maps, each series on a suitable scale. It is a simple matter to select any sheets of a series that may be required for any particular purpose; these sheets give all the information that can be looked for in a topographical map, and so there is no need to search elsewhere for anything better. The same work is carried out in France by the Service Géographique de l'Armée, an organization corresponding to the Ordnance Survey of Great Britain. Italy, Austria, Germany and other European countries have similar organizations and publish regular series of topographical maps.

A small beginning has been made in Canada but only a few topographical sheets have been issued and they include but a very small portion of the Dominion. With this exception, the maps available, where there are any, are more or less rudimentary. For the outlying regions, rough exploratory maps are the only ones in existence.

Many government organizations are engaged in mapping. The federal services who are executing surveys for that purpose are the Geological Survey, the Topographical Surveys (Surveyor General's), the Hydrographic Survey and the Military Survey. The Geological Survey has the greatest number of maps to its credit; our knowledge of the geography of the outlying portions of the Dominion is almost entirely due to its explorers. The Surveyor General comes next; the sectional maps issued by his office cover the western provinces with the exception of British Columbia, and his publications include many topographical and other maps. Charts of the sea coasts and inland navigable waters are issued by the Hydrographer. The Military Survey is a topographical survey; some sheets in Ontario and Quebec have been completed.

The lands and mines departments of the several provinces are also making surveys and issuing maps The British Admiralty, the U.S. Coast and Geodetic Survey, the U.S. Hydrographic Office, the U.S. Lake Survey, the

French Service Hydrographique, are publishing charts which include parts of Canada. Other maps of Canada are found in the bulletins or journals of geographical societies and in books of travel and exploration.

After their publication by the survey organizations, the maps are frequently copied, re-arranged, compiled, or put in a different shape, by other services or editors of geographical publications. Some of these compilations may be the work of persons unskilled in surveying and may actually be misleading.

Among such a multiplicity of maps and variety of origin, it was somewhat difficult for anyone but an expert to ascertain what maps of any particular region or locality had been published, and where they could be obtained. This difficulty is removed by the "Catalogue of the Maps in the Collection of the Geographic Board."

The nature of the work of the Geographic Board requires as large and comprehensive a collection of maps of Canada as can be obtained. The collection, which on the 1st January, 1918, consisted of 1258 maps, may be considered as fairly complete. With few exceptions, it includes all the important maps issued during the last fifty years and many earlier ones. Generally, plans on a scale greater than one mile to the inch have been left out but a few were included for special reasons.

A graphical index of eleven sheets accompanies the list of maps. The outlines of each map are shown in blue on the index sheet, the catalogue number of the map being inserted in the upper right hand corner.

The catalogue is divided into five parts, the first one, "Dominion," containing all maps of more than 400 miles in length or breadth; these are shown on sheet No. 1 of the index. The other parts are Maritime Provinces,— Quebec, Ontario, Manitoba, Saskatchewan, Alberta and the Northwest Territories,— British Columbia and Yukon. Any map less than 400 miles in extent is outlined on the index sheet, or one of the index sheets of the province in which the greater part of the map lies; generally it is not shown on the sheet of the adjoining province.

Copies of the Catalogue can be obtained from the Secretary of the Geographic Board of Canada, Royal Bank Building, Ottawa.

New Certificates

Many corporate members who have been elected within the past nine months have been wondering why they have not received their certificates of membership. The delay has been due to the fact that a new certificate has been under consideration and was given final approval at the meeting of Council on December 17th. It is intended that the certificates will be prepared as soon as possible and forwarded to those who have been elected since the change of the name has been effected.

A number of inquiries have been received regarding changing the old certificate, and this question will rest entirely with the members. All who desire, may receive one of the new certificates by paying the regular rate.

Institute Fraternity

On December 4th, a letter was forwarded by the Council of *The Institute* to the Council of the American Society of Civil Engineers, which is reproduced below and a similar letter to the Councils of the American Institute of Electrical Engineers, American Institute of Mining Engineers and the Institution of Civil Engineers of Great Britain. As the American Society of Mechanical Engineers was holding its Annual Meeting at that time, a telegram of good will was forwarded which was read at one of the sessions and received with enthusiasm. The letters in question were as follows:

Gentlemen:—

Taking advantage of the occasion offered by the signing of the armistice terms imposed by the Allies and the United States, we desire to extend to the Council and Members of the American Society of Civil Engineers, our cordial greetings of felicitation and good will.

It is with unusual satisfaction that we find ourselves banded together in having helped to achieve a common purpose. Members of our respective organizations have played no small part in the world events, which, we believe, should lead to a greater recognition of the part the engineer plays in the world's development.

Assuring you of our highest regard and cordial good will and expressing the hope that in our common aim to work for the elevation of the engineering profession we may be drawn closer together in our mutual endeavours.

On behalf of the Council of
The Engineering Institute of Canada,
Yours faithfully,
FRASER S. KEITH,
Secretary.

Replies to this letter show how cordial is the feeling which exists between ourselves and our sister engineering societies in the United States. Quite recently the question has come up of closer co-operation between the two branches of the American societies, which have been established in Canada and ourselves, leading to affiliation or amalgamation, which has been discussed but as there is nothing in our By-Laws which will enable us to admit corporate members, except inasmuch as the individual is qualified, it is not possible to adopt such a procedure. In the new By-Laws the Branches have power to establish sections representing the main divisions of engineering and through these sections a member interested in any particular line may receive the greatest benefit. The suggestion has been received that members of other engineering societies in good standing be admitted with a lower entrance fee.

The Presidents and Secretaries of all our sister societies have been invited to attend our Annual General Meeting and it is expected that several will accept the invitation. Already the President of the American Institute of Electrical Engineers, Comfort A. Adams, has intimated that he will be in attendance, and also Alfred D. Flinn, Secretary of the Engineering Council. The attendance of men prominent in other societies will give an opportunity of discussing matters of mutual interest.

The following letter has been received from the Secretary of the American Institute of Electrical Engineers:

Dear Sir:—

Your communication of December 4th was presented to the Board of Directors of this *Institute* at a meeting held in Philadelphia, December 13th.

The Board directed me to convey to you its sincere appreciation of the sentiments expressed in your letter, which are heartily reciprocated, and to advise you that this Institute is in full accord with your organization in the belief that the coming economic, social, and technical developments impose obligations upon and afford opportunities to the engineering profession which demand the close co-operation of all engineering societies.

This Institute will be glad at all times to work with your organization of our brother engineers in Canada in the interests of the entire profession.

Very truly yours,
F. L. HUTCHINSON, Secretary.
American Institute of Electrical Engineers.

Branches Memorialize Government

On December 18th a deputation representing the Ottawa, Hamilton and Toronto Branches, in all fifteen members of *The Institute*, presented a memorial to the Honourable the Provincial Secretary of Ontario, which included the recommendations made by the Committee on Sewage Disposal of the Toronto Branch consisting of Professor Peter Gillespie, Fred A. Dallyn, William R. Worthington, Irving H. Nevitt and Willis Chipman. The report forwarded by the chairman of the Committee, Willis Chipman, to Geo. Hogarth, Secretary of the Toronto Branch, and which constituted the memorial to the Provincial Secretary, is as follows:

Dear Sir:—

The committee appointed by the Toronto Branch re Sewage Disposal has held five meetings since September last, at which many questions connected with Sewage Disposal were discussed and considered, and at a final meeting held on the 14th instant, it was decided to submit the following recommendations to the Branch for submission to the Parent Institute:—

1. That the Provincial Public Health Acts of the different provinces should provide that two or more members of each Provincial Board of Health shall be engineers and corporate members of *The Engineering Institute of Canada.*

2. That the Provincial Public Health Acts should provide that all reports, plans, etc., respecting schemes for sanitation and sewage disposal required to be filed by Provincial authorities, shall be prepared, signed and submitted by an engineer, a corporate member of *The Engineering Institute of Canada.*

3. That Dominion Legislation should be enacted respecting the pollution of International and Inter-Provincial Waters, and that Provincial Legislation in the different Provinces respecting stream pollution be made uniform as far as practicable.

4. That the Public Health Acts of each Province should give to the Provincial Boards of Health some measure of control over the operation of municipal water purification plants and sewage disposal works.

5. That all Provincial Public Health Acts should stipulate that no municipality can submit to the votes of the electors any by-law providing for the raising of money for the construction, alteration or extension of any water works system or water purification works, or of any sewage system or sewage disposal works, without having had the approval of the Provincial Board of Health, based on plans, reports and designs submitted by engineers.

6. That the keeping of accurate and up-to-date records of all extensions and services added to sewer and waterworks systems, should be required of municipalities by the Provincial Board of Health. Where municipalities have no system of their own for keeping such records the adoption of a method endorsed by the Provincial Board might be insisted upon.

7. That where Provincial Boards of Health maintain laboratories for the investigation of problems in public sanitation, such laboratories might, under reasonable conditions, and with much advantage to the country, the engineering profession and the Boards themselves, be placed at the disposal of this *Institute* and through it, of its members who have problems in municipal sanitation for which they desire solutions

The Provincial Secretary promised full consideration by his colleagues of the memorial as presented by the Ontario Branches. The action of the Branches in this connection is worthy of the highest praise as it is by such public spirited action that a better appreciation of the profession is to be obtained.

Salaries of Engineers

Correspondence on this subject, published in this and previous issues of *The Journal*, shows how acute is the feeling respecting remuneration being received by engineers, particularly those employed in the Government service. In many cases salaries received by men doing responsible engineering work have been distressingly low, so much so in some cases, as to be an affront to the profession.

For many years members of our profession, of whom C. E. W. Dodwell, M.E.I.C., of Halifax, is noteworthy, have made earnest efforts to the end that engineers in the Government service should receive recognition as such, and not as clerks, the accomplishment of which would not only give a standing to the engineer in his technical capacity, but would also increase his monetary reward. A number of years ago a bill was submitted to the then Prime Minister, Sir Wilfrid Laurier, by a committee of this organization, and the promises made at that time led members of *The Institute* to believe that an Act would be passed placing engineers in the Government employment on a proper basis. Shortly after, the Government experienced difficulties and went out of power. In 1917 the question was revived and a strong committee of men in the civil service was appointed to go into the subject thoroughly and make recommendations which would raise the standard of the engineer in the civil service. At that time the hearty co-operation of Council was promised and given. However a change made by the Government in appointing a Civil Service Commission, designed to remove all appointments from the realm of politics, has presented a further opportunity for the engineer to receive recognition. A strong committee of the Council has been appointed, consisting of W. F. Tye, chairman, President H. H. Vaughan and President-elect, Lieut.-Col. R. W. Leonard, to represent *The Institute* in securing more adequate recognition and remuneration from the Government for engineers. This committee has made an appointment with the Civil Service Commission, at which time its members will, no doubt, prove to the Commission that the standard of reward for the technical men in the Government service should be raised by a very considerable amount. In meeting the representatives of *The Institute* the Commission has shown a willingness to be educated in this connection, and the education they will receive from the committee will work to the advantage of every engineer employed in the Government.

In the reclassification that will take place shortly it is expected that a very substantial increase will be accorded to engineers in the Civil Service.

Legislation Situation

Nearly every branch of *The Institute* has had this important subject under discussion during the past two months. A résumé of the situation throughout Canada from the viewpoints of the various branches will be published in the Februaıy issue of *The Journal.*

Programme of Meetings

At the time of going to press a complete programme of the Annual Meeting and the General Professional Meeting is not available. Below is published a tentative programme for Tuesday, Wednesday, and Thursday, February 11th, 12th and 13th, forwarded by the Secretary of the Professional Meeting Committee, G. Blanchard Dodge, M.E.I.C.

Tuesday

Morning, 10 a.m.	President Vaughan, presiding. Business session.
Luncheon and Addresses	His Excellency, the Duke of Devonshire, Hon. M.E.I.C. C. A. Adams, President, A. I.E.E. A. D. Flinn, Secretary, United Engineering Council on International Engineering Affiliation.
Afternoon, 4 p.m.	Business session. President's Address (invitations)
Evening	Informal dinner and smoker.

Wednesday

Morning	Unfinished business of annual meeting (if any). " Standards in Engineering," by Capt. R. J. Durley, M.E.I.C. "Soldiers Re-establishment," by Major Anthes. "The Development and Future of Aviation in Canada," by M. R. Riddell, Chief Engineer, Canadian Aeroplanes Ltd.
Luncheon and Address	Dr. Ira N. Hollis, representing American Society of Mechanical Engineers.
Afternoon	National Highways and Good Roads, by J. Duchastel, M.E.I.C. Hon. President, Canadian Good Roads Association. Frazil, by R. N. Wilson, M.E.I.C. Chief Engineer, Montreal Light, Heat & Power Company, Ltd. Standard Datum Planes in Canada, by W. Bell Dawson, M.E.I.C., Supt. of Tidal Survey, Department of Naval Service.
Evening	Formal gathering. Reception by President: Ladies, Music, Refreshments, Dancing.

Thursday

Morning	(1) Topical discussion on the Economics of Railway Electrification, opened by John Murphy, M.E.I.C., Dept. of Railways and Canals, and Railway Commission. (2) Mining and Metallurgy of Cobalt Silver Ore, by Lt.-Col. R. W. Leonard, M.E.I.C. President, Coniagas Mines.
Luncheon and short address	by Hon. F. B. Carvell, Minister of Public Works, to be followed by a visit to the New Parliament Buildings, Ladies.
4.30 p.m.	Motion Pictures, by B. E. Norrish, A.M.E.I.C.

Luncheon—Tuesday 11.00 - 1.00 p.m., at Chateau Laurier. Complimentary tickets to visiting members.

Informal Dinner and Smoker—
Tickets $2.50, to be obtained on registering.

Luncheon—Wednesday and Thursday, Feb. 12th and 13th, 1.00 p.m., at Chateau Laurier. Tickets $1.00 to be obtained on registering.

In connection with the arrangements for hotel accommodation which may constitute somewhat of a problem, visiting members are earnestly requested to make their own arrangements, concerning which mention was made in the December Journal. If when arranging for reservations a copy of the letter is also forwarded to G. Blanchard Dodge, M.E.I.C., Topographical Surveys, Department of the Interior, Ottawa, the Reception Committee will assist in securing reservations.

REPORT OF COUNCIL MEETINGS

Special Meeting

A special meeting of the Council was held at headquarters on Tuesday evening, December 3rd, at 8.15 P.M., at the call of the President, to discuss an urgent request received from the Saskatchewan Branch, that approval be given for the submission of an Act to the Saskatchewan Legislature, immediately.

The Secretary presented a draft just received from the Saskatchewan Branch which was presumed to be similar to the one submitted by Council to the Branch. It was found, however, to contain radical points of difference.

The minutes of the meeting of a special committee of *The Institute* and the Canadian Mining Institute were read, in which it was pointed out that as far as the draft Act regarding legislation published in the November issue of *The Journal* was concerned, it did not contain any points that could be classed as objectionable by the Mining Institute, from the viewpoint of working to the disadvantage of its members. This meeting further recommended that legislation should have the careful consideration and approval of the majority of the Canadian engineers before being enacted. The members of the Mining Institute would recommend to their Council that legislation be opposed until it had more mature consideration but that the Mining Institute would co-operate with *The Engineering Institute* towards securing legislation.

After general discussion it was decided that Council had no power to authorize the Saskatchewan Branch to proceed to secure legislation, as such an important matter should be laid before the entire membership. The Secretary was instructed to send a nightlettergram to the Saskatchewan Branch as follows:—

> " At a special meeting of Council held at your request I was instructed to advise the Saskatchewan Branch that it does not lie within the power of the Council to approve an act for submission to a legislature without the mandate of the membership at large. My communication of October second was intended to convey to your Branch that Council

is sympathetic towards the endeavours of your Branch to draft suitable legislation and would assist in framing and submitting a suitable Act for the consideration of the membership. The action of other Branches in submitting to the Council drafts of proposed Acts and discussion of the general question subsequent to the submission of your first draft, strengthen the feeling of Council that action should be deferred until all the Branches have had an opportunity of expressing their views."

Regular Monthly Meeting

The regular monthly meeting of the Council was held at headquarters on Tuesday, December 17th, at 8.15 P.M.

When the minutes of the previous meeting had been approved the report of the Executive Committee was presented and their recommendations approved as follows:

Co-operation for National Reconstruction: It was decided, in view of the letters received from the Toronto and Ottawa Branches, that meetings be held by all the Branches to obtain expression of opinions and suggestions from Branch members in regard to the co-operation of *The Institute* for national reconstruction.

Legislation: Correspondence from various Branches, giving their opinions regarding legislation was noted, it being intended, when the view points of all the Branches are received to publish same in *The Journal.*

Co-operation with the Canadian Branches of the A.I.E.E. and the A.S.M.E.: A letter was received from Professor Peter Gillespie of Toronto, suggesting co-operation with the American Institute of Electrical Engineers and the American Society of Mechanical Engineers. A lengthy discussion took place and it was decided that there was no way in which the Toronto Branch of the American Institute of Electrical Engineers or the Ontario Branch of the American Society of Mechanical Engineers could be affiliated. A committee, consisting of Walter J. Francis, Julian C. Smith, President H. H. Vaughan and the Secretary was appointed to meet Mr. Alfred D. Flinn, when in Ottawa in attendance at the Annual General Meeting, to discuss the question of *The Institute* joining the Engineering Council, at which time the question of branches in Canada of the United States societies could be discussed. The Secretary was instructed to communicate with Mr. Flinn in this connection.

Annual General Meeting: The following replies to invitations to attend the Annual General Meeting were presented; C. A. Adams, President, American Institute of Electrical Engineers, F. L. Hutchinson, Secretary, American Institute of Electrical Engineers, Bradley Stoughton, Secretary, American Institute of Mining Engineers, A. D. Gresham, for President, American Institute of Mining Engineers, D. B. Dowling, President, Canadian Mining Institute, H. Mortimer-Lamb, Secretary, Canadian Mining Institute, C. T. Main, President, American Society of Mechanical Engineers.

Annual Meeting, A.S.M.E.: Note was made of the telegram sent to the American Society of Mechanical Engineers on the occasion of their Annual Meeting as follows: " The President and Council of *The Engineering Institute of Canada* extend to the Council and members of the American Society of Mechanical Engineers cordial good wishes for the success of your Annual Meeting and express the hope that with the close of the world war we may be drawn in closer co-operation in our mutual endeavours for the welfare of the profession" and of the cordial reply received from Secretary Rice.

Joint Committee of Technical Organizations: The consideration of Council was asked in connection with a suggestion received, that the Joint Committee of Technical Organizations was not worthy of further support or recognition. It was resolved that the principle of scattering the energies of the members of the branches was detrimental to their strength, and, consequently, further recognition or support of the Joint Committee of Technical Organizations was withdrawn. The Secretary was instructed to so advise the branches.

Professional Meeting, Ottawa: The minutes of a meeting of the Special Professional Meeting Committee of the Ottawa Branch were received and noted.

Resolution of the Quebec Branch: A resolution received from the Quebec Branch regarding representation of the engineering profession on commissions was received and a copy passed on to Mr. Tye, chairman of a special committee appointed to look into and recommend regarding the Civil Service Commission.

New Certificates: Approval was given to the revised certificate which had been previously submitted to Council and in which Council desired a slight alteration. It was further confirmed that the title of the certificate be the form used on the official stationery of *The Institute,* and the Secretary was instructed to publish a cut of the certificate in *The Journal* and have new certificates prepared, the Committee to choose the paper upon which they shall be printed. As to new certificates, it was decided that they should be issued to any members who desired them.

Journal Postal Privileges: It was decided, in view of a report made by the Secretary in regard to his interview with the Post Office authorities, including Dr. R. M. Coulter, Deputy Post Master General, that a letter be sent to the members of *The Institute* requesting subscriptions to *The Journal.* The President and the Secretary were appointed a Committee to draft the letter.

Branch By-Laws: The By-Laws drawn up by the Special Committee of the Council and a Committee of the Montreal Branch, were submitted and the Secretary was instructed to send a copy to each Branch for discussion and approval.

Co-operation re Civic Development: A letter from Frederick Wright, Editor of the Canadian Municipal Journal, asking the co-operation of *The Institute* in a movement for civic development, was submitted. Full approval was given to the proposal and the Secretary was instructed to advise Mr. Wright that the Council would be pleased to appoint delegates to attend the suggested meeting.

Classifications: Classifications were made for a ballot returnable January 21st, 1919.

A ballot was canvassed and the following elections and transfers effected:—

Members

Angus Daniel Campbell, B.A.Sc., M.E. of Cobalt, Ont. Since 1911 mining engineer of the O'Brien Mine. George James Jeffrey, of Vancouver, B. C. (Since deceased). William Frederick McLaren, M.E., of Hamilton, Ont. With the Westinghouse Company since 1901 and since 1905 chief draftsman with the Canadian Westinghouse Company. Mr. McLaren has seen active service at the front, being a Captain in the 164th Batt. C.E.F., during 1916 and 1917. Walter Taylor Moodie, of Winnipeg, Man. With the Canadian Northern Railway since 1908. At the present time district engineer. Harold Allison Russell, of Dartmouth, N.S. Member of the contracting firm Russell & McAulay. James Alfred Stairs, of Wayne, Mich. General superintendent, ordnance department, Harroun Motors Corporation, Wayne, Mich.

Associate Members

Kenneth Carling Berney, B.Sc., of Hamilton, Ont. Electrical engineer for Canadian Westinghouse Company since 1909. Joseph George Cameron, B.Sc., of Finch, Ont. Since 1917 County roads superintendent and engineer for the Counties of Stormont, Dundas and Glengarry. Walter Francis John Cosser, of Schumacher, Ont. At the present time mechanical superintendent in charge of plant for the McIntyre Porcupine Mines. James Simpson Galletly, B.A.Sc., of Oshawa, Ont. Since 1912 in charge of parties on Dominion Land Surveys. Harvey Wilfred Harris, B.Sc.. of Winnipeg, Man. Engineer for Thomas Kelly & Sons, general contractors, of Winnipeg, since 1916. Frederick Innes Ker, B.Sc., of Montreal. Since 1912 chief engineer and general superintendent, Cook Construction Company. Albert Ernest Kerr, B.A.Sc., of Hamilton, Ont. Electrical draftsman, Steel Company of Canada, in complete charge of electrical drafting. Albert Levvy, of Winnipeg, Man. Managing Director of the Levvy Electrical Company, Limited, Winnipeg. Donald Lewis, of New Glasgow, N.S. Since 1915 with the Nova Scotia Steel & Coal Company. Since 1917 has occupied the position of chief draftsman. Edwin Markham, B.C.E., of Regina, Sask. Assistant to Stewart Young, district surveyor, Highways Department, Saskatchewan. Emerson Hibbert Morse, of Norwood, Winnipeg, Man. Draftsman with the G.T.P.Ry., Winnipeg. Christopher Anthony Newton, of Magnolia, Maryland. At the present time progress and resident engineer on construction of water works for the United States Government chlorine plant, Edgewood Arsenal, Maryland. Roland Foster Palmer, of Winnipeg, Man. Member of the firm of Palmer & Hobson. Francis William Bertram Scholefield, of Winnipeg, Man. With the J. McDiarmid Company Limited, general contractors, as chief engineer. William James Stuart, of Vancouver, B.C. At the present time on active service as lieutenant with the Third Field Company, Royal Engineers. Before enlisting he was resident engineer on construction of permanent pavements and roadways, Vancouver. Isaac Joseph Tait, of Montreal. Associated with J. T. Farmer since 1917. Previous to this he was chief engineer in charge of mechanical equipment for the C.P.R.

Associates

William McNeill, of Vancouver, B. C. Since 1908 assistant general manager of the Western Canada Power Company. Gerald Steele Roxburgh, B.A.Sc., of Winnipeg, Man. Since 1905 with Fetherstonhaugh & Company as Western manager, headquarters, Winnipeg.

Juniors

Henry Donald Holland, B.Sc., of Montreal, superintendent of construction for M. J. Stack, contractor. Thomas Earl Gordon Sissons, of Montreal. Engineer on construction for the Abitibi Power & Paper Company, Iroquois Falls, Ont. Hercules Smart, of Ottawa, Ont. American Gauge Production representative, Imperial Ministry of Munitions. Albert William Swan, B.A.Sc., of Sherbrooke, Que. Has been in the production department of Canadian Ingersoll-Rand Limited, Sherbrooke, on time-study and kindred work from May 1917 till March 1918, since then he has been in charge of preparation of all technical publicity for the company.

Transferred from the Class of Associate Member to Member

William Harvey Carson, C.E., of Ottawa, Ont. Since 1913 district engineer for the Province of Ontario, Department of Marine, Ottawa. Claude Vernon Johnson, of Quebec, Que. Since 1914 engineer in charge of construction and engineering for Joseph Gosselin Limited, General Contractors & Engineers. George Douglas Mackie, of Moose Jaw, Sask. (Chairman of the Saskatchewan Branch, and Member of Council). City Commissioner, Moose Jaw.

Transferred from the Class of Junior to Associate Member

Seth Wilson Crowell, B.A., of Yarmouth, N.S. Town Engineer, Yarmouth. Harry Wendell Mahon, B.Sc., of Great Village, N.S. Since 1917 with the C.C.H.A. Headquarters, B.E.F., France. Before going overseas was assistant engineer, Water Power Branch, Department of the Interior, Halifax. Major Alan Bretell McEwen, B.Sc., M.C., of Montreal. At the present time principal assistant to R. S. & W. S. Lea, Montreal. Major McEwen served with the C.E.F., from 1914 to 1918. Peter Scott, of Glasgow, Scotland. Since the outbreak of the War, senior assistant inspector of the munitions areas, Glasgow. Previously, with the C.P.R., Eastern Lines. Briton Oliver Smith, B.Sc., of London, Eng., formerly of Montreal. At the present time mechanical engineer with Vickers Limited, England.

Transferred from Class of Student to Junior

Captain John Frederick Harkom, M.C., of Melbourne, Que. Has been overseas since 1914, with the Royal Field Artillery, B.E.F., France, in command of the 57th Medium Trench Mortar Batteries. Joseph Ovila Rolland, C.E., Ch.E., of Montreal. At the present time chief analyst, Canadian Explosives Limited, Belœil, Que.

BRANCH NEWS

Victoria Branch

J. B. Holdcroft, A.M.E.I.C., Secy.-Treas.

The November meeting of the Victoria Branch was held on the 25th inst. with a representative attendance of members, and nominations were received for officers to guide the destinies of the Branch during the coming year. Every position brought forward enough applicants to necessitate a ballot, except that of Sceretary, to which J. B. Holdcroft, A.M.E.I.C., will be elected by acclamation.

A resolution was passed that the Branch volunteer to co-operate with the local Government representatives and authorities, in the work of returning demobilized soldiers to civilian life and fitting disabled men for employment. The committee appointed to report on this matter promptly proceeded to interview Major Livingstone, vocational officer, with most satisfactory results, which will be presented to the Branch at next meeting.

It was suggested that the Council at Montreal take similar action by offering the support of our *Institute*, as a national body, in this most important problem, to the Cabinet at Ottawa; also that each Branch take similar steps with the local authorities in charge of this work. Further, the question of public works to provide employment and develope the country should be taken up by our Institute without delay, and on sound scientific lines.

The annual meeting of the Victoria Branch, of *The Engineering Institute of Canada*, was held on the 11th inst., the principal business of the evening being the election of officers for the ensuing year.

The following were elected:— Chairman, W. Young; Vice Chairman, R. A. Bainbridge; Treasurer, E. Davis; Secretary, J. B. Holdcroft; Executive, W. Everall and N. A. Yarrow. These, with Messrs. D. O. Lewis and R. W. MacIntyre, past chairmen, form the executive committee. Auditors, F. Knewstubb and W. Stokes.

Following the taking of the chair by Mr. Young a hearty vote of thanks was tendered the retiring chairman, Mr. R. W. Macintyre, and general appreciation was expressed for his untiring efforts towards the furtherance of the interests of the profession as a whole, and of the Victoria branch in particular.

Among other new business which will engage the attention of the branch during the coming year is the problem of the returning soldiers and the provision of sufficient and suitable employment and training. A discussion was opened on this subject, and it is hoped that the branch, by suggestion and influence, may be able to take a useful part in the work of re-establishing our soldiers in civilian life.

Toronto Branch

W. S. Harvey, A.M.E.I.C., Secy.-Treas.

On Tuesday, December 3rd, a well attended meeting of the Branch was held in the Chemistry and Mining Building of the University of Toronto, when H. K. Wicksteed, M.E.I.C., gave an interesting illustrated address on the Montreal Tunnel from an Economic Point of View. This paper is published in another part of *The Journal.*

On Tuesday, December 10th, C. H. Rust, M.E.I.C., gave a paper on the Water Supply of the City of Victoria, B.C., which was illustrated and which was enjoyed by the members present. This paper will be published in a future issue of *The Journal.*

Minutes of an open meeting of the Branch held at the Institute's Rooms, Engineers Club, at 8 p. m., Tuesday, December 17th, 1918.

The meeting was called to canvass the ballot for the election of members for the 1919 Executive.

The meeting was called to order at 8.15 p. m., with G. A. McCarthy in the Chair.

The scrutineers appointed by the meeting to canvass the ballot were Geo. Clark, R. E. W. Hagarty and A. F. Stewart.

While the scrutineers were preparing their report a discussion was entered into by the members present regarding a copy of a communication issued by the Civil Service Commission of Canada and dated November 21st, 1918, regarding an opening for a position as assistant engineer on the staff of the British Columbia Hydrometric Survey at a salary of $1,500.00 per annum. The discussion was very lively and Messrs. Proctor, Hewson, Cross, Goedike, Phelps and Hogarth took part in it.

The scrutineers reported that the following members were elected to office for 1919 by the ballot just received:— Chairman, A. H. Harkness; Secretary, W. S. Harvey; Committee men, H. G. Acres, Willis Chipman and W. A. Bucke.

The members of the Committee elected in 1918 for a two-year term, and therefore, members of the 1919 Executive are Professor H. E. T. Haultain, J. R. W. Ambrose and R. O. Wynne-Roberts.

The retiring Chairman, Professor Gillespie, is also a member of the Executive. Members of Council at Montreal are also members of the Executive of the Toronto Branch.

The report of the scrutineers was received and confirmed.

Mr. Chipman addressed the meeting and urged on the members that they should attend the meetings of the Branch and thus encourage the Executive, who are endeavouring to create a greater interest in the affairs of *The Institute.* Mr. Wynne-Roberts spoke on the subject of the members becoming acquainted with manufacturing industries in the city, and urged that the Branch should make inspection trips to various plants of interest. The meeting adjourned at 10 p. m.

Calgary Branch

C. M. Arnold, A.M.E.I.C., Secy.-Treas.

Christmas Happiness and New Year Prosperity.

The Calgary Branch extends a Hearty Greeting to all members of *The Institute,* wishing them

A Happy Christmas and Prosperous New Year.

G. W. CRAIG, Chairman.
C. M. ARNOLD, Sec.-Treas.

At the Annual Meeting of the Calgary Branch, held in the Board of Trade rooms on the afternoon of Saturday, December 7th, the following officers were elected for the coming year: Chairman, S. W. Craig, Secretary-Treasurer, C. M. Arnold, Executive, Wm. Pearce, A. S. Dawson, F. H. Peters, B. L. Thorne, A. S. Chapman, Executive Alberta Division, F. H. Peters, S. G. Porter, Auditors, J. S. Tempest, R. C. Gillespie.

Mr. Craig was given a hearty reception upon assuming his new duties and made a short address, dealing with the desirability of publicity on engineering matters. The full report of this meeting will be published in the February issue.

At the general meeting of the Branch held on November 30th, with F. H. Peters in the chair, there were present fifteen members and Messrs. L. B. Elliott and R. G. Gibb of the Edmonton Branch were the guests of the Branch.

The purpose of the meeting was to discuss the draft of the proposed act governing the practice of professional engineering in Alberta. Edmonton representatives who had attended especially for this purpose were introduced by the Chairman. Mr. Peters drew attention to the fact that the preliminary advertisement dealing with the proposed legislation had already appeared in the Alberta Gazette. The executives of both branches had decided to proceed in the matter, as no time was to be lost if the Bill was to be presented this coming season. The Branch would be asked to confirm the action of the Executive in this matter. It would be necessary for the draft to be approved by both branches and the Alberta Division and it was proposed to send a delegation to Edmonton to interview the Premier, if this could be arranged, to obtain his views.

The Secretary was then called upon to read the minutes of all previous meetings since the last annual meeting and on the motion of Mr. Craig seconded by Mr. Houston these were approved and the minutes of the last meeting held were signed by the Chairman. Mr. Peters then asked Mr. Gibb to read the draft bill on legislation. Mr. Gibb stated that the draft had been prepared largely by the late Professor Muir Edwards and had been gone over by the executives of eachbranch and was now considered to be in shape to go before Parliament. Mr. Côté, a prominent engineer of Edmonton who was also in the Provincial Cabinet, had promised to do all in his power to forward the passage of the Bill, provided it received the approval of the Premier. He had therefore suggested that a delegation wait on the Premier to learn his views on the matter. Mr. Gibb then read the draft Bill, which was discussed at length clause by clause, and all points that were at all debatable were fully explained to the satisfaction of the meeting by the Chairman and Mr. Gibb. Mr. Peters stated that the Bill had been framed on broad lines and details had been avoided as far as possible. Any imperfections found to exist after the Bill had been enacted could be dealt with in the future by amendments. The delegation would consist of two members from each Branch and two non-resident members of these could be obtained. Mr. Craig moved that the draft Bill as submitted be approved by this meeting — seconded by G. N. Houston. Carried. Mr. Houston moved that delegates be appointed to wait on the Premier, to learn his disposition towards the proposed legislation, and that a report be submitted to the branch — seconded by C. M. Arnold. Carried.

It was decided to provide the Councillors of the Alberta Division and Executive of each branch with copies of the draft bill and also that a copy should be forwarded to the Saskatchewan Branch.

Mr. Peters moved a vote of thanks to the Edmonton members present for the work they had done in connection with the preparation of the draft bill and steps taken to present it to the proper authorities. Carried.

Mr. Craig, seconded by Mr. Peters, moved that a message of condolence be sent to Mrs. Sidenius, widow of the late Mr. H. G. Sidenius. The Secretary was requested to do this by vote of all present.

The meeting adjourned at 10.40 p.m.

Sault Ste. Marie Branch—Proposed

In keeping with the increased interest in Institute affairs, and as a result of a desire on the part of members of the profession resident at Sault Ste. Marie it is expected that a strong branch of *The Institute* will be in existence there at an early date. On Thursday, December 19th, a meeting of the local members of *The Institute* was held at the Y.M.C.A. at which time it was decided to apply for permission to form a Sault Ste. Marie branch.

An application was consequently prepared and submitted to the Council as follows:—

"We the undersigned hereby beg to apply for permission to form a local branch, to be known as the Sault Ste. Marie branch of *The Engineering Institute of Canada.*

R. S. McCormick
B. E. Barnhill
N. L. Somers
William S. Wilson
F. F. Griffin
A. G. Tweedie
L. R. Brown
C. H. E. Rownthwaite
J. W. LeB. Ross
W. J. Fuller.

At this meeting a temporary executive committee was formed consisting of:

J. W. LeB. Ross, Chairman, B. E. Barnhill, C. H. E. Rownthwaite, J. H. Ryckman, N. L. Somers, L. R. Brown, Secretary.

A second meeting has been called for January 9th, at which time the Secretary of *The Institute* is expected to be present to give all the assistance he can to the members at Sault Ste. Marie in the establishment of a strong enthusiastic branch.

Ottawa Branch

J. B. Challies, M.E.I.C., Secy.-Treas.

Good Roads

The widespread demand for constructive consideration by the Dominion Government of a practicable good roads policy has resulted in definite action that portends much for the future. The rapid advance in recent years, especially during the war, of motor transportation, both passenger and freight, and the important factor the automobile bears to rural development has proven, even to the most skeptical, the absolute necessity for good roads. The following item from the editorial columns of the Ottawa Journal will be welcome information to the engineering profession, and an assurance that at last the question of good roads will be given adequate attention by the Federal authorities:—

" The good roads movement, which must be one of the leading factors in the reconstruction and development of the country, is given a great lift forward through the Dominion Government's having availed itself of the experience and ability of Archie W. Campbell, M.E.I.C., in connection with it. Mr. Campbell has been appointed to advise the Government as to what its position should be in the matter of roadway improvement and construction, and it is probable, as it should be — that he will be retained permanently to supervise the carrying out of all plans.

No better choice could have been made. Mr. Campbell was an outstanding champion of good roads a quarter of a century ago, and as the result of work he did then, in co-operation with the late Andrew Patullo, of the Woodstock Sentinel Review, he was appointed Ontario Good Roads Commissioner, subsequently becoming Provincial Deputy Minister of Public Works. It was a serious loss to the better highways programme when he was taken from that position and made Deputy Minister of Railways and Canals at Ottawa. Better highways are for him almost a religion, and in the field to which he has returned he can serve the country better than anyone else we can think of. It is well that Mr. Campbell's exceptional experience and interest in the subject are to be turned to the advantage of the country as a whole. The good roads development must be carried out on an orderly and progressive programme, and Mr. Campbell's appointment will insure this.

Mr. Campbell is now preparing for submission to the Government, a report on the subject of highway construction in the Dominion. In it he will advise as to the best methods of obtaining the required co-operation between the Federal and Provincial authorities, and will recommend the adoption of legislation necessary to secure greater uniformity.

Nailacrete — An Important Discovery

Engineers generally, will be interested to learn of the important discovery made by one of the Affiliates of the Ottawa Branch, E. Viens, Director of the Public Works Laboratory for Testing Materials. A well-deserved tribute from the editorial page of the Ottawa Citizen to Mr. Viens' discovery, under the caption, " A Civil Sérvant's Good Work," follows:—

" Faithful work in the Civil Service has been so seldom noticed outside, many people have little appreciation of it. When the new parliament buildings were being inspected by a party of visiting engineers last Saturday, many were surprised to learn for the first time of the flooring material, called " Nailacrete," a discovery made by Mr. E. Viens, director of the Public Works Laboratory for Testing Materials.

"Nailacrete has a strength greatly exceeding wood, with a durability of concrete. It has the resilience of wood, a nail may be driven into it, and it will hold with greater firmness than in wood. Carpets can be tacked on Nailacrete, and desks or other furniture screwed down to it. But Nailacrete does not need a carpet covering. It can be given a surface finish as smooth as hardwood, glossy and more durable. It is fireproof, waterproof, and sanitary. It is lighter than concrete, can be laid without forms on a sloping surface — such as for roofing. It is an insulator.

" The Chief Architect of the new parliament buildings, John A. Pearson, has proven the reliability of Nailacrete by severe tests before adopting it for the floors in the main building. Credit is due to the Chief Architect for being sufficiently without prejudice to adopt Mr. Viens' discovery. The public should know, however, when a public servant by patient research, carrying out experiments in the first instances after work hours, at his own expense in the purchase of experimental materials, has contributed something apparently so valuable to the community as Mr. E. Viens' discovery of Nailacrete."

Branch Visits New House of Commons

Tangible evidence of the splendid progress made in the construction of the new home of the Canadian Parliament, according to the *Evening Journal*, was displayed on Saturday, December 7th, to the members of the Ottawa Branch of *The Engineering Institute of Canada* who, after doing full justice to the first luncheon served in what will be the House of Commons dining-room, were given an opportunity to inspect the buildings under the guidance of the staff in charge of the reconstruction, G. Gordon Gale, chairman of the Ottawa Branch, presided at the luncheon, and about 135 members and their friends were present.

The trip through the buildings proved of unusual interest. On every side could be seen evidence of the amount of work already done, and an attempt to visualize the buildings as they will be when completed framed so compellingly a mental appraisal of the work still to do that the assurance of the architect that the buildings will probably be ready for occupancy by January, 1920, was almost doubted.

The cornerstone of the new buildings was laid on September 1st, 1916, but for practically nine months thereafter little or no work was done and the buildings as they now stand represent about 17 months of actual labor, conducted for at least part of that time under a serious handicap due to difficulty in securing workmen.

In external appearance the buildings convey a much stronger inpression of solidity, massiveness and dignity than did those they replace. While the frontage is the same as formerly the new structure contains much more accommodation due to the fact that a solid block has been built in at the rear or north side. The general plan is of one great structure, in part divided by three light courts or wells into five smaller buildings. The Commons chamber is situated in the western end, then alternate light courts and offices, with reading and smoking rooms, to the Senate chamber on the eastern end. Ample main corridors, broad and stately, run east and west through the entire building with cross corridors, but little narrower, connecting the various units. In all there are more than two miles of corridors in the building — ample opportunity for corpulent statesmen to exercise while pondering questions of national import.

Possibly the feature of the entire structure that, when completed, will attract most attention and Dominion-wide interest, is the splendid hall or "Court of Honor." As planned, this leads directly from the main entry through the width of the building to the Library, and will be in every way worthy of its name. Even on Saturday, while complete comprehension of its majestic spaciousness was prevented by the spidery scaffolding which fills most of the space, it was evident that when finished it will stand alone in Canada as an example of the dignity and beauty that can be attained in interior architecture of the Gothic school. As it is, it is reminiscent of the sublimity of a vaulted cathedral, and when the windows, and statuary, silently eloquent testimonials of the men who made Canada, are in their positions the effect will be imposing in its majesty.

The Commons chamber is spacious and lofty, gallery accommodation will be in excess of that contained in the former House, while a new feature will be the provision of private boxes for visitors to whom it may be desired to extend signal honor. As might be expected, ample arrangement has been made for the press gallery and the rooms in which the newspaper workers record the achievements or errors of Canada's statesmen will be more commodious and convenient than heretofore. The Senate chamber in general lines, follows that set aside for the members of the elected branch of Parliament.

The office accommodation for ministers and the various grades of private members will be much superior to similar arrangements in the former building. The individual offices will be larger and better appointed. Nothing will be spared that will make for the comfort and convenience of those who devote a large portion of each year to the business of the country.

But it is the wonderful wealth of detail, already commencing to show, that will make the new Parliament buildings one of the show-places of Canada. Carvings, typifying events in Canadian history, broad sweeping effects representing Canadian life and industry, delightful miniature bits characterizing and, in some cases — caricaturing — men prominent in Canadian public life, present or past, will afford days of pleasant occupation to students of art as revealing character. The entire building will be alive and vibrant with such delights; few of them are as yet in position, but numbers are to be seen, completed, waiting only to be placed in their respective niches.

From the artistic and sublime to the practical brings one to consideration of the arrangements made for heating the building — a most necessary feature in this latitude. The heating plant is situated in the power house at the foot of Cliff street, several hundreds of yards from the buildings themselves. Forced circulation of hot water will provide sufficient heat to serve the new buildings, the Supreme Court building and the Langevin block, and the plant is so constituted that it can be made to heat additional buildings in that vicinity which it may be necessary to construct.

Dealing more particularly with the progress made on the building within the last year it may be said that in the summer of 1917 it was but rising from its four foundations. Now the walls and roof are completed, many of the inner walls run, basic floors laid and in some portions work has started on the floor tiling. Practically the body of the entire structure has been completed, the interior fitting is yet to be done. This, it is expected, will consume another year.

Of the architect in charge, John A. Pearson, who already has a national reputation as one of Canada's master builders, it need only be said that nothing he has ever done will surpass his work in the provision of a beautiful and fitting home for Canada's Parliament. A man might well study and labor for a life-time to produce but one such monument to his genius.

Address on Ceramics

One of the most interesting evenings held by the Ottawa Branch for the year 1918, was an address on "Clay and Clay Products in Canada," by Joseph Keele, chief engineer of the Ceramic Division of the Department of Mines. Mr. Keele is the recognized authority on this subject in Canada, and succeeded in conveying a great deal of exceedingly valuable information respecting one of the most important and little appreciated industries in the Dominion. So important is this industry to Canada generally, and of such immediate interest to all branches of the engineering profession, that it is hoped Mr. Keele may be able, in the near future, to prepare a similar paper for presentation to *The Institute*, in order that all of its members may enjoy the advantage of those who attended the meeting in Ottawa.

Transferred to Dept. of Trade of Commerce

The Electrical Standards Laboratory, Ottawa, O. Higman, M.E.I.C., Chief Engineer, has sent out notice that the administration of the following Acts of the Federal Parliament has been transferred from the Inland Revenue Department to the Department of Trade and Commerce; the Electrical Units Act; the Electrical Inspection Act; the Electricity and Fluid Exportation Act; and the Gas Inspection Act.

Dominion Power Board

The Government has added to the personnel of the Power Board, W. A. Bowden, M.E.I.C., Chief Engineer of the Department of Railways and Canals; and Arthur Amos, M.E.I.C., Chief Engineer of the Hydraulic Service of Quebec and a member of the Quebec Streams Commission.

The Government has consented, at the request of the Dominion Power Board, to have A. B. Lambe, A.M.E.I.C., Asst. Chief Engineer of Gas and Electricity of the Department of Inland Revenue; and A. J. Matheson, M.E.I.C., Chief Engineer of the Montreal Water Levels Commission, attached to the Board for special work.

Hamilton Branch

H. B. Dwight, A.M.E.I.C., Secy.-Treas.

It was with considerable regret to the members of the Hamilton Branch that Geo. F. Porter's lecture on the Quebec Bridge had to be cancelled because the prohibition of all meetings was suddently renewed by the Board of Health. The Health Officer had intimated several times that matters were not serious and that the meeting could be held as scheduled. However, outside pressure was brought to bear, as matters really were more serious than most people supposed, and the ruling was made on a few hours' notice. The unfortunate part was that there was no time to telegraph Mr. Porter. The members of the Branch had a very enjoyable visit with him, however, and he was most agreable about the misfortune.

Montreal Branch

F. B. Brown, M.E.I.C., Secy.-Treas.

A discussion of the subject of legislation has occupied two meetings of the Montreal Branch held on November 28th, and December 19th, where it was given consideration in an exhaustive manner. At the meeting of the Branch held on December 19th, Lieut.-Col. Dubuc was present and in addition to being welcomed by the chairman, Walter J. Francis, one of his classmates, Arthur Surveyer, voiced the sentiments of those present in well-chosen words of appreciation. Lieut.-Col. Dubuc was given a reception in keeping with his distinguished services and made a happy speech in reply to the reception accorded him.

The following resolutions passed by the Montreal Branch embody the result of the two meetings on the subject of legislation. It was moved by W. F. Tye, seconded by G. H. Duggan and carried:—

WHEREAS it seems advisable that legislation should be sought defining the statuts of engineers throughout Canada, AND

WHEREAS the widespread activities of the engineering profession, the great difference in the interests and occupations of the individuals, the necessity of getting satisfactory legislation in the different provinces, the unsatisfactory result of such legislation as has already been obtained and the dangers and difficulties certain to be encountered by *The Institute* as a whole during the time period of passing of Canadian engineering from an open to a closed or a partially closed profession, make it inadvisable and inexpedient to ask for any further legislation in any province until the whole question has been thoroughly studied, reported upon and submitted in concrete form to the full corporate membership of *The Institute.*

BE IT RESOLVED:

THAT the Executive of the Montreal Branch be instructed to ask the Council to arrange for the appointment of a Committee representing all provinces and all branches of the profession to inquire into, study, and report upon the whole question of legislation, including a report upon the best method of getting such legislation as will ensure a satisfactory and uniform status of engineers throughout Canada, also to draw up such sample legislation as it may deem necessary and advisable in order that the member of *The Institute* in the different provinces may seek legislation on some uniform basis.

That before the final adoption of any proposed Act it shall be the duty of the Committee to co-operate as far as possible with similar incorporated technical bodies with a view to harmonizing clauses which might contain points of contention.

That the Secretary of the Montreal Branch be instructed to forward a copy of this resolution to the Secretary of *The Institute* and to the Secretaries of the Provincial Divisions and the Branches, and to request the Executive of the Provincial Divisions and the Branches to assist the Council in securing the appointment of a strong and representative committee."

It was further moved by Arthur Surveyer, seconded by F. B. Brown and carried:—

" *THAT* the Executive of the Montreal Branch take immediate steps to obtain, in co-operation with the Quebec Branch and by letter ballot, the views of the members of *The Institute*, residing in the Province of Quebec, on the question of licensing engineers, AND

THAT the following questions for this letter ballot be suggested to the Executives of the Montreal and Quebec Branches for their consideration:

Question 1. Are you in favour of a closed corporation for engineers having responsible charge of engineering works?

Question 2. If so, do you favour legislation embracing all engineering works, or only public works?

Question 3. In the event of the majority of the members of *The Institute* residing in Quebec, declaring in favour of a close corporation, what are your opinions on the following questions:

(a) Do you consider that the only method of entrance into the engineering profession should be through the engineering colleges?

(b) If no, do you think that candidates who do not follow college engineering courses should be obliged to pass an examination for admission to study somewhat along the lines of the matriculation examination required for university entrance?

(c) Do you think that candidates should be required to pass an examination for admission to practice, similar to the examinations required by the Bar and Medical Associations?

(d) Should candidates be obliged to serve a period of apprenticeship or employment under an engineer, before being allowed to take the final examinations for admission to practice? (The word practice is understood to mean taking responsible charge of engineering works).

(e) If in favour of examination, do you consider that these should be held by the corporation only or by a joint board of the members of the corporation and representatives of the McGill and Laval faculties of applied science?

(f) Do you consider that graduates of engineering schools should be exempted from any or all the examinations?

(g) If so, from what examinations should they be exempted?

(h) Do you think that graduates of engineering schools should be required to prove that they have had experience under some engineer before being admitted to take charge of engineering work?

AND THAT the results of this letter ballot be passed on to the committee appointed under Mr. Tye's motion for their information irrespective of any action that the members of *The Institute* in Quebec may wish to take."

Gallant Officer Returns

Lieut.-Col. Dubuc, C.M.G., Croix de Guerre, Cross of the Legion of Honor, D.S.O., M.E.I.C., commander of the famous 22nd Battalion of Montreal, which has added so much to the lustre of Canadian arms, arrived at his home in Montreal recently where he was accorded a reception in keeping with the distinguished services he has rendered. This gallant officer, who has seen so much of actual fighting, has been three times wounded, including the loss of an eye from machine gun bullet, the last time so dangerously that his life was dispaired of. Going to the front as a Captain after three years on the fields of many battles he returns to us a Lieutenant-Colonel, commander of his old battalion and bearing decorations which prove him a warrior of great courage.

Of the engagement in which he was wounded the last time, he said that out of 23 officers and 625 other ranks, there were 23 officers casualties (every one was killed or wounded) and 505 of the other ranks either laid down their lives or will hereafter wear the scars of battle. This all happened in 24 hours. It was on August 27th, in front of Cherisy, in the attack on Cambrai and the start of the great Arras battle, that was the beginning of the end, that Lieut.-Col. Dubuc was hit, by a machine gun-bullet, and was given up for dead. The command of the 22nd automatically passed to Major Vanier at 2.30 that day, and he carried on until he lost his leg.

At a meeting of the Montreal Branch, held on December 19th, Lieut-Col. Dubuc was accorded a rousing reception and he gave a brief address to the members present, which, coming from one who occupied such a proud position in the great engagements of the war, was highly enjoyed. Every member of *The Institute* will feel a personal sense of pride in the distinguished part which Lieut.-Col. Dubuc has taken in the mighty conflict.

CORRESPONDENCE

Legislation for the Engineer (A Western View Point)

Editor *Journal*:—

"These engineers were priests of a sort, albeit they did not preach or pray. It was a new world. Has it ever struck you that with every victory over Nature won by the human spirit a fragment of their omnipotence is wrested from the hands of the gods? I always feel as if we were using fire and steel, mechanical energy and human thought, as weapons of revolt against the Heavenly tyranny." Bojer.

In consideration of the present essential effort upon the part of engineers to obtain legislative support and recognition as a class, with a long delayed but necessary acknowledgement by the public of their services and merits let us make clear to each other that this "object" is what we aim at and that a successful issue is of much greater importance than the "method" by which this result may be attained. As a Westerner from Alberta I view the position so, and feel that whilst pleas for unanimity and possible similarity of action are insistent from many sources, it does not appear at all possible to achieve this, or even desirable to attempt uniformity for the following amongst other good reasons, especially affecting the West.

We have four Legislatures, Manitoba, Saskatchewan, British Columbia and Alberta, each with a differing outlook and history, a varying practice and local conditions and an independent legislative personnel distinctly enamoured of their own principles and practice, so much so that the chance of common action is of very remote possibility and to spend time and effort upon a futile aim such as uniformity of practice, must be under the circumstances of urgency, misplaced energy much to be regretted.

The objects to be attained are in each Province exactly similar, what does it matter about the plan of the road by which the goal is to be reached, its grade or the make and variety of its bridges, these may vary as does the topography of these Provinces but if the same successful result be reached why worry? Manitoba has had a plan since 1896, why this has not been travelled is not self evident and having had all these years of experience of the "lions in the way" one would assume they should be best prepared and armed to take action immediately, so that their claim for delay to secure uniformity does not seem to rest upon sufficiently definite grounds as to warrant suspension of effort on the part of other Western Provinces. Saskatchewan has a plan which doubtless meets its members' requirements and it is to be hoped also those of its legislators and whilst some of its features would not pass through the Alberta House, we are not so placed that we dare ask them to await general agreement upon forms and procedure, their duty is to secure from their legislature the best terms and conditions for effective legislation protecting engineers and the method by which this is gained is to them a domestic problem containing factors of which outsiders cannot judge.

B. C. we have no doubt with last years experience to guide, are now well aware of the lines of least resistance and likely success and formulating a plan for submission to their Legislature, we wish them well. Montreal can but express a parental solicitude that its children whilst struggling with varying conditions and doing the best they can for themselves shall do their utmost to maintain the family credit and its highest traditions. We in Alberta are in a measure the most happily situate of all in that a well travelled road has been cleared for us by other professions with lines of uniformity laid down by the Legislature, satisfactory to them and to us, achitecture, law, medecine, dentistry, chemistry, surveying and other public services have a common, accepted and satisfactory system of public control to which we must conform in any legislative proposals we may submit.

In technical matters the Legislature of Alberta has always taken the stand that public control of such services had best be exercised by the first body of educational standing in the Province, i.e. the Senate of the University of Alberta, a doctrine of economy of effort on the part of the Legislature and of success from the viewpoint of such technical services already so associated and of satisfaction from the public point of view, as being a simple, effective and desirable curb upon any close corporation practices likely to injure the freedom of its best interests. Having but one university and that in the nature of a state institution we are most favorably situated and we hope it will shortly be possible to submit the draft act proposed to be submitted to the next session of the Legislature, this follows most carefully along the lines of preceding acts governing technical and professional services and will we hope secure the approval of our legislators as well as that of our fellow engineers in this and other Provinces.

May attention be called to one danger, that of overloading an act with matter more properly belonging to by-laws as items of internal government and the relations of Institute members with each other do not require to appear in the Act, this should be explicitly confined to the delimitation of relations between the public and the service in question.

This is not a plea for delay but a call for action, engineers are usually associated with realities and dealing with matters of material or force and facing the reality of an unrecognized profession of legally indefinite status without protection, and the presently heavy barrage of the H. C. L., action definite, direct and decided cannot occur any too soon.

By independent action but free co-operation to the desired end we shall secure for some, or more happily we hope, for all, the legal status and recognition which the talents and services of our members deserve and to this end it is essentially necessary that all without exception shall sink their differences and with enthusiasm enter into all measures or methods devised to secure this long delayed but no less patiently earned reward, giving full support and countenance to all who in any measure or position endeavour to solve the attendant difficulties.

Lo: a cloud's about to vanish
From the day
And a brazen wrong to crumble
Into clay.
Lo: the Right's about to conquer;
Clear the way.
With the Right shall many more
Enter smiling at the door;
With the giant Wrong shall fall
Many others, great and small,
That for ages long have held us
For their prey.
Men of thought and men of action,
Clear the way.
Mackay.

—DONENZ.

Move for a Raise

Editor *Journal*:—

I have to congratulate you and the other executive officers on the success of *The Journal* which along with the other matters contains an employment bureau. The salary paid to civil engineers to-day is ridiculously small and one remedy which occurs to me is for the profession to take every advantage of any new position offering a larger salary. This shuffling would force many raises in salary in order to hold men who to-day may not be in touch with other positions which are available and pay more money. This *move for a raise* policy would I think improve the situation as there are too many of our men to-day holding down positions at practically the same salary which they received five, yes and ten years ago, thus making the engineering profession the greatest rut in existence.

I would respectfully suggest that you give more attention to the employment bureau and endeavour to give the readers of *The Journal* the benefit of all positions which are open in Canada and as many as practical of those in foreign countries as well. I have noticed that heretofore you have not even included all the appointments which the Civil Service of Canada have to make.

I am,
Yours faithfully,
District Engineer.

* * *

Error re Diving Bell

Editor *Journal*:—

With reference to my letter of October 24 to you. Mr. MacDonald has called my attention to an error in my letter on page 2.

In my letter, I have, by an error of dictation, misplaced the relative positions of the metre centre and centre of gravity of the device under discussion, and I did not notice the error until my attention was called to it. The mistake is an obvious one, otherwise the outfit would not have been stable when afloat. I will be obliged if you will correct this error in my letter.

Yours very truly,

JOHN TAYLOR, A.M.E.I.C.

Education Through Journal

Dear Editor:—

I am in receipt of a copy of your letter of November 29th to the Secretary of the Civil Service Commission, which should cause their officers to reflect upon the salaries being paid engineers as compared with those made for other work.

I think the whole trouble is with the engineers themselves. If they are in a position to demand better pay for one another, they don't do it. If engineers will accept positions at $1,500 per year, the Civil Service Commission will feel that it is quite justified to continue offering that salary. I think a campaign of education carried out through the columns of *The Journal* would be the best method of crusading at the present time for better salaries for Government engineers.

Yours faithfully,

GOVERNMENT, M.E.I.C.

* * *

Grand River Conservation

Editor *Journal*:—

The water shed of the Grand River (Urse River on map of 1763, later " Ouse or Grand " River) the central part of the peninsula of South Western Ontario, comprises about 2,600 square miles, parts of the Counties of Grey, Dufferin, Perth, Oxford, Wentworth and Haldimand and practically the whole of Wellington, Waterloo and Brant. The highest part of the peninsula may be called an irregular plateau, 1,400 to over 1,700 ft. in elevation above sea level, and having an area of about 1,100 square miles, the northerly edge closely approaching Georgian Bay. Apparently one half or more of this area was originally dense swamp, the headwater source of most of the considerable rivers of the peninsula.

A marked topographical feature is the Niagara escarpment extending from Queenston on the Niagara River, and there marking the difference in water level between Lakes Erie and Ontario, more or less definitely across the peninsula to Georgian Bay. For a considerable part of its length this abrupt break in the surface forms practically the easterly limit of the Grand River water shed.

The Grand River rises on the highest part of the plateau, in Melancthon Township, within 25 miles of Georgian Bay, has a length along its windings of about 160 miles, flows in a general southerly direction, has a total fall of over 1,100 ft. and empties into Lake Erie at Port Maitland. Principal tributaries in their order from up stream are the Conestogo River from the west, rising near the source of the main river, the Speed from the east and the Nith from the west.

The water shed is wide in the headwater area, becomes narrower further down, and more so in the flat country toward Lake Erie, where smaller streams flow directly to the lake. Declivity of the stream bed is greatest after it leaves the plateau, is considerable further along and small toward the outlet. What may appropriately be called the upper river extends to about the 1,150 ft. contour, and the lower river from there on.

The importance of the Grand River water shed, particularly of the lower river, is well known. In fertility of soil, in density of population, in agriculture and in manufactures, it is one of the best sections in the Dominion of Canada. Numerous cities and towns, manufacturing cent es noted throughout the Dominion and beyond, Brantford, Galt, Kitchener, Paris, Guelph, Preston, Hespeler, New Hamburg, etc., are directly on the river banks.

The spring floods are a constantly increasing menace, both in the cities and towns and generally along the valley, and summer flow of the river has become very small.

Original conditions, forestation, and particularly the large swamp areas on the head watershed, which effected natural regulation, restraining floods and maintaining dry weather flow, by retarding snow melting, by better holding back of water on the surface and by greater volume of ground water, are impossible of restoration.

There are various methods of flood alleviation, such as: confining the channel by means of walls or dykes, as has been done in Brantford on the Grand River, and to some extent in Galt; deepening and correction of the river channel; elevation or filling in of ground subject to overflow; detention or retardation reservoirs, as now under construction in the Miami Conservancy District, Ohio. Preferable to any of these methods, and constituting true conservation, are storage reservoirs, where practicable. A storage reservoir of ideal capacity and performance retains the surplus flood flow and releases the stored water for equalization of flow during periods of small yield from the watershed.

Conservation by storage has been found to be to large extent practicable on the Grand River. The Hydro Electric Power Commission of Ontario by surveys made mainly in 1912 and 1913 established the fact that sufficient storage can be obtained to give good control. In the township of Pilkington on the main river, about at the foot of the upper river, storage capacity of about 2¾ billion cubic feet in one basin has been found to be available. Further storage, on the Conestogo tributary, would give a total of nearly 4 billion cubic feet of capcaity with watershed area above the basins of about 600 square miles, constituting on the whole fairly unique and very favorable conditions for true conservation. There remains to be done, as to investigation, definite exploration of sites for dams and ascertaining of their practicability and estimates of cost. No estimates or investigation as to cost of reservoir sites, land condemnation, highway changes etc., has as yet been made either.

The benefit of such conservation would in the first place be elimination of flood danger. The sustained summer flow, which on the above storage could be over four hundred cubic feet per second in addition to the present flow, eight to ten times the present flow for a good part of the river affected, would be a great benefit in sanitation and water supply. Evaporation from the surface of the storage reservoirs an area of six square miles or over, is a feature to be considered. During the hot summer months, June, July, and August this may be assumed to total from 15 to 20 inches, or possibly a little more. Rainfall during this season is extremely variable.

Local observation (Waterloo County) shows a total for the three months ranging, in a short period of four years, from 22.11 to 4.99 inches. Evaporation is greatest during drouth, but considering even a net evaporation, after deducting direct rainfall, of 15 inches or more, it is negligible against the yield from the contributary watershed, of which every accretion would be held in the storage reservoirs. Existing developed water powers on the river would also gain greatly. The heights of fall of such water powers are: at Galt, 8½ ft.; at Paris, 14 ft.; at Brantford, Upper Dam, 16 ft., Lower Dam, 33 ft.; at Caledonia, 7 ft.; at Dunnville, 6½ ft.

A promising use of the conserved water has been recently proposed. (by N. Cauchon, A.M.E.I.C.) This is to make a diversion canal, probably from below Galt — where, along the old Great Western Railway branch, there is a lateral depression toward the east — to the escarpment, drop the water over this, with fall of 500 ft. or more, enabling development of large power, and make further use of the water for irrigation throughout the lake shore district. Irrigation, once the flood danger is removed, will also find extended and valuable application in the immediate valley floor of the river.

W. H. Breithaupt, M.E.I.C

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Government Salaries

Editor *Journal:—*

I have been following with a certain amount of interest and a much greater amount of disappointment the semi dignified movement on behalf of the engineers of *The Institute* regarding a fair wage for the profession.

Some even go so far as to give the remuneration received for our work the high sounding name of a salary — which it is not — in fact the average wage of the Canadian engineer is hardly more than the wage paid the most ordinary and uneducated class of mechanic or make-believe tradesman in practically all parts of the country. Why, most men are paying their chauffeurs from $100.00 to $125.00 per month; we even in this small town have several instances of workmen being paid better than so called professional men; one in particular — a man who files saws draws $7.50 per day, and a foreman in charge of a small construction job $10.00 per day. When employing a foreman over a dozen men this summer I was asked to pay within 75c. per day of my own wage.

It is all very well to be dignified when one has something to be so over, or when one can be dignified at all times; when, however, the baker and butcher, etc. have to be treated with something else besides dignity, and the life of an intelligent man has to be ordered so that his main thoughts, after the execution of his work, are taken up with the problems of how to make last years suit do again or the roast from yesterdays dinner do the rest of the week, etc., it is quite time that he got his thinking cap on again after hours for his own benefit.

If our profession is worth anything it is worth at least a good fight to make it appreciated, and if it is necessary to have a fight to gain recognition let us get at it and have a real one and have it over with, and if we cannot succeed let us get out like men.

We have the weapons and they are not of German manufacture either. Hadn't we better get busy and use them?

I do not see why a committee of hustlers should not be appointed by *The Institute* to get after this end at once, and arrange a campaign that will bring results.

Yours sincerely,

A poor Government Engineer.

* * *

Protest Against Engineers' Salaries

Editor *Journal:—*

I wish to call the attention of the Council, through you, to the great difference in salaries offered clerical help, such as stenographers, clerks, etc., and that of engineers.

One has only to take up the Civil Service Bill, which passed through the Federal House last spring and glance at the salaries which are paid to first, second and third class clerks (we are not even allowed the title of engineers) to see my point of view. This state of affairs reflects very unfavorably on the future welfare of *The Institute.* This matter will receive very serious attention at our next Branch meeting, and I trust this will be the case in every Province throughout Canada.

Yours truly,

A Manitoba Associate Member.

* * *

Editor *Journal:—*

Herewith are announcements of the Civil Service Commissioners' Bulletin applications for positions, which should be noted by the engineering profession, as to me they appear to be more or less an affront to the profession:—

1. A *Secretarial Clerk* for the permanent staff of the President of the Council, Grade D. of the First Division, at an initial salary of $1,800.00 per annum. Candidates must have secretarial ability, capacity in office management and special shorthand reporting ability.

2. A *Female Clerk* in the Employment Division of the Department of Labour at a salary of *$1,600.00* per annum. Candidates must be university graduates with training in economics and some practical experience in social work. Some experience in office management is desirable with particular reference to statistical work. A good working knowledge of French is required.

3. An *Assistant Engineer* on the staff of the British Columbia Hydrometric Survey at a salary of *$1,500.00* per annum. Candidates should not be more than forty-five years of age, and should be graduates in engineering of a recognized university. They should have at least two years field and office experience in engineering.

Yours very truly,

An Associate Member.

Diving Bell, Halifax, N. S.

Editor *Journal:* —

The writer has just received by mail a copy of the "Canadian Engineer" of 31st October, 1918, in which are published extracts from a letter to you from John Taylor, of Hamilton, Ont., regarding a paper read by J. J. Macdonald on the Floating Caisson or Diving Bell used in preparing foundations for quay walls at Halifax, N.S.

The writer has not yet seen Mr. Macdonald's paper or his statements, but Mr. Taylor's letter and especially his concluding statement that "he feels it is only just that the facts should be made known to the engineers of Canada as a whole and he fully expects this to be done" causes him (the writer) to write to you in this matter, as he is probably the one best personally acquainted with all the facts.

The Halifax Ocean Terminals quay walls were designed for the Canadian Government Railways by F.W. Cowie, M.E.I.C., of Montreal, as consulting engineer, and the writer, as superintending engineer, in 1912-1913. Many designs and schemes were studied before the type (of original design) finally adopted was decided upon early in 1913, and needless to say, much detailed consideration was given to the foundation work and to the new types of plant and appliances that would be required for the proposed works, including rock drilling, dredging and concreting plants, helmet and bell diving outfits, block setting cranes and lifting tongs, etc.

The writer had in 1911-1912, with Foley, Welch & Stewart as contractors, successfully used as diving bells, the large pneumatic foundation caissons designed by him for the river piers of the Skeena River bridge on the G.T.P. Railway in B.C., for removing large boulders and obstructions in fast flowing deep water on the sites of the piers, by working in the working chambers with the caissons grounded or afloat and made moveable as desired by displacing or pumping out water. Other people, he believes, have done the same with other caissons. The writer discussed this with Mr. Cowie, and together they developed and sketched out the Floating Caisson or large mobile Diving Bell idea for their foundation work. The doubtful elements of the scheme were cost and rate of progress. It was therefore decided that in letting the docks contract the choice of methods should be left to the contractors, subject to stipulated rates of progress and qualities of finished work.

In November, 1913, the contract for the first unit of the Halifax docks was let to Foley, Welch, Stewart & Fauquier, who brought to Halifax as their superintendent James Taber, a well known Canadian expert with wide experience in deep foundation and compressed air work. The floating caisson or diving bell method was then again taken up, and was thoroughly examined by Messrs. R. B. Porter and Fauquier of the contracting company, Mr. Taber, Mr. Cowie, and the writer, further detailed sketches of the bell and estimates of cost of construction being made. It was felt by all these parties that better work could be done, with better inspection and more certainty, with the large diving bell than by other methods, though not at less cost.

The contractors, with a spirit and enterprise for which they deserve great credit, decided to adopt the Diving Bell method, and in view of the advantages to the work, the writer, with the approval of Mr. Gutelius, general manager, Canadian Government Railways, prepared the working drawings for the bell in his office at Halifax. Mr. Macdonald was then the writer's assistant and office engineer there, and he, along with the late Lieut. C. S. DeGruchy, M.C., and other assistants, did excellent work on the completion of the design and of the working drawings.

The tender scow with its air compressors, etc., and the air locks, etc., of the Bell were designed and constructed, or supplied and fitted by the contractors, mostly under Mr. Taber's direction and supervision.

The general plan and details of the Halifax Bell were certainly original in that they were designed for a definite purpose on scientific first principles and from practical personal experiences, and were not copied from any other plans or plant. The designers, were, however, aware of, and were naturally supported in their decisions by the knowledge and precedents of the large Bells or floating Caissons that had been successfully used in dock works in years past at Marseilles, Antwerp, Rotterdam, Bilbao, etc.

In the winter of 1913-1914, when the Halifax Bell was designed in its present form, none of those responsible had, so far as the writer knows, any knowledge of Mr. Taylor's scheme, plans, or plant. Unlike Mr. Taylor's apparatus, the new Halifax Bell of new design and working under new conditions in fairly open tidal waters, for the first few days, as was to be expected, was the cause of some little anxiety and revealed some minor defects. The skill and energy, however, of J. P. Porter, who had then taken charge for the contractors, rapidly overcame these troubles, and the writer may safely say that the Bell for two years without mishap did excellent work under his personal supervision and made steady progress and good time.

Writing from the Field in France, the writer is at the disadvantage of having no notes or means of reference at hand, but the principles and applications of compressed air in working chambers of Caissons, Diving Bells, etc., for subaqueous work must be familiar to many members of *The Institute*, and he thinks that they will agree that Mr. Taylor unduly flatters himself if he claims to be the sole anticipator, originator or inventor of large Diving Bells of the Halifax type.

The writer regrets he has never had the privilege of seeing Mr. Taylor's plant, but he has a hazy recollection of having heard, probably in 1914, about an outfit, which he thinks may have been Mr. Taylor's, for cutting off and capping piles on the lakes a foot or two below water level in still water, subject to no rise or fall or range of tide; that is, for application to work and conditions quite different to those at Halifax.

JAMES McGREGOR, Major.
C.E. 3rd Bn. Can. Rly. Troops.
In the Field, B.E.F., France,
3rd December, 1918.

Thoughtful Suggestions

Editor *Journal* :—

I think an occasional letter from individual members, in appreciation of what you are doing in our behalf, may serve to encourage you in your future efforts. The work of getting out a monthly "Journal" is in itself no mean task, and the numbers I have received are a credit to *The Institute*. The influenza epidemic has retarded progress in our local branch as public meetings were out of the question. There are important matters to be discussed, particularly that of legislation affecting the engineering profession. I think the draft act submitted by the Saskatchewan Branch illustrates one of the great dangers to be avoided by *The Institute* in Canada.

The idea that competition among members of the profession is the cause of the unsatisfactory conditions of employment and remuneration is entirely erroneous. Engineering work is not a fixed quantity in any community, nor can it be reckoned as a percentage based on population. There is room for unlimited growth and expansion, one successful enterprise making way for another. It is a case of "work makes work" and the benefit is not limited to any one line. The lack of definite knowledge that a certain undertaking can be carried through successfully often exerts a retarding influence on other lines of development. Likewise research work, exploration and the collecting and tabulating of data have a marked influence in increasing demand for engineering services. To-day an engineer must specialize, consequently he must be able to move in the widest possible field to keep steady employment. This prohibits local protection. There is no surer way of producing stagnation in the profession than by forming closed corporations. It is true that congestion is bound to occur in certain centres from time to time which re-acts most unfavorably on those who are permanently located there. Better organization and more mutual consideration among members would do much to obviate this difficulty.

One good feature embodied in the Saskatchewan draft was that of registration, but such a measure should require merely a nominal fee. This would enable the local branches to keep tab on irresponsible individuals who were practising engineering to the detriment of the profession. I am not here referring to competition, but to the injurious effect of incompetent work. The failure of an undertaking, excessive cost, reports which are unreliable, all make for a decreased demand for engineering services.

With the seasons's best wishes.

Sincerely yours,

G. B. McColl, A.M.E.I.C.

Some Salary Offers

Editor *Journal* :—

Owing to my position here as district engineer, I am in receipt each week of a Government publication called the "Canadian Official Record." In reading over this paper I have come across some items which I believe should be brought to the notice of Council for action.

On page 4 of the issue of November 5th, 1918, there is a notice of positions vacant in the Civil Service, I quote therefrom as follows:—

"2. A Clerk in the Statistical and Research Branch of the Department of Labor at a salary of *$1,800.00* per annum. Candidates should be graduates of a recognized university with training in economics and research work and some knowledge of office routine.

3. A Photographer for the Exhibits and Publicity Bureau of the Department of Trade and Commerce at an initial salary of *$1,600.00* per annum. Candidates must have a complete knowledge of photography, etc.

5. *An Assistant Engineer in the office of the Water Power Branch at Winnipeg, Department of the Interior, at a salary of $1,500.00 per annum. Applicants should be British subjects,* not more than 35 years of age. They should be graduates in engineering of some recognized university and should have at *least two years field and office experience in engineering.*"

Here is another, in the issue of December 3rd, as follows:—

"1. A secretarial clerk for the permanent staff of the President of the Council, Grade D. of the First Division, at an initial salary of $1,800.00 per annum. Candidates should know shorthand and have office ability.

2. A female clerk in the Employment Division of the Department of Labour at a salary of *$1,600.00* per annum. Qualifications as in paragraph 2 above."

3. An assistant engineer on the staff of the British Columbia Hydrometric Survey at a salary of *$1,500* per annum." Qualifications as for the other engineering position vacant."

Is *The Institute* interested in its members? Is it taking any notice of the fact that the Civil Service Commission is at present working on the reorganization of the outside service and the question of the remuneration for a great many members of *The Institute*.

It would look as though it were better to be a "female clerk" than an engineer.

Yours sincerely,

One Affected, A.M.E.I.C.

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UNCLASSIFIED

Eye, Sensibility. The Sensibility of the Eye to Light of Different Colors. Sci. Am. Supp., vol. 86, no. 2236, Nov. 9, 1918, p. 301, 1 fig. Results of measurements carried out at Bureau of Standards.

Rolling Mills. Diagonals for Designing Rolls for Billet Mills, A. R. Mitchell Iron Age, vol. 102, no. 20, Nov. 14, 1918, facing page 1198. Tables for determining dimensions of passes when width and corner radii of billets are given.

Spark Plugs. Note on the Effect of Temperature on the Resistances of Spark Plug Insulations, J. D. Morgan. Engineering, vol. 106, no. 2758, Nov. 8, 1918, pp. 513-514, 3 figs. Description of an investigation.

PERSONALS

Gunner W. G. Mawhinney, B.C.E. (Man.) S.E.I.C., returned to Canada, December 20th, on the SS. "Regina," and is spending a furlough at his home in Tuelon, Manitoba.

Among the many members of *The Institute* who have been rewarded for their bravery during the War, will be noted with great satisfaction the name of Lieut. Frederick Alport, A.M.E.I.C., who was recently decorated with the Military Cross.

E. L. Cousins, A.M.E.I.C., chief engineer and general manager, Toronto Harbour Commissioners, who has been for the past six months acting as assistant fuel controller for Ontario, has recently accepted the position of industrial commissioner for the city of Toronto, in which capacity his services will be gratuitously given.

Lieut. W. D. Stavely, is still another member of *The Institute* to receive recognition for conspicuous bravery while on active service, having recently been awarded the Military Cross. Lieut. Stavely is a graduate of McGill University and became an associate member of *The Institute* in 1913. Before going overseas he was with Thomas Kirk, A.M.E.I.C., Q.L.S.

Major A. Douglas Fisken, M.C., J.E.I.C., of Toronto, was welcomed home recently after many months of active service at the front. Major Fisken who is an R.M.C. man, was in the thick of the fighting with the Canadians, was gassed and severely wounded. He plans to go to Victoria at an early date, pending his discharge from the army, and anticipates residing at the Coast.

Boris A. Bakhmeteff, M.E.I.C., Russian Ambassador to the United States, is now in Paris with other Russian diplomats seeking to preserve a United Russia. In an announcement to the Associated Press Mr. Bakhmeteff stated that Russia has been granted a respectful hearing by the Allies in her request for representation at the Peace Conference.

V. I. Smart, M.E.I.C. formerly Professor of Railway Engineering and Transportation, McGill University, and J. A. Burnett, A.M.E.I.C., formerly Electrical Engineer, Grand Trunk Railway System, are now associated as Consulting Engineers, located at, 821 New Briks Building, Montreal. The lines handled will be civil, electrical and mechanical engineering.

H. T. Eaton, who is a student member of *The Institute*, has received his commission as a lieutenant in the Canadian Engineers. Lieut. Eaton has been with the Canadian Expeditionary Force since 1914 when he went overseas with the 1st Field Troop. He is a graduate of Queen's University and was practicing as a civil engineer in Controller Tyrrell's office, Toronto, before enlistment.

Howard G. Kelley, M.E.I.C., President of the Grand Trunk Railway System, in his New Year's Greetings to the officers and employees said in part:—

"At the close of this eventful year, in which peace has been restored to the world, I desire personally to thank all officers and employees for the part they enabled the Grand Trunk to play in winning the war by their loval and efficient service."

The Dominion Government has appointed A. W. Campbell, M.E.I.C., to report on the action which should be taken by the Government in connection with the construction and improvement of roads, for which it is being asked to give its aid. Mr. Campbell was greatly interested in the subject while Deputy Minister of Public Works for Ontario about eight years ago before becoming Deputy Minister of Railways and Canals, which position he has lately resigned.

G. J. Lamb, Jr., J.E.I.C., has resigned his position as acting engineer of the city of Port Arthur and accepted an engineering appointment with the Kipawa Fibre Co., Temiskaming who are constructing a new town site in connection with their plant, with housing accommodation for about 7,000 people. R.S. & W.S. Lea and H. S. Ferguson, members of *The Institute*, are the consulting engineers for this work, the contract for which is held by The Fuller Construction Co.

Brigardier-General Charles J. Armstrong, C.M.G., M.E.I.C., is receiving the congratulations of his many friends on the honor bestowed on him by the King at the New Year in being created a Companion of the Bath. At the outbreak of the war he was one of the first to volunteer and went over with the First Contingent as Colonel in Command of the Engineers. He became Brigadier-General and after receiving severe injuries in a railway accident which kept him in hospital nineteen months, he was attached to the Imperial forces. He is now Chief Engineer of the Seventh Army Corps, and in charge of the repair and reconstruction of canals in Belgium and France. He also saw service in South Africa.

Captain Geo. H. Ferguson, M.C., B.A.Sc., A.M.E.I.C., of Toronto, has recently retired from the army and expects to resume his former occupation at an early date. Enlisting in the early days of the war Captain Ferguson was in the thick of the fighting in the forward area during the Somme, Vimy and Paschaendael engagements and was continuously under fire during the German advance in the spring of 1918 and remained unhurt until the end of June, when his leg was broken. Due to continuous exposure he suffered from complications, which necessitated his returning home for a rest, where he was convalescing when the armistice was signed. Captain Ferguson's many friends in the profession wish him a speedy recovery to enable him to continue his successful engineering career.

Major F. L. C. BOND, A.M.E.I.C.

Major F. L. C. BOND, A.M.E.I.C.

Chief Engineer, Grand Trunk Railway

Major F. L. C. Bond, A.M.E.I.C., has been appointed by the Executive of the Grand Trunk Railway as chief engineer of the System to succeed H. R. Safford, M.E.I.C., who resigned recently to become regional director of the Central Western District, United States Railroad Administration. Major Bond has just returned from overseas after two years' service with the 10th Battalion Canadian Railway Troops. He was born in Montreal in 1877, was educated at Montreal High School, the Collegiate Institute and McGill University. Upon graduating from McGill in 1898 he entered the service of the Grand Trunk as Assistant Resident Engineer of the Eastern Division, and in 1901 was appointed engineer in charge of double track construction. In 1902 he was night superintendent on the construction of the Park Avenue tunnel, of the New York subway, but returned to the Grand Trunk as Resident Engineer, Eastern Division, a position which he held until 1913. From 1913 to 1916, when he went overseas, Major Bond was Division Engineer,. Eastern Lines, Grand Trunk Railway System. He holds a high reputation in railway and engineering circles, and his work with the Canadian Expeditionary Force won the highest commendation.

+ + OBITUARIES + +

Henry Martyn Peck, S.E.I.C.

News of the death but no particulars have been received concerning Henry Martyn Peck, Student member of *The Institude,* who died of wounds in France, September 28th, 1918. The late Mr. Peck was twenty-six years of age and was educated at Moncton College, England and Toronto University. His home was at 324 Glen Road, Toronto.

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Leonard Oswald Clarke, A.M.E.I.C.

On November 22nd, Leonard Oswald Clarke, A.M.E.I.C., O.L.S., succumbed to an attack of influenza-pneumonia at the age of thirty-seven years. He entered *The Institute* as a Student member in 1903, and became an Associate Member in 1906, at which time he was town engineer of North Bay, Ont. During this time the present water and sewer systems, including large storage reservoirs, were designed and constructed. Previous to this he was connected with F. W. Farncomb, of London, Ont., and afterwards with the late Jos. Cozens, at Sault Ste. Marie, Ont. For a number of years the late Mr. Clarke engaged in private practice in North Bay, following which he was engaged in contracting, mainly on the Lake Superior Division of the Canadian Pacific Railway.

Mr. Clarke was well know in the north country, having laid out many of the town sites along the T. & N. O. Railway, including Cobalt, Ont. He was a prominent Mason, being Past District Grand Prior for Algoma District. For the past three years Mr. Clarke has made his home in Toronto, where he was buried on November 23rd, at Mount Pleasant Cemetery. His family will make their home in Aurora, Ont.

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Walter Kendall Greenwood, B.A.Sc., A.M.E.I.C.

After a brief illness from pneumonia, Walter Kendall Greenwood, A.M.E.I.C., engineer of the Orillia Water, Light and Power Commission, died at his home in Orillia at the age of thirty-seven years. Born in Toronto on June 1st, 1881, he entered the Upper Canada College in 1894 and later attended the University of Toronto, graduating with honours in 1905. During his summer holidays he occupied positions as draftsman with Canadian General Electric Company, draftsman and engineer with Hamilton Gas Light Company, assistant to superintendent Toronto Niagara Power Transmission Line. For a year he was manager and superinendent of the Bowmanville Electric Light Company and later occupied a position with the Producer Gas Company of Toronto. In 1907 he was resident engineer of the Simcoe Water Works construction and in 1908 occupied a similar position at Thorold, Ont., later securing the position which he occupied at the time of his death.

The late Mr. Greenwood was elected an Associate Member of *The Institute* in 1908 and took an active interest in its affairs. At the time of the Professional Meeting held in Toronto last spring, he took an active part in the discussion of several of the papers. He was a son of Russell Greenwood, of Toronto, and was held in the highest esteem by all who knew him.

* * *

William John Galbraith, B.Sc., A.M.E.I.C.

An illness of only two weeks from influenza which developed into pneumonia, caused the death of William John Galbraith, B.Sc., A.M.E.I.C., at his home, 4145 Dorchester Street, Westmount, on Saturday, December the 21st, at the age of 32 years. The late Mr. Galbraith was a Montreal boy, having attended high school in this city, graduating from McGill University in 1909. In the statement of his engineering career, he mentioned that he was engaged as a draftsman with the Dominion Bridge Company, in 1902, previous to his entering McGill. On his graduation he was with the Geological Survey in British Columbia; about two years later, he was assistant engineer on caisson work on the sub-structure of the Quebec Bridge. As a contractor on his own account he undertook a number of important works, including the Government dock at Berthier, Que.; dam and power house at Ingles Falls, Ont.; two railway bridges at St. Hyacinthe; reinforced concrete rib arch bridge over the Speed River at Guelph, the wireless station at Newcastle, N.B., and the dam and power house over the Severn River, for the Hydro-Electric Power Commission, Ontario.

In 1916 the late Mr. Galbraith joined the Foundation Company as superintendent of construction, and devoted his attention to the erection of shipbuilding plants at Victoria, Seattle, Tacoma and Savannah, and at the time of his death was engaged in construction of a ship canal and shipyards at New Orleans. He had been called to Montreal in connection with the valuation of a shipyard for the Dominion Government.

An energetic, capable, construction engineer and typically Canadian, at an early age engaged on some of the largest construction works on the Continent, he had already achieved success and his career promised to be one far beyond the average.

He is survived by Mrs. Galbraith and one daughter.

* * *

Laurence Anable Darey, M.E.I.C.

Laurence A. Darey died suddenly at his home in Sherbrooke, on November 29th, and was buried at the Mount Royal Cemetery, Montreal, on December 2nd. He was widely known in Canada in connection with railway engineering.

In later years he had been mainly connected with the building of the Transcontinental Railway, though in the western construction camps of the Canadian Northern and on various lines in the western United States, "Larry" Darey was equally well known and widely popular.

He was born in Montreal on May 8th, 1865, the second son of the late P. J. Darey, Professor of French at McGill University. He was educated at McGill University and Union College Schenectady. He early entered the profession of railway engineering some years in Georgia, a year in Chili four years in the Panama and a period in the western States were among his early railroad experiences. In 1902 he married Ardella E. Murphy of Decorah, Iowa. He was later with the Canadian Northern in Saskatchewan and afterward with the G.T.P. at Winnipeg. For a few years he was chief engineer for the St. Maurice Construction Company at Three Rivers and for nine years prior to the outbreak of war he was divisional engineer on the Transcontinental Railway above La Tuque, Que.

For the past four years the late Mr. Darey had resided in Sherbrooke where he held the post of chief engineer for the Good Roads movement. Ill health had prevented him from engaging in active work for the last two years but his death came unexpectedly. Disappointed at the fact that his health prevented him from joining a construction unit for overseas service, he went last spring to the Rockies and spent two months at the Yellowhead Pass in connection with the taking up of steel for shipment to France.

He is survived by Mrs. Darey, who is at present residing in Sherbrooke.

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Albert James Hill, M.E.I.C.

One of the original members of *The Institute* passed away on November 26th, at his home in New Westminster, B.C., in the person of Albert James Hill, at the ripe age of eighty-two years. He is survived by Mrs. Hill, one daughter and two sons, F. T. Hill, of New Westminster and E. B. Hill, M.E.I.C., of Vancouver.

The late Mr. Hill was born at Sydney, Cape Breton, on April 7th, 1836, his parents being John Lewis and Margaret Hill, the latter a daughter of Dr. Joseph Whyte, R.N., of Banff, Scotland. His early education was acquired at home and he spent several years associated with his brothers in the building and launching of two schooners. In 1860 he entered Horton Collegiate Academy, where he completed his education, and in 1866 married Agnes Lawrence, the youngest daughter of Alexander Lawrence of St. John, New Brunswick. After spending two years as a member of the faculty of Horton Academy, Mr. Hill accepted an appointment on the European & North American Railroad, assisting in locating the line to Winn on the Penobscot River. During the next six years he was connected with different railroad companies in their exploration, survey and construction departments. After that he turned from railway building to the development of the coal resources of the country. He carried on a geological survey of the eastern Cape Breton coalfields, afterward embodied with the plans of the Dominion geological survey and published by order of the government. On January 1st, 1880, Mr. Hill was ordered to British Columbia on the construction on the Canadian Pacific Railroad, on the contract from Yale to Savona.

He continued in that work until October, 1882, when he was removed to Port Moody, closing his connection with the government service in December, 1884. He then engaged in the private practice of his profession in New Westminster. He was at one time engineer for the Municipality of Surrey. He has rendered efficient service both in public and private capacities to geological research in his native province and in British Columbia. His life work has been a valuable contribution to those labors which figure as factors in civilization and general improvement and he had a wide acquaintance among those who are prominent in scientific and professional circles throughout the country.

* * *

Professor William Muir Edwards, M.Sc., M.E.I.C.

The Edmonton Branch, and, in fact, the entire Institute, suffered a severe loss in the death, on Thursday, November 14th, of Professor William Muir Edwards, of pneumonia following influenza. His death will cause the deepest regret among a very wide circle of friends and admirers, not only in the city of Edmonton, where he was professor in civil and municipal engineering in the University of Alberta, but throughout Canada. Few men have the combined ability and devotion to public service that were his. Following a brillant career at McGill University, where he graduated with the degrees of B.Sc. in mining engineering, and M.Sc., he was for two years in charge of municipal engineering and mathematics, also hydraulic engineering, at McGill University. When the University of Alberta was organized in 1907 he was appointed to the professorial chair which he occupied at the time of his death.

Late Professor W. M. Edwards

In university circles he was a leading member of the Faculty, having held the Presidency of the Faculty Club for five years. His interests in student welfare were of the most varied character and always sustained with unflagging energy. He took an active part in athletics and trained the Varsity team in 1914 which carried off the senior Provincial championship. He was President of the Soldiers' Comfort Club and editor of the "News Letter" which was sent every week to every student of the University on active service. His public spirit and citizenship was shown in his being the prime mover in establishing the south side branch of the Young Men's Christian Association and for two years he served as officer commanding the 101st regiment.

He was also actively connected with Knox Presbyterian Church of which he was an elder as well as a member of the board of managers.

The following tribute to the late Professor Edwards appeared in an editorial of the Edmonton Journal on November 15th.

"Many devoted Edmonton men and women have literally sacrified their lives in fighting the scourge which has played such havoc here in the past few weeks and in seeking to alleviate the suffering of those already stricken down. Professor W. Muir Edward, of the University of Alberta, belonged to that heroic band. The volunteer work which has been done in this city during this period of great affliction has been of the kind that gives one a new faith in humanity. Whether, like him, they have given the last full measure of devotion or whether they have come safely through the dangers of their self-imposed tasks, we cannot begin to render to them the tribute that is their due.

Apart from this, the loss of Professor Edwards to the city and the province is a most serious one. One of the original members of the University staff, he did most excellent work in his department both in the days of small things for the institution and after it had attained a large development. His engineering advice was often sought and highly valued in connection with civic and other undertakings.

Few men have a wider range of interests. He was as active in church and Y.M.C.A. work as in the promotion of athletics. Nothing which went to the building up of clean, virile young manhood failed to attract his interest and his energies. He had nothing whatever in common with the ordinary notion of a university professor, living in a world of abstractions apart from the world of men. It is because the provincial seat of higher learning has, in all that it has done, kept so close to the everyday life about it that it has made such a place of usefulness for itself and has made such a growth in its comparatively short time of existence.

In the great years ahead of us, men like Professor Edwards will be needed as never before and his death, with all its attendant circumstances, is a most poignant tragedy."

In the engineering profession in which he occupied a high place his interest was constant. When the Edmonton Engineering Society was in existence he took an active interest in the organization and when elected President arranged a re-organization as the Edmonton Branch of the Canadian Society of Civil Engineers, which gave Edmonton engineers better status. Shorty before his death he helped the Edmonton Branch to take a prominent part in provincial legislation and the draft Act which the Branch has submitted is largely his work.

The late Professor Edwards was born in Montreal, November 14th, 1879 and is survived by Mrs. Edwards and a small family.

Preliminary Notice of Application for Admission and for Transfer

The By-Laws now provide that the Council of the Society shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in January, 1919.

FRASER S. KEITH, Secretary.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BALFOUR—HARRY E., of Quebec, Que. Born at Emerson, Man., Jan. 22nd, 1884. Educ. Vancouver high school, I. C. S., graphic statics and proportioning materials, reinforced concrete construction. International Library of Tech. With National Transcontinental Ry., as follows: 1906-07, draughtsman, Ottawa; Jan. 1907 to June 1907, draughtsman and topographer on location; 1907-09, asst. engr. on constr. Resy. 21B (2 mos. acting res. engr.); 1909-10, draughtsman dist. office, North Bay; Mar. to Nov. 1910, res. engr. Resy. 23, D; 1911-12, draughtsman in Winnipeg Car Shops (3 mos. asst. engr. constr.); 1912-13, draughtsman on design, Quebec Loco. Shops; 1913-16, asst. engr. of constr., Quebec shop plant; 1916 to date, asst. engr. Jos. Gosselin Ltd.

References: C. V. Johnson, A. C. Fellows, J. H. Holliday, W. N. Cann, D. A. Evans D. MacPherson.

BALLS—MATTHEW, of Vancouver, B.C. Born at Ryton-on-Tyne, Eng. Oct. 8th, 1887. Education, 2 yr. science course, Westoe higher grade school, South Shields, Eng. 1906 (7 mos.), with the S.P. & S. Ry., as rodman, leveller, etc.; 1907, draftsman, Northern Pacific Ry.; 1907-08, rodman and instrumentman, S.P. & S.Ry.; 6 mos. on railway work in Alaska; with the N.P.Ry., from 1909 to 1915, as rodman, topographer, etc., and res. engr.; 1915 to date, asst. engr., Dom. Govt Hydrometric Survey.

References: T. H. White, S. H. Sykes, E. R. Millidge, R. G. Swan, J. B. Challies, F. W. Knewstubb.

BELLOWS—WARREN SYLVANUS, of Fort William, Ont. Born at Kansas City, Mo., Aug. 15th, 1889. Education, B.Sc. (C.E.), Univ. of Kansas, 1911. 1908, on ry. constrn., Union Pacific Ry.; 1909, ry. survey, Los Angeles aqueduct; 1910, bldg. foreman, Wilson & Co.; 1911-13, dftsman, designer, etc., bridge dept., Kansas City Terminal Ry.; 1913-15, supt. bldg. constrn., for Marsh, Hutton, Powers Co., Fort William and Port Arthur; 1915-18, member of Fegles-Bellows Engr. Co. Ltd., Fort William, Ont., designing and constrn. of bldgs.

References: W. A. Duff, B. S. McKenzie, H. B. R. Craig, L. M. Jones, W. E. Joyce, J. F. Greene.

BOESE—GEORGE PHILIP FREDERICK, of Calgary, Alta. Born at Torton, England, March 3rd, 1880. Educ., science courses at Worcester and Nottingham, England. With C.P.R. as follows: 1907-1910, transitman and asst. to engr. in chg., Montreal and Ottawa; 1910-11, engr. in chg. of constr. of steel diversion and tunnel and locating and estimating for water gravity systems, Lake Superior dist.; 1911-12, asst. engr. in chg. of constr. new line; 1912-14, res. engr. in chg. of constr between Montreal and Toronto and at Trenton; 1915-17, work on mech. designs and drawings for private concerns; 1917 to date, asst. engr. C.P.R., dept of natural resources engr. branch at Lethbridge and Calgary.

References: A. S. Dawson, A. McCulloch, J. E. Beatty, C. W. P. Ramsey, H. L. Sherwood.

BROWN—LOREN LEWIS, of Vancouver, B.C. Born at Portland, Ore., Jan. 22nd, 1887. Educ., B.Sc. Civil Engineering, Univ. of Idaho, 1911. Instrumentman, with the Spokane & Inland Ry; 1911-12, in chg. of concrete constr., Canadian Mineral Rubber Co., Victoria, B.C. (paving); 1912-13, in chg. of frame and reinforced concrete building constr. for the Westholme Lumber Constr. Co., Victoria; 1913-14, in chg. of reinforced concrete building constr. for the B. C. Constr. Co., Victoria; 1914-15, testing machine operator and computing engr., Forest Products Laboratories of Canada, McGill Univ.; 1915 to July 1918, Lieut. 1st Canadian Tunnelling Co. At present time superintendent, Forest Products Laboratories of Canada, Univ. of B.C., Vancouver, B.C.

References: A. Lighthall, C. E. Webb, R. G. Swan, W. J. Johnston, E. G. Matheson.

BUCHANAN—COLIN ARCHIBALD, of Levis, Que. Born at Levis, Que., Sept. 14th, 1889. Educ., 3 yrs. applied science, McGill Univ. With T. C. Ry., as follows: 1907-10, draftsman; 1910-13, instrumentman, dist. B.; 1914 (3 mos.), instrumentman, (3 mos.) res. engr.; May 1916 to Sept. 1916, with Messrs. W. P. & J. T. Davis, contractors, as asst. engr.; Lauzon Dry Dock, Sept. 1916-Oct. 1917, and summer of 1918, instrumentman with Quebec & Saguenay Ry. At present 4th yr. student Civil Engineering, McGill University.

References: H. M. MacKay, E. Brown, A. Ferguson, A. Dick, W. N. Cann, A. Babin.

CAMPBELL—NEIL, of Ottawa, Ont. Born at Perth, Scotland, Nov. 25th, 1887. Educ. Crieff, Acad. Perthshire, Sharps Inst., Perth, and school of engineering, Dundee, Scotland. 1905-09, pupilage in dist. engr's office, Caledonian Ry. Co. Perth; 1909-10, res. engr. on constr. work for C. Ry. Co.; 1911-14, draughtsman, instrumentman and acting res. engr. on location and constr., C.P.R.; 1915, engr. with Imperial Munitions Board on shell production work; 1916-17, field engr., Dom. Bridge Co., on munitions plant, constr. and maintenance; 1918, to date, production engr. in shipbuilding dept., Imperial Munitions Board, Ottawa.

References: C. W. P. Ramsey, F. MacArthur, L. W. Klinger, W. H. McGaan, L. J. M. Howard.

CHILDERHOSE—ERWIN ALFRED, of Winnipeg, Man. Born at St. Thomas, N. Dak., U.S.A., April 14th, 1894. B. E. E., i Manitoba, 1917. Instrumentman on roads and drainage; draughtsman in elec. engr's office; elec. eng. on power house and substation constr. and installing of machinery; at present asst. to ch. engr., city of Winnipeg, Light and Power dept.; in chg. of installing apparatus in generating station and constr. of substations and equipment, elec. wiring and installation of plants in public buildings.

References: E. V. Caton, W. M. Scott, E. E. Brydone-Jack, G. C. Dunn, F. H. Farmer, J. M. Leamy, T. Roberts.

COLHOUN—GEORGE ANDREW, of Hamilton, Ont. Born at Sparta, Ont., Dec. 23rd, 1881. Educ. S.P.S., Toronto, 1906. 1903 (9 mos.), in machine shops and foundry of Thom's Imp. Works, Watford, Ont.; 1904 (3 mos.), in office of Stanley Code, C.E., Alvinston; with the Hamilton Bridge Works Co., as follows: 1906-09 detailer of structural steel drawings; 1909-14, checker of structural steel drawings for buildings, bridges, etc.; 1914, and at present time, with Hamilton Bridge Works in designing and estimating dept., making and checking designs and estimates of all kinds of structural steel.

References: J. A. McFarlane, E. H. Darling, E. H. Pacy, J. G. Jack, A. S. Code.

CROLY—JOHN BULL, of Vancouver, B.C. Born at Cork, Ireland, Jan. 8th, 1867. Educ. Queen's Coll., Galway, Ireland, certificate for military engr. 1900-06, temporary surveyor on civil staff of R. E.; 1906-11, on engr. staff, C.P.R., as inspector of steel bridges, elevators, freight sheds, etc.; 1911-12, municipal engr. Chilliwack B.C., in chg. of constr. work; 1913, with prov. Govt as inspector of steel on the new Parliament Bldgs., Victoria, B.C.; 1 yr. with Messrs. Waddell & Harrington, bridge designers, Kansas, U.S.A.; in chg. of erection of bridges at Vancouver, B.C.; at present with Robert Hunt & Co., consulting engrs., Vancouver, B.C., as inspecting engr

References: F. F. Busteed, H. Rindal, C. E. Cartwright, A. D. Creer, C. B. Freeman.

DANKS—FRANK A., of Toronto, Ont. Born at Petrolea, Ont., March 20th, 1888. Educ. C. E. Univ. of Tor., 1908. 1908 with Allen Hazen, N.Y., as dftsman on design of Tor. filtration & asst. on constr. Yonkers filtration, 1909-10 asst. works dept. Toronto on constr. Tor. filtration, 1910-13. F. H. Latimer, Penticton, B.C., on Hydro-elec. survey & installation, irrigation & subdivisions, 1913 bridge designer, Kettle Valley Ry., Penticton, 6 mos. transitman on roadways, Toronto, 1913-18 asst water supply section, Toronto, installation of steel conduits & Toronto Drifting Sand Filtration plant, 1918 constr. supt. J. B. Nicholson Ltd., Hamilton and at present constr. engr. British Forgings, Ashbridges Bay, Toronto, under F. R. Miller.

References: F. H. Latimer, J. B. Nicholson, J. Milne, G. G. Powell, R. B. Evans.

FULLER—HAROLD PAUL, of St. James, Man. Born at Bury, Que., Nov. 4th, 1887. Educ. high school & I. C. S. course in C. E. Summer 1907 rodman with G.T.R. Aug.-Dec. 1908 leveller on location Q. C. R., Apr.-Aug. 1909 asst. to field engr, J. G. White & Co., survey power development at St. Timothy, Que. Aug.-Dec. 1909 inspector of constr. under engr. of constr. Montreal & Southern Counties Ry., 1910-14 instrumentman on constr., location & maintenance G. T. R., 1915-16 instrumentman C. N. R., 1916 to date asst. engr. C. N. R.

References: A. T. Fraser, T. Turnbull, W. Walkden, T. W. White, W. Burns, J. N. deStein, J. T. Morkill, J. A. Burnett.

GAINES—EDWARD C., of Montreal, Que. Born at Slater, Missouri, Feb. 1st, 1878. Educ. B.S. in E.E., Univ. of Missouri, 1900. 1900-01, Supt. Elec. Light & Motor Plant, Holden, Mo., 1901-02, crane inspector and foreman of maintenance and operation elec. dept., Hamstead Steel Works of Carnegie Steel Co., Pittsburgh, Pa.; with Heyl & Patterson, of Pittsburgh, Pa., as follows: 1902-06, draftsman; 1906-11, asst. div. engr.; 1911-16, div. and elec. engr. in chg. of design of coal and ore handling machinery, etc.; 1916-18, designing mech. engr., Dominion Bridge Co., Montreal; at present engr., crane and conveyor dept., Dominion Bridge Co., in chg. of dept.

References: H. H. Vaughan, G. H. Duggan, W. F. Angus, E. S. Mattice, F. P. Shearwood, A. E. Johnson.

HOBSON—ROBERT, of Hamilton, Ont. Born at Kitchener, Ont., Aug. 13th, 1861. Educ. public schools, Guelph and Hamilton. 17 yrs. with chief engr. of G. W. & G.T.Ry. (his father); in the iron and steel business since 1896; at the present time president Steel Co. of Canada.

References: J. M. R. Fairbairn, H. H. Vaughan, G. H. Duggan, H. R. Safford, W. J. Francis, W. F. Tye.

HOWARTH—CHARLES, of Calgary, Alta. Born at Newport, England, July 21st, 1885. Educ. tech. courses, Board of Educ., London; in maths. and mechs., and general engr., City & Guilds School of Tech., London; apprenticed as mech. engr. with Emlyn Engr. Wks., Newport, England; 1906-08, student dftsman, Uskside Engr. Co.; and 1908-11, foreman dftsman at same place. 1911-13, supt. of constr., Albert Engr. Co., Calgary; 1913, dftsman Northwest Steel Co., Vanc.; 1914, dftsman under C. M. Arnold, bridge engr., Calgary; 1915, to date, ch. engr., United Grain Growers Ltd., in chg. of all engr. work required by the company.

References: C. M. Arnold, F. W. Alexander, G. W. Craig, C. H. deKam, W. J. Gale, A. S. Chapman, H. S. Johnston.

HUETHER—ALVIN DAVID, of Niagara Falls, Ont. Born at Newstead, Ont., July 24th, 1887. Education, B.A.Sc., Univ. of Toronto, 1909. 1909-1911, in city hall as rodman, instrumentman and dftsman, Toronto; 1910, trstman, D.L.S., Alta.; 1911, asst. to city engr., Owen Sound; 1912-16, in city hall, Toronto, as dftsman and res. engr. in sewer dept.; 1916-1918, not in eng. work; at present time instrumentman for Hydro Elec. Power Comm'n.

References: T. H. Hogg, W. Jackson, G. F. Hanning, R. McDowall, W. R. Worthington, E. G. Hewson.

JONES—THOMAS MARSDEN, of Toronto, Ont. Born at Cardigan, South Wales, Feb. 25th, 1886. Educ. Tech. Inst., Newport, Mon. Courses in steam applied mechs., machine constr., practical math., South Kensington, London. 1901-07, apprenticed with the Newport, South Wales Docks & Ry. Co., England, 4 yrs. machine shop, 1 yr. pattern shop and foundry, and 1 yr. drawing office; 1907-08, marine engr., trading to the Mediterranean and Black Sea, in chg. of watch on main engines; 1908-10, engr. with Jordans Ltd., Newport, Mon., Pipe Foundries & Engrs., in chg. of constr. of installation of Herberts' Patent Hydraulic Pipe Moulding Machines, and of modern gas drying systems for pipe moulds, etc.; 1910-11, Caledonian Iron Works, draughtsman on Worthington Turbine Pumps; 1911-13, ch. engr., Canada Iron Corporation, in ch. of all new equipment and constr. in Canadian plants; 1913-16, Can. Allis-Chalmers Ltd., Toronto, ch. designer of Mather & Platt Turbine and Centrifugal Pumps; 1916, to date, ch. engr. and manager of the Bawden Pump Co. Ltd., Toronto.

References: J. Milne, C. L. Fellows, P. Gillespie, R. O. Wynne-Roberts, E. A. James.

LARSON—CARL HERMAN, of Cabri, Sask. Born at Skofde, Sweden, July 26th, 1872. Educ. B.S., Nebraska, 1902. 1902-03, with Chicago Great Western Ry., concrete inspector and instrumentman; 1904-06, with C.R.Ry. as concrete inspector and instrumentman; 1906-09, with C.R.Ry., res. engr. in chg. of grading, and Saskatoon bridge and terminal constr.; 1910-14, with C.P.Ry., in chg. of railway and constr. work; at present time municipal engr., R. M. Riverside, in Sask.

References: W. A. James, J. G. Sullivan, J. Callaghan, J. R. C. Macredie, A. McCullough.

MACDONALD—AUSTIN PERCY, of Minto, N.B. Born at Moncton, N.B., March 30th, 1892. B.Sc., Univ. of N.B., 1917. Summers of 1916 and 1917, with N. B. Crown Land Survey; 1918, and at present, engr. Rothwell Coal Co., Ltd., Minto, N.B., in chg. of stripping operations.

References: J. A. Stiles, A. K. Grimmer, S. B. Wass.

MACDONALD—WILLIAM COLE, of Woodmans Point, N.B. Born at Shelburne, N.B., May 9th, 1884. Education, E. E. course, Dalhouse Coll. 1907-13, dftsman, instrumentman and res. engr., N.T.Ry.; 1913-14, res. engr., C.P.R., Sudbury; 1914-16 engr., Cook Constrn. Co., on Montreal aqueduct; 1916, to present time, engr. and accountant, Kennedy & MacDonald, St. John & Que. Ry., Woodmans Point.

References: C. O. Foss, H. Longley, W. J. DeWolfe, R. H. Cushing.

McCALL—JAMES FERGUSON, of Calgary, Alta. Born at Dumfries, Scotland, Oct. 12th, 1868. Educ. public school. Mach. shop practice on constr. and repairing and erection of steam machy. For 25 yrs. in responsible chg. of steam boilers, engines, turbines, elec. generators, etc. At present chief engr. of the city of Calgary, Power dept.

References: G. W. Craig, A. S. Chapman, W. J. Gale, C. M. Arnold.

MILLS—GEORGE ARTHUR, of Winnipeg, Man. Born near Independence, Iowa, July 5th, 1885. Education, B.S. (E.E.), Iowa State Coll., 1909; one yr. post grad. in E.E., Univ. of Penn. 1909-10, apprentice with Allis-Chalmers Mfg. Co.; 1911-17, elec. engr., Waterloo, Cedar Falls & Northern Ry.; Dec. 1917, to date. Winnipeg Elec. Ry. Co., and since April, elec. engr. in charge of power and transmission, etc.

References: E. V. Caton, G. L. Guy, E. C. Hanson, T. L. Roberts, A. W. Lamont, S. Wilkins.

MILNE—WINFORD GLADSTONE, of Hamilton, Ont. Born at Malvern, Ont., June 16th, 1877. Educ. 2½ yrs. S. P. S. Tor., mech. and elec. engr.; 1 yr. Lindsay Light, Heat & Power Co.; 1 yr. W. A. Johnston Elec. Co., Toronto, in chg. of installation contracts, including generating equipment; 6 yrs. superintending and developing process for manufacture of peat fuel and machinery for harvesting the dry peat; 9 yrs., and at present time, plant engr., Hamilton Bridge Co., Ltd., responsible for co's equipment and design and constr. of new equipment for shop and field, and recently the design and constr. of what is believed to be the largest standard gauge bridge erection derrick can in existence. At present occupied with special features of ship constr. of much new equipment.

References: R. L. Latham, E. H. Pacy, E. H. Darling, J. A. McFarlane, J. G. Jack.

MUNRO—ST. JOHN, of Vancouver, B.C. Born at Walkden, England, June 24th, 1888. Educ. private school in England; 2nd yr. engr. School of Tech., Manchester, and recent tuition by E. G. Matheson in structural engr. 1906, with D. P. W., Manitoba, and C. C. Chataway, surveyor, Winnipeg, as rodman, etc.: with C. N. R., as follows: 1907-12, transitman on location; 1913, res. engr., Prairies, 1914-15, res. engr., Yellowhead; 1916, res. engr., maintenance of way; 1917-18, on leave of absence from C.N.R., supervising engr. for Pratt & Ross, Winnipeg, with full chg. of constr. of C.N.R.'s station and freight and train shed, Vancouver, B.C. At present time res. engr. maintenance of way dept., C.N.R., Vancouver, B.C.

References: H. A. Dixon, T. H. White, E. G. Matheson, R. P. Wilson, D. A. Ross, G. R. Pratt.

NESHAM—LIONEL CHARLES, of Ottawa, Ont. Born at Torquay, Eng. Nov. 5th, 1892. Education, B.Sc., McGill, 1916. Nov. 1911-Oct. 1912, computer and recorder, Geodet. Survey of Canada; May 1913-Nov. 1916, on the Internat. Boundary Survey, as topographer, etc.; 1916-1917, inspec. for Montreal Tramways Co. underground conduit system (2 mos.); 1917-18, instrumentman on gen. constrn. and hydrographic surveys, Port Nelson Terminals; at present time draftsman, dept. of Rys. and Canals, Ottawa.

References: D. W. McLachlan, J. J. McArthur, E. Brown, H. M. MacKay, C. B. Daubney.

NEVILLE—EVERETT ARTHUR, of Windsor, Ont. Born at Gosfield South, Ont., Jan. 8th, 1887. Education, B.Sc., Univ. of Toronto, 1911. Summers 1909 and 1911, transitman, D.L.S. party; summer 1910, transitman on location, G.T.P.; 1912-13, chief of survey party for Dom. Govt.; 1914-15, right of way surveyor for G.T.P., in B.C.; 1916-17, dftsman Can. Steel Corp., Ojibway; July 1917, to date, asst. to city engr., Windsor.

References: M. E. Brian, O. McKay, J. A. Heaman, W. H. Powell, J. S. Nelles, N. C. Stewart.

OWENS—JAMES EDWARD, of St. John, N.B. Born at Fredericton, N.B., June 12th, 1894. Education, B.Sc., Univ. of N.B., 1915. 3 summers timekeeper with Powers & Brewer, Dom. Atlantic Ry.; 1 summer with city engr. of St. John; 1915-16, dftsman and estimator, Union Fdy & Machine Wks. Ltd.; 3 mos. dftsman on survey St. J. & Que. Ry.; 1916 to date, office engr. St.J. & Que. Ry.

References: C. O. Foss, R. Thompson, H. A. Ryan, J. A. Stiles, S. B. Wass.

PALMER—ROBERT KENDRICK, of Hamilton, Ont. Born at Geneva, N.Y., Jan. 16th, 1872. Education, B.Sc. (C.E.), Univ. of Michigan, 1894. 1894, dftsman, American Bridge Works; 1895, dftsman, New Columbus Bridge Co.; 1896, dftsman, Elmira Bridge Co.; 1896, to date, with Hamilton Bridge Co., as chief dftsman, designer; and at present time, chief engr.

References: P. B. Motley, R. L. Latham, J. M. R. Fairbairn, W. P. Chapman, J. L. Weller, J. A. MacFarlane, E. H. Darling.

REID—JOHN ALEXANDER, of Cobalt, Ont. Born at Halifax, N.S., Oct. 23rd, 1877. Educ. B.Sc., Queen's Univ., 1902, licensed assayer of B.C. May-Sept. 1900, in chg. of stamp mill, Torquoy Mining Co., Moose River, N.S.; May-Sept. 1902 and 1903, exploration work, Ham. Steel & Iron Co., Hamilton; Sept.-Dec. 1902, assayer and surveyor, Brookfield Mining Co., N.S.; Nov. 1903-April 1904, asst. assayer, Le Roi No. 2 Mining Co., Rossland, B.C.; with Daly Reduction Co., Hedley, B.C.; June-Oct. 1905, asst. assayer; Oct.-Nov. 1905, ch. assayer; 1904-05, asst. to R. W. Brock (late dir. geol. survey), on examination of mines at Rossland and Phoenix, B.C.; 1907-08, cyanide foreman on various reduction works for mining companies in Mexico, May-Nov. 1909, exploration work, Temiskaming dist. for B. C. syndicate, in chg. of exploration work for private syndicate under F. W. Connell on exam. work and development of silver mining property in Portland canal and Skeena dists., B.C.; April-Nov. 1910, and in Mexico 1910-12, fall of 1913 mine exam. in E., Que., for Can. Mining & Explor. Co.; Jan.-Oct. 1914, field and exam. engr. in northern Man. and Sask. for Can. Min. & Explor. Co.; session 1915-16, asst. in dept. of mining and metallurgy, Queen's Univ.; 1916, to date, field engr. and mining geologist for M. J. O'Brien Ltd., on exam. and valuation of outside properties.

References: J. G. Dickenson, R. W. Leonard, J. C. Gwillim, A. V. Redmond, W. P. Wilgar, W. R. Rogers, J. B. Harvey, H. W. Sutcliffe.

SANDOVER SLY—R. J., of Campbellton, N.B. Born at Warminster, Wiltshire, England, Jan. 9th, 1886. Educ. grammar school (English), 3 yrs. articled pupil under A. F. Long, municipal engr., Wilts., classes at South Kensington School of Art., in chg. of constr., Huntsville, Ont., under late Galt Smith, Toronto, and under T. Aird Murray, Dec. 1909-Mar. 1910, acting town engr., Oshawa, Ont.; 1910-11, in chg. of constr., Kitchener, Ont., under Herbert Johnston, city engr.; 1911, to date, town engr., Campbellton, N.B., in chg. of all engr. work since town was destroyed by fire in 1911.

References: H. Johnston, G. Stead, F. G. Goodspeed, E. A. James, F. Chappell, G. G. Murdock.

SEDGWICK—ARTHUR, of Toronto, Ont. Born at Windsor, Ont., April 22nd, 1884. Educ. S.P.S. Tor., 1909. Rodman and instrumentman on Detroit River tunnel during college vacations; 1909-10, engr. in chg. Dog Lake Dams constr. of storage dams at head waters of Kaministiquia River, 1911, to date, asst. engr., Ont. dept. of Public Highways, on the administration of provincial aid to county highways, building object lesson roads and examination of plans for highway bridges for Ontario.

References: R. P. Fairbairn, A. J. Halford, W. A. McLean, G. Hogarth, E. A. James, W. R. Rogers.

STEWART—ROBERT ADDIE, of Winnipeg, Man. Born at Chapelhall, Scotland, Sept. 21st, 1881. Educ. 4 yrs. course, evening class, mech. engr.; 2 yrs. course (evenings), Glasgow and West of Scotland Tech. Coll., I.C.S. course; 7 yrs. apprenticeship. 3 yrs. with D. Rowan & Co., Glasgow; 1 yr. Barclay Curb Co.; 8 yrs. with C.P.R. (3 yrs. foreman); 3 yrs. boiler inspector foreman, C P R.; 2 yrs. engr., Tribune Publishing Co.; 1916, ch. boiler inspector province of Man., and at present acting ch. inspector, Bureau of Labor, province of Man., in chg of boiler, factory and elevator inspection.

References: E. Hanson, G. L. Guy, J. M. Leamy, H. Edwards.

SVENNINGSON—SVEN, of Montreal. Born at Christiania, Norway, Mar. 19th, 1884. Education, Mech. Engr., Christiania, 1907, and apprenticeship. 1907-08, designing and drafting of water turbines, Christiania; 1908-09, in charge of dsgn. and constrn. of rubber mfg. plant in Norway; 1909-11, gen. dftg. and inspec. work, Pa. Water & Power Co.; 1911-12, dsgr. of water and steam power station, Wm. Fargo, Jackson, Mich.; 1912-13, dsgn. and constrg. high tension transmission lines for Stone & Webster; 1913, to present time, with Shawinigan Water & Power Co., in charge of mech. and structural dsgns. for Cedar Rapids Mfg. Co., and special engr. in chrge. of desgn. and engrg. supervision of constrn.

References: J. C. Smith, C. E. Fraser, J. H. Brace, F. T. Kaelin, J. Morse

TIMM—CHARLES HENRY, of Westmount, Que. Born at Sheffield, England, Aug. 16th, 1877. Educ. public school, 4 yrs., Montreal Tech. Night School. 4 yrs. apprenticeship with James Cooper Mfg. Co., 1893-97. In 1901, in James Cooper Mfg. Co's drawing office as junior draftsman, 1903-04, with Rand Drill Co., as draftsman; 1904-05, with Can. Foundry Co., Toronto; May 1906-08, with A. W. Robinson, steam shovel and dredge engr., as elevation draftsman on dredges for River Nile and River Niger; 1908-09, work on Dredge No. 10 for Sir John Kennedy, ch. engr., Montreal Harbour; 1909-13, elevation draftsman, C. P. R. Angus Shops; 1913-15, draftsman with St. Lawrence Bridge Co., on erection of Quebec bridge; 1915, to date, with Dominion Bridge Co., as ch. draftsman in chg. of mech. superintendent's drawing office.

References: G. H. Duggan, Sir John Kennedy, H. H. Vaughan, G. F. Porter, A. L. Harkness.

TOBEY—WILMOT MAXWELL, of Ottawa, Ont. Born at Picton, Ont., May 14th, 1877. Educ. M.A., Tor., Gold Medal, Math., 1900, D.L.S., D.T.S., 1901-05, with International Boundary Survey on rectification of 49th parallel between B.C. and Idaho; 1906-09, taking special course under the late Dr. King in connection with present work; 1910-18, examiner on Board of Examiners for Dom. Land & Topographic Surveys, succeeding late Dr. King, Supt. Geodetic Survey, on examination of accuracy of all field work of the Geodetic Survey and refinement of such work, at present asst. supt. and geodesist of the Geodetic Survey.

References: N. J. Ogilvie, J. J. McArthur, W. J. Stewart, J. B. Challies, G. G. Gale.

VAUGHAN—FRANK P., of St. John, N.B. Born at Liverpool, England, 1874. Educ. Regent Coll., Southport, England. 1891-92, New Westminster & Barrard Inlet Telephone Co., Vancouver, B.C.; 1892-95, B. C. dist. Telegraph & Tel. Co., Vancouver, B.C., Nanaimo Telephone Co., Vanc. Island, B.C.; 1895-96, Yarmouth St. Ry. Co., Yarmouth, N.S.; 1896-97, Northern Elec. Wks., St. John; 1897-99, G. M. Ongier & Co., elec. engrs., Boston, Mass.; 1899-1900, Wilkinson & Co., elec. engrs. & contractors, and Lord Elec. Co., Boston; 1900-02, The General Elec. Co., Schenectady, N.Y., testing dept.; 1902-06, business for self, elec. engr. and contractor; 1906-18, engr. and manager The Vaughan Electric Co., Ltd.

References: J. A. Shaw, M. A. Sammett, C. C. Kirby, A. Gray, A. R. Crookshank, C. P. Edwards, J. K. Scammell.

WARDWELL—WILLIAM HENRY, of Westmount, Que. Born at Buffalo, N.Y., on June 8th, 1875. Educ. Buffalo grammar and high school courses, mech. engr., Cornell Univ., 1897. 1891-93, machinist with Jno. T. Noye Mfg. Co., 1897, with Buffalo Engr. Co., in chg. of design and constr. of sub-contract on Great Northern Elevator; 1898-99, head of testing dept , with J. I. Case Co., Racine, Wis.; 1899-1900, supt., Wisconsin Wheel Works, Racine, designed and rebuilt this plant when same burned down in 1900; 1901-04, ch. engr. and supt. of constr. with Shawinigan Carbide Co., in complete chg. of constr. and equipment of plant; 1904-07, gen. manager, Continental Heat & Light Co.; 1907-11, gen. manager Shawinigan Carbide Co.; 1912-13, Reynolds Wardwell Co., engrs., Montreal; 1913-17, consulting engr., Montreal specializing in fireproof design and construction. At present time Major, Engrs., U.S. Reserve, on duty in France special duty with the constr. dept. of the Aviation Section of the Signal Corps.

References: J C. Smith, R. M. Wilson, A. Adams, B. Leman, J. A. DeCew, H M. Lamb.

WEEKES—MELVILLE BELL, of Regina, Sask. Born at Brantford, Ont., Nov. 28th, 1875. Educ. B.A.Sc., Tor., 1898, Ont., Sask. and Dominion Land Surveyor. Asst. to city engr., Brantford, on general work and flood prevention work. 1901, drainage work at Winchester, Ont.; 1902-05, Dominion surveys in Alberta and Manitoba; 1908-09, in chg. of road surveys and drainage in Sask.; 1910, to date, director of surveys for the province of Sask.

References: T. H. Jones, H. S. Carpenter, W. T. Thompson, C. P. Richards, H. G. Phillips.

WINCKLER—GEORGE WALTER, of Toronto, Ont. Born at Cochin, India, 2nd Dec., 1844. Education, C.E., Calcutta University, 1865, and Sanitary Institute, Great Britain, 1870 (A.M.I.C.E., 1871). Govt. of India public works dept.; asst. engr. on state rys. 8 yrs.; executive engr. in charge of a div.; then transferred to roads and bldgs. branch in exec. charge; during the Afghan War, on the Boland Pass on rys. surveys to Quetta; afterwards transferred to Assan in exec. charge of roads and bldgs.; later in exec. charge of state rys. surveys, Cumbum dist.; at the present time consl. engr. at Toronto, Ont.

References: L. M. Arkley, R. O. Wynne-Roberts.

YOUNG—WILLIAM IRVING, of St. John, N.B. Born at Brockway, N.B., Oct. 10th, 1882. Education, B.Sc., Univ. of N.B., 1910. Topographer for Roberval & Saguenay Ry. Co.; 1912, to present time, instrmtman and then res. engr., St.J. & Que. Ry.

References: C. O. Foss, D. F. Maxwell, S. B. Wass, R. Thompson.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

ARMSTRONG—JOHN, of Winnipeg, Man. Born at York Co., Ont., May 17th, 1873. Educ. high school, B.A.Sc., Tor., 1897. Instrument work with O.L.S. during summer vacations; 1898-1903, asst. engr. C.N.Ry., in chg. of location parties and constr.; 1903-05, locating engr., G.T.P.Ry.; 1905-08, dist. engr., G.T.P.Ry., in chg. of location from Saskatoon to Prince Rupert, B.C., and inspector of constr. for the National Transcontinental Ry. through N.B. and Que.; 1908-13, dept. Rys. & Canals, Hudson Bay Ry., as ch. engr.; 1914-15, ch. engr. Hudson Bay, Peace River & Pacific Ry.; 1916-18, div. engr. Greater Winnipeg Water Dist., on constr. of aqueduct from Shoal Lake to Winnipeg; at present div. engr., Greater Winnipeg Water Dist.

References: M. H. Macleod, W. G. Chace, W. A. Bowden, T. Turnbull, G. C., Dunn, J. A. Heaman, A. E. Doucet, G. Grant.

BOND—FRANK LORN CAMPBELL, of Montreal. Born at Montreal, Feb. 21, 1877. Educ., B.Sc., McGill, 1898. 1898-1901, asst. res. engr., G.T.R., also instrumentman, draftsman, etc.; 1901-02, asst. supt. on constrn. of Park Ave. Tunnel, N.Y.C.; 1902, to date, with the G.T.R. as res. engr. and div. engr., eastern lines, and in December, 1918, chief engr. Serving in France, 1916-18, as company commander, 10th Batt., C.R.T.

References: F. P. Gutelius, J. M. R. Fairbairn, F. W. Cowie, H. R. Safford, P. Johnson.

COLE—FRANCIS THORNTON, of Quebec, Que. Born at St. Catharines Ont., July 8th, 1884. Educ., B.Sc., McGill Univ., 1910. Summer 1907, draughtsman, Phoenix Bridge Co.; summer 1908, on erection Montreal harbour sheds; summer 1909, inspection of various work around Montreal for Inspection Co.; with Dom. Bridge Co., as follows: 1910-11, draughting, designing and estimating; 1912, res. engr. in Toronto; 1913, to date, ch. engr. of Eastern Canada Steel Co., Quebec, in ch. of all structural steel contracts.

References: E. S. Mattice, P. L. Pratley, F. P. Shearwood, D. C. Tennant, W. V. Taylor, A. C. Fellows, J. Ruddick, W. D. Baillarge.

DERROM—DONALD LAIRD, of Chicago, Ill. Born at Caracas, Venezuela, South America, July 1885. Educ., B.Sc., McGill Univ., 1910. 1902-06, apprentice mach., G.T.R., and rodman on western div., C.P.R.; 1908, and 9 summer vacations designing draftsman in mach. experts office, G.T.R., Montreal; 1910, in chg. of loco terminals, G.T.R., Depot Harbour, Ont.; 1911, in chg. of loco. terminals, Belleville, with Can. Venezuelan Ore Co., as follows: 1912, mech. and elec. engr.; 1913, supt. of constr.; 1914, manager with Can. Cement Co.; 1915, mech. supt., Winnipeg Mill; 1916-17, supt. of shops, munition dept.; 1918, and at present, works manager for Winslow Bros. Co., Chicago, on manufacture of shells.

References: H. O. Keay, F. B. Brown, C. J. Chaplin, H. M. MacKay, V. I. Smart, W. McNab, R. J. Durley, H. M. Jaquays.

McARTHUR—FRANKLIN, of Guelph, Ont. Born at Vanderbilt, Mich., March 12th, 1885. Educ. B.Sc., Queen's Univ., 1907. 1907-08, asst. engr., Guelph; 1908-09, city engr., Guelph; 1909-11, municipal engr. for Yorkton and other Sask. towns; Jan.-Aug. 1912, res. sanitary engr. to the bureau of Public Health, Prov. Sask.; 1912-15, city engr., Regina, Sask.; 1915, to date, city engr., Guelph, Ont.

References: O. W. Smith, L. A. Thornton, J. N. deStein, R. O. Wynne-Roberts, E. A. James, W. M. McPhail.

McFARLANE—JOHN ALEXANDER, of Hamilton, Ont. Born at Atwood, Ont., Feb. 24th, 1874. Education, B.A.Sc., Univ. of Toronto, 1904. Summer 1903, dftsman, Riter & Conley Steel Co.; summer 1904, with the Western Portland Cement Co., in charge of design and installation; 1904-05, Fellow in Mechanical Drawing, S.P.S., Toronto; 1905, to present time, with the Hamilton Bridge Works, as dftsman, and chief dftsman, in charge of all detail drawings, etc.

References: R. L. Latham, E. H. Darling, E. R. Gray, E. W. Oliver, P. Gillespie, J. G. Jack, H. B. Dwight, P. B. Motley.

MONTGOMERY—EDLIN GEORGE WILLIAM, of Regina, Sask. Born at Howrah, India, May 10th, 1877. Educ., trained for Indian Public Works dept., in Thomas Coll. of civil engr. Admitted to that service in April 1898, by competitive exam. 1898-1902, with P.W.D., central provinces, India, on maintenance and constr. of roads and bldgs., rural water supply, city drainage, irrigation surveys, etc.; 1902-11, engr. to dist. board, Gurdarpur, Punjab, India, responsible for all engr. work undertaken by board; 1912-15, with board of highway commissioners, province of Sask. on location, design and constr. of bridges and dams; 1915, to date, acting asst. ch. engr., bridge branch, highways dept., Sask.

References: H. S. Carpenter, L. A. Thornton, G. D. Mackie, J. N. deStein, C. P. Richards, J. McD. Patton, E. B. Webster.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

ASKWITH—FRANK CHATHAM, of Ottawa, Ont. Born at Chatham, Ont., Jan. 1st, 1884. Coll. Inst., coached in theory and practice of engr., by E. P. Fetherstonhaugh, B.Sc., 1901-03. With city of Ottawa as follows: ch. draughtsman, city engr's dept., 1909-10; 1910-11, asst. engr. in chg. of special works and concrete walks; 1911-12, asst. engr. in chg. of roadways; 1912-13, acting city engr. in full chg. of dept.; 1913-14, asst. city engr., in chg. of works, br.: 1914-16, acting city engr. in ch. of roadways, bridges and special works, 1916 to date, deputy city engr., in chg. of works dept., on constr. of bridges, (Billings bridge, a 5-span through plate girder structure over Rideau river, and a Strauss direct lift bridge with approaches over Rideau canal), Water works, sewers, etc.

References: A. F. Macallum, N. J. Ker, G. A. Mountain, R. S. Lea, J. B. McRae A. A. Dion, A. T. Phillips.

DEVEREUX—LAWRENCE JAMES, of Edson, Alta. Born at St. Peters, N.S., Aug. 1888. Education, high school. 1907-09, rodman, dftsman, Que., Montreal & Southern Ry.; 1909, to date, with the G.T.P.Ry., as rodman, instrumentman, asst. engr., and at the present time res. engr., in charge of constrn. and maintenance, at different western points.

References: G. C. Dunn, J. A. Heaman, W. H. Tobey, J. C. Legrand, R. W. Ross.

DIXON—ARTHUR, of South Fort George, B.C. Born at Whitehaven, Eng., Aug. 1st, 1883. Education, Ghyll Bank Coll., Whitehaven, and articled pupil 3 yrs. 1904-05, asst. engr. and clerk of works on drainage and sewage disposal works, Trowbridge, Eng.; 1905-06, dftsman and instrumentman, C.P.R., in Que. and Ont.; 1906-10, chief dftsman and instrumentman, Atlantic, Quebec & Western Ry., responsible for design of sub-structure of bridges; 1910-14, field dftsman and res. engr., of constrn., C.N.Ry.; 1917, to date, dist. pub. wks. engr., for B.C., in charge of roads, bridges, and bldgs.

References: E. S. M. Lovelace, T. H. White, D. O. Lewis, W. K. Gwyer, A. E. Foreman.

HILL—GEORGE RIXON, of Virden, Man. Born at Ashburnham, Ont., Dec. 4th, 1888. Education, Collegiate Institute. 1906-07, on Brandon, Saskatchewan & Hudson Bay Ry., as rodman, etc.; 1908-09, D.L.S., Man. & Sask.; with the C.P.R. from 1909 to 1912, as instrumentman, topographer, leveller, transitman, etc.; 1912-14, govt. engr., western Manitoba; 1914, municipal engr., Wallace, Man.; 1915, to date, municipal engr. for Wallace and Pipestone, Man. (34-miles).

References: W. A. James, A. McGillivray, M. A. Lyons, S. A. Button, D. A. Livingstone.

HUNT—WILLIAM HAROLD, of Winnipeg, Man. Born at Lennoxville, Que., Nov. 24th, 1884. Educ. B. C. E., Univ. of Manitoba, 1902-05 apprentice mach., Northern Iron Works, Winnipeg, 1905-07 journeyman mach. C.P.R., 1907-11 (summers) on surveys & constr. with H. B. Ry., C. P. R. & C. N. R., 1912 (6 mos.) asst. engr. Can. Northern Bridge dept. (concrete substructure) 1913-15 asst. engr. in city engr's dept., Moose Jaw, Sask on design & constr. of sidewalks, sewer & water extension, etc., 1915-16 civil engr., 1916 to date road engr. Good Roads Board, D.P.W., province of Manitoba.

References: E. E. Brydone-Jack, A. McGillivray, N. B. McTaggart, N. A. Lyons, T. W. White.

INNESS—ROBERT D., of Woodman's Point, N.B. Born at Liverpool, N.S., Aug. 20th, 1888. Educ. High School, Liverpool Acad. With N. T. Ry. 1906-08 rodman on surveys & constr., 1908-13 transitman on constr., 1913-16 instrumentman, maintenance of way, Can. Govt. Rys., Campbellton, 1916-17 partner in firm of Longley & Inness, superintending contract in rock cutting on St. John & Que. Ry., 1918 to date superintendent N. S. Constr. Co., Ltd., Halifax, on constr. work on St. John & Que. Ry.

References: C. O. Foss, H. Longley, R. A. Black, C. B. Brown, R. H. Cushing, E. M. Archibald.

RUTLEDGE—MICHAEL JOSEPH, of Montreal, Que. Born at Brighton, Mass. Feb. 16th, 1887. Educ. B.Sc. Univ. of N.B., 1908, bridge design, reinforced concrete and electricity courses, Franklin Union, Boston, 1915. Summers 1905 and 1906, with Boston Elevated Ry.; Summer 1907, Mass. Highway Comm'n.; 1908-09, Hudson Bay Ry. Survey, leveller and transitman; 1910-11, C.P.R. instrumentman and Vice-President Thompson Lumber Co.; 1912-13, res. engr., C.N.R., Roberval (3 mos. acting div. engr.); 1914-15 (6 mos.), and 1915-16 (8 mos.), Pub. Service Comm'n, New York, dept. of subway design; 1916-17, designer, Mt. Royal Tunnel & Terminal Co. At present time designer with Henry Holgate, consulting engineer.

References: H. Holgate, J. L. Allison, S. P. Brown, W. E. Joyce, S. J. Waller, J. O. Montreuil.

STAIRS—GORDON S., of Halifax, N.S. Born at Maitland, N.S., Aug. 31st, 1889. Educ. B.Sc., Dalhousie, 1911. Summer 1909, structural steel drafting on factory erection; summer 1911, at New Glasgow, with Brown Machine Co.; 1911-13, with Christie & Dawson, land surveyors, Kamloops, in chg. of survey office and field parties; 1913-14, with Western Canada Power Co., asst. to constr. engr. on topographical surveys and constr. work; 1914-16, asst. to Mr. A. V. White, consulting engr. International Joint Comm'n, hydrographical and topographical surveys and hydraulic engr. studies; 1916 to date, Lieut. C.E., asst. to Third Division officer, R.C.E., M.D. 6, Halifax, N.S.

References: J. F. Pringle, R. W. McColough, T. S. Scott, F. J. Dawson, K. H. Smith.

STRACHAN—JOHN, JR., of Hudson Bay Junction, Sask. Born at Halifax, N.S., March 31st, 1883. Educ. Acacia Villa School, N.S., St. Andrews Coll., Toronto. With T.C.Ry., as follows: 1905-08, rodman; 1908-09, topographer and levelman on location; 1909-11, instrumentman on constr.; 1912-14, res. engr.; 1915-18, res. engr., Hudson Bay Ry., Dec. 1918, supervisor "Pasquia Forest Reserve."

References: A. E. Doucet, J. W. Porter, A. D. Porter, F. P. Moffat, W. T. Jamieson, D. S. Scott, A. Dick, E. J. Bolger.

TURNER—STANLEY ROY, of Peterboro, Ont. Born at Peterboro, Mar. 22nd, 1888. Educ., B.Sc., Queen's Univ., 1916. 1904-08, mech. shop work, pattern and mach. shops and foundry, with Wm. Hamilton Co., Peterboro; 1908-09, asst. supt. of steel constr., bldgs. and penstock, Structural Steel Co., Montreal; 1909-12 (3½ yrs.), draughting, checking and designing of steel bldgs. and bridges, Can. Foundry Co., Toronto; 1913 (6 mos.), draughtsman on Quebec bridge, St. Lawrence Bridge Co., Montreal; 1914 (4 mos.), C.E.F.; 1915 (5 mos.), water power design, Wm. Hamilton Co., Peterboro; 1916 (7½ mos.), in chg. of installation and erection of machinery of power development at Bala, Ont., Wm. Hamilton Co.; 1916-18, mill engr., Riordon Pulp & Paper Co., Hawkesbury, Ont.; 1918, engr. Spanish River Pulp & Paper Co., Espanola, Ont. (5 mos.); 1918 (3 mos.), C.E.F. At present engr., Wm. Hamilton Co., Peterboro, Ont.

References: W. J. Francis, G. R. Munro, E. A. Stone, E. C. Kerrigan, A. L. Harkness.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

BOULTON—CHARLES ALBERT, of Saskatoon, Sask. Born at Ayr., Ont., Jan. 3rd, 1893. Educ. commercial course, Galt Business Coll., 1913, B.Sc., Queen's Univ., 1917. 1914-18, staff-sergeant on the engineering staff of Military dist. No. 3, Kingston, Ont., at present with Murphy and Underwood, consulting engrs., Saskatoon, on municipal engineering work.

References: J. E. Underwood, A. A. Murphy, E. A. Stone, J. C. Gwillim, J. B. Harvey, G. Hemmerick, G. L. Guillet.

DALTON—GEORGE FRANCIS (Lieut.) of Ottawa, Ont. (now on Active Service). Born at Ottawa, Ont., July 6th, 1891. Educ., B.A.Sc. (structural engr. option), Toronto, 1914, Summers 1908-10-11-12, with Geodetic Survey of Canada, field work, triangulation and precise levelling, 1913-15, with Geodetic Survey precise levelling and triangulation in chg. of work. At present Lieut. 3rd. Can. Engr. Battn., B.E.F., France.

References: N. J. Ogilvie, J. J. McArthur, J. D. Craig, J. L. Rannie, L. O. Brown.

GIGUERE—EUDORE, of Montreal, Que. Born at Lachine, Que., Jan. 13th, 1895. Educ., commercial course, Civil Engr., Laval, 1917, and Chemist Engr., Laval, 1918. Summers of 1912-13-14, with E. Desaulniers, C.E., on survey work; 1915, with Geological Survey; 1916, with Roads Material Survey. At present time chemist analyst with The Canadian Explosives Ltd., Bel-Oeil.

References: E. Marceau, P. Lecointe, C. Leluau, S. A. Baulne, A. Frigon.

WELSFORD—HUBERT GRAY, of Winnipeg, Man. (now in France). Born at Los Gates, Cal., U.S.A., July 16th, 1894. Educ., 2 yrs. private tuition in math. and engr. With Dominion Bridge Co., Winnipeg, Man., as follows: 1911-13, draughtsman on structural steel work; Jan.-Oct. 1913, asst. to shop supt.; 1913-1916, in engr. office. designing, estimating and contracting; 1916, to date, engr. officer in R.A.F.; Feb.-Nov, 1917, asst. officer in chg. of engines No. 1 Aircraft Depot; 1917, to date, officer in chg. of engines, Reception Park, B.E.F., in command of 120 mechs. (man supply depot for France). Experience includes care and tuning of engines and 100 hrs. flying as engr. observer on air tests.

References: G. E. Bell, J. G. LeGrand.

ENGINEERING INDEX

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AERONAUTICS

AEROPLANE PARTS

STICK CONTROL. The Warner Duplex Stick Control. Aerial Age, vol. 8, no. 13, Dec. 9, 1918, p. 661, 3 figs. Brief description of hand and knee grips for use of pilots.

TAIL. A Gotha Biplane Tail. Flight, vol. 10, no. 40, Oct. 3, 1918, pp. 1107-1108, 1 fig. Design consisting of two horizontal approximately triangular planes, top plane being supported on cabine of steel tubes, while sides of bottom plane are bolted to sides of body.

AEROSTATICS

MILITARY. Military Aerostatics, H. K. Black. Aerial Age, vol. 8, nos. 6, 7 and 9, Oct. 21 and 28, and Nov. 11, 1918, p. 325, 1 fig., 371, 1 fig. and 475, 2 figs. Oct. 21 : Balloon baskets. Oct. 28 and Nov. 11 : Equipment of basket. (Continuation of serial.)

AIRCRAFT PRODUCTION

U. S. NAVY. Naval Aircraft Factory at Philadelphia, Indus. Management, vol. 56, no. 6, Dec., 1918, pp. 465-470, 13 figs. Story of great industrial achievement of United States Navy.

APPLICATIONS

EXPLORATION. The Possibility of Aerial Reconnaissance in the Himalaya. A. M. Kellas. Aeronautics, vol. 15, no. 257, Sept. 18, 1918, pp. 275-277. Fundamental facts and requirements of undertaking. Paper before Roy. Geog. Soc.

AUXILIARY SERVICE

TRUCKS. Building for the Aviation Service, M. E. Hoag. Am. Mach., vol. 49, no. 23, Dec. 5, 1918, pp. 1043-1044, 7 figs. Building a 3 ¼-ton special truck for U. S. Aviation Signal Service. First article.

DYNAMICS

CEILING. Elementary Considerations on the Ceiling of an Airplane (Données élémentaires sur le plafond d'un avion), André Lainé. l'Aérophile, year 26, nos. 17-18, Sept. 1-15, 1918, pp. 264-265. Points out convenience of high ceiling and means of attaining it.

On an Experience of the Flyer Gilbert (Sur une expérience du pilote Gilbert). F. Roux. l'Aérophile, year 26, nos. 17-18, Sept. 1-15, 1918, p. 236, 1 fig. How it happened that Eugène Gilbert maintained his plane stationary in air while machine was running at full speed.

STABILITY. Lateral Stability in Aeroplanes, C. Levick. Aerial Age, vol. 8, no. 13, Dec. 9, 1918, p. 660, 3 figs. Computation of effect of a roll on a machine in terms of dihedral angle of aerofoils. Also in Flight, vol. 10, no. 42, Oct. 17, 1918, p. 1165, 3 figs.

ENGINES

DESIGN. The Design of Airplane Engines (II), John Wallace. Automotive Eng., vol. 3, no. 9, Oct., 1918, pp. 415-417 and 401, 3 figs. Comparison of rotary and fixed radial; trend of modern design; cooling of cylinders; indicator diagram; compression ratio. From Aeronautics. (Continuation of serial.)

HISTORY. Outline of History of Aviation Engine Production, H. H. Emmons. Aerial Age, vol. 8, no. 13, Dec. 9, 1918, pp. 662-665, 2 figs. Elementary training engines; development of Liberty, 12; methods of production. Also in Motor Age, vol. 34, no. 23, Dec. 5, 1918, pp. 18-19 and 30, 3 figs.

LIBERTY. American Liberty Motor (Le moteur Américain Liberty). l'Aérophile, year 26, nos. 17-18, Sept. 1-15, 1918, p. 271. Abstract of description authorized by War Department. Also in Sci. Am., vol. 99, no. 23, Dec. 7, 1918, pp. 455 and 466, 4 figs.

MAYBACH. The 300-Hp. Maybach Aircraft Engine, Automotive Ind., vol. 39, nos. 18, 20 and 21, Oct. 31, Nov. 14 and 21, 1918, pp. 755-759, 8 figs., 840-842, 9 figs., 882-887, 5 figs. Technical description of largest German Aircraft engine model. Issued by Tech. Department, Aircraft Production, Ministry of Munitions; Nov. 14 : Lubricating system; details of oil pumps; cooling and ignition systems; carburetor and fuel feed system; details results of horsepower and fuel consumption tests; table of engine dimensions; general analysis of weights; chemical and physical analysis of material in various parts. Also in Automobile Engr., vol. 8, no. 119, Oct. 1918, pp. 285-295, 27 figs.; Flight, vol. 10, no. 39, Sept. 26, 1918, pp. 1084-1087, 2 figs.

The 200-Hp. Austro-Daimler Aero Engine. Engineer, vol. 126, nos 3279 and 3280, Nov. 1 and 8, 1918, pp. 376-379, 10 figs, 393-394, 7 figs. Description of details, with principal data and illustrations. Also in Flight, vol. 10, nos. 44 and 45, Oct. 31 and Nov. 7, 1918, pp. 1217-1222, 10 figs., and 1255-1259, 12 figs.; Engineering, vol. 106, no. 2757, Nov. 1, 1918, pp. 488-492, 17 figs.; Aeronautics, vol. 15, no. 263, Oct. 30, 1918, pp. 403-417, 27 figs.

PANHARD. The Panhard—300 Hp. (Direct Type Aviation Motor), E. H. Sherbondy. Aerial Age, vol. 8, no. 6, Oct. 21, 1918, pp. 308-309, 5 figs. Motor with two rows, each of six cylinders, set at an angle of 60 deg. from each other.

GLIDERS

An Interesting Biplane Glider, F. J. Camm. Aeronautics, vol. 15, no. 262, Oct. 25, 1918, p. 393. Chief dimensions and process of construction.

HISTORY

LANGLEY. What Langley Did for the Science of Aviation (II). Automotive Ind., vol. 39, no. 17 and 18, Oct. 24 and 31, 1918, pp. 714-718 and 728, 10 figs., and 761-765, 7 figs. Experiments with rubber-driven models and others using compressed air, carbonic acid, gas and electric batteries; adoption of steam as source of power. Oct. 31: Experiments with quarter-size and man-carrying aerodromes. (To be continued.)

INSTRUMENTS

BAROGRAPH. German Barograph No. 1623, Range o to 8000 m. Flight, vol. 10, no. 42, Oct. 17, 1918, pp. 1167-1168, 6 figs. General remarks on details of construction. Also in Aeronautics, vol. 15, no. 262, Oct. 23, 1918, pp. 382-384, 6 figs.

Instruments for Air Use, W. A. Robson. Sci. Am. Supp., vol. 86, no. 2235, Nov. 2, 1918, p. 285. From Flight.

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STEEL TUBES. Steel Tubes, Tube Manipulation, and Tubular Structures for Aircraft, W. W. Hackett and A. G. Hackett. Flight, vol. 10, no. 44, Oct. 31, 1918, pp. 1233-1235. Tapered tubes; tubular liners or reinforcements; tests on soldered joints; brazing; welding; rust prevention. (Concluded.) Also in Automotive Eng., vol. 3, no. 9, Oct. 1918, p. 396 and (discussion) pp. 397-398.

METEOROLOGY

Meteorology in Relation to Aeronautics (1), W. H. Dines. Sci. Am. Supp., vol. 86, no. 2239, Nov. 30, 1918, pp. 351-352. Review of data required by an aviator when in the air. Paper before Aeronautical Soc. of Gt. Britain. From Aeronautical Jl.

MILITARY AIRCRAFT

BRITISH. Some Recent Types of Allied Military Planes. Automotive Ind., vol. 39, no. 17, Oct. 24, 1918, pp. 706-707, 4 figs. General features of Spad single-seater tractor scout, Vickers F B-14, long-distance reconnaissance tractor biplane, Sopwith "Hippo" two-seater fighter, and Avro training machine.

GERMAN. German Aircraft. Times Eng. Supp., no. 527, Sept., 1918, p. 198. Abstract of five reports of Technical Department, Aircraft Production, Ministry of Munitions, describing Maybach engine, Rumpler two-seater biplane. Hannoveraner biplane, an armored machine, and Pfalz scout.

MODELS

MODEL CONSTRUCTION. Model Aeroplane Building as a Step to Aeronautical Engineering. Aerial Age, vol. 8, nos. 6, 7, 8 and 9, Oct. 21, 28 and Nov. 4, 11, 1918, p. 377, 7 figs., 389, 1 fig., 433 and 483, 1 fig. Oct. 21: Construction vertical stabilizer. Oct. 28 : Design and building of a man-carrying aeroplane. Nov. 4 and 11: Calculation of sustaining power and resistance of wings and explanation of table giving aerodynamic laboratory tests. (Continuation of serial.)

Model Aeroplanes (XVI). F. J. Camm. Aeronautics, vol. 15, nos. 258 and 261, Sept. 25, Oct. 16, 1918, p. 300, 1 fig., 369, 2 figs. Details of a tractor monoplane. Oct. 16: Notes on attaching elastic and on manner of flying model.

MODEL TESTING. The Theoretical Basis of Model Strength Tests for Aeroplane Structures, W. L. Cowley and H. Levy. Aerial Age, vol. 8, no. 6, Oct. 21, 1918, pp. 322-323. Application of principle of homogeneity of dimensions to determination of strength of structure.

PLANES

A. E. G. A. E. G. Armoured Aeroplane. Engineering, vol. 106, no. 2754, Oct. 11, 1918, pp. 416-417, 15 figs. Principal data and description, with details of construction illustrated.

The Fokker Biplane, Type D VII. Flight, vol. 10, nos. 40, 41 and 42, Oct. 3, 10, and 17, 1918, pp. 1109-1116, 1142-1144 and 1161-1164, 23 figs.

Data relating to performance and detailed particulars of weights. Issued by Technical Department, Aircraft Production, Ministry of Munitions. Also in Aerial Age, vol. 8, no. 8, Nov. 4, 1918, pp. 424-427, 20 figs.; l'Aérophile, year 26, nos. 17-18, Sept. 1, 1918, pp. 257-262, 10 figs.: Aeronautics, vol. 15, no. 259, Oct. 2, 1918, pp. 310-316, 23 figs.

A. R. The French A. R. Biplane. Aerial Age, vol. 8, no. 7, Oct. 28, 1918, pp. 374-375 6 figs. Particulars of two-strutter biplane of 13.3 m. span wihich has its fuselage supported between planes on ash struts.

Berg. The Austrian Berg Single-Seater. Flight, vol. 10, no. 44, Oct. 31, 1918, pp. 1225-1227, 7 figs. Mounting of 200-Hp. Austro-Daimler engine with which plane is equipped; tanks; instruments; control; undercarriage. (Continuation of serial.)

Continental. The Continental Kb-3T Training Tractor, John F. McMahon. Aerial Age, vol. 8, no. 6, Oct. 21, 1918, pp. 316-317 and 345, 4 figs. General specifications of machine designed for cheap construction by the Continental Aircraft Corporation.

Halberstadt. Report on the Halberstadt Fighter. Flight, vol. 10, no. 41, Oct. 10, 1918, pp. 1133-1141, 38 figs. Details of performance and construction. Issued by Technical Department Aircraft Production, Ministry of Munitions. Supplementing brief description given in issue of Aug. 1. Also in Engineer, vol. 126, no. 3276, Oct. 11, 1918, pp. 302-304, 25 figs.

Pfalz. Report on the Pfalz Single-Seater (G141). Aeronautics, vol. 15, no. 257, Sept. 18, 1918, pp. 270-274, 22 figs. Particulars and performance of German scout with streamline-shaped fuselage. By Technical Department. Aircraft Production, Ministry of Munitions.

Roland. The Roland Chaser D II, G, Douglas Wardrop. Aerial Age, vol. 8, no. 6, Oct. 21, 1918, pp. 310-312, 9 figs. Construction of fuselage, planes, tail, engine and undercarriage.

Siemens-Schuckert. A New German Chaser. Flight, vol. 10, no. 39, Sept. 26, 1918, p. 1083, 2 figs. Characteristics of Siemens-Schuckert biplane.

Sopwith. The Sopwith "Camel." Automotive Ind., vol. 39, no. 19, Nov. 7, 1918, pp. 790-791, 6 figs. Description of late model of British scout plane. Translated from German aircraft publication.

Zeppelin. The Zeppelin Biplane, Jean Lagorgette. Sci. Am. Supp., vol. 86, nos. 2237 and 2238, Nov. 16 and 23, 1918, pp. 316-319 and 334-335, 8 figs. Description of German bombing machine 134 ft. long. From Aeroplane.

PRODUCTION

Standardization. Effect of Changes on Airplane Output, Ind. Man., vol. 56, no. 5, Nov., 1918, pp. 375-377. Manufacturers must abandon idea of standardized production.

PROPELLERS

Analysis. Notes on Airscrew Analysis (III), M. A. S. Riach. Aeronautics, vol. 15, no. 257, Sept. 18, 1918, pp. 265-266. Outlines process by which experimental results on airscrews are analyzed and compared with their respective calculated performances. (Concluded.)

Calculations. Calculating Airplane Propeller Strength and Efficiency (II), F. W. Caldwell. Automotive Eng., vol. 3, no. 9, Oct., 1918, pp. 402-405. Limit of ceiling, comparison of conventional designs; calculations of efficiency during climbing; calculations for propeller chart. (Concluded.)

SPECIFICATIONS, AEROPLANE

U. S. Navy. Navy Department Airplane Specifications. Jl. Soc. Automotive Engrs., vol. 3, no. 5, Nov. 1918, pp. 325-329. Issued for use in connection with contracts and submission to Navy of new and undemonstrated designs.

TRANSATLANTIC FLIGHT

Transatlantic Flight, Frithiof G. Ericson. Jl. Soc. Automotive Engrs., vol. 3, no. 5, Nov. 1918, pp. 319-321. Favorable routes; requirements of airplane; flight endurance. From Aviation.

CIVIL ENGINEERING

BRIDGES

Concrete Bridges. Bridging the James River at Richmond, Va. Cement & Eng. News, vol. 30, no. 11, Nov. 1918, pp. 15-16. General dimensions of structure consisting of 18 reinforced-concrete arch spans.

Reinforced Concrete Bridges and Their Architectural Treatment, F. G. Engholm. Contract Rec., vol. 32, no. 45, Nov. 6, 1918, pp. 880-883, 6 figs. Recommends considerations of fitness, proportion and adaptability in design, and moderate use of decorations.

Reinforced-Concrete Trestles. Sci. Am. Supp., vol. 86, no. 2238, Nov. 23, 1918, p. 324, 3 figs. Viaducts recently constructed by Can. Pac. Ry.

Design. New Impact Formulas Needed in Designing Bridges of Various Types, J. A. L. Waddell. Eng. News-Rec., vol. 81, no. 21, Nov. 21, 1918, pp. 924-928, 2 figs. Scarcity of experimental knowledge of impact shown by review of tests and studies; group of formulas proposed; lower impact allowances for solid-floor bridges and concrete arches.

The Principal Bridges of the World. Sci. Am. Supp., vol. 86, nos. 2235 and 2236, Nov. 2 and 9, 1918, pp. 286-288 and 294. Comparison of their size, importance and principles of design.

Highway Bridges. Standardization of Detail in Highway Bridge Design, M W. Torkelson. Cement & Eng. News, vol. 30, no. 11, Nôv. 1918, pp. 33-34. Practice of Wisconsin Highway Commission.

Lift Bridges. Scherzer Lift-Bridge at Keadby (Ponte levatoio tipo Scherzer a Keadby). Ingegneria Italiana, vol. 2, no. 37, Sept. 5, 1918, pp. 131-134, 7 figs. Plans, dimensions and details of mechanism. From Génie Civil, Jan. 10, 1918.

Railroad Bridges. Special Foundation Work for a Railroad Bridge, J. H. Merriam. Ry. Age, vol. 65, no. 22, Nov. 29, 1918, pp. 951-953, 6 figs. New Burlington structure over Platte River is supported entirely on concrete piles.

Wilson Bridge. The Wilson Bridge at Lyons. Engineer, vol. 126, no. 3280, Nov. 8, 1918, pp. 387-388, 9 figs. Drawings, illustrations and description of le pont Wilson, formally opened at Lyons, July 14, 1918, and named in honor of President Wilson.

BUILDING AND CONSTRUCTION

Churches. Steel Construction Characterizes Chicago Church. Eng. News-Rec., vol. 81, no. 19, Nov. 7, 1918, pp. 860-863, 5 figs. Cantilever trusses carry front wall and gallery; dome trusses are supported by girders on tall four-post tower having no interior bracing.

Concrete Pedestal Pile. The McArthur Concrete Pedestal Pile. Contract Rec., vol. 32, no. 42, Oct. 16, 1918, pp. 830-831, 2 figs. Processes followed in construction of pile consisting of a 16-in. cylindrical shaft, with an enlarged base.

Fire-Resistive Construction. Fire Resistive Construction Committee Report. Eng. & Cement World, vol. 13, no. 10, Nov. 15, 1918, pp. 13-14, 1 fig. Specifications drawn by joint conference of representatives from ten American technical societies and the Can. Soc. of Civil Engrs.

Railroad Station. Toronto's Union Station Nears Completion. Contract Rec., vol. 32, no. 41, Oct. 9, 1918, pp. 805-808, 9 figs. Water-proofing; roof; elevators.

Reservoirs, Oil. Circular Earth Embankment Lined with Concrete Forms Oil Reservoir, E. D. Cole. Eng. News-Rec., vol. 18, no. 21, Nov. 21, 1918, pp. 932-936, 3 figs. Type originated in California; introduced into Texas fields on account of lack of steel; concrete roof carried on wood frame also because of lack of steel.

Reinforced Concrete Fuel-Oil Tanks. Can. Engr., vol. 35, no. 17, Oct. 24, 1918, p. 376, 2 figs. Dimensions and process of executing work.

Reservoirs, Water. Newton, Mass., Water Reservoir, Edwin H. Rogers, Eng. Cement World, vol. 13, no. 10, Nov. 15, 1918, pp. 9-12, 3 figs. Details of its four rectangular sections and circular gate chamber at centre, in which are installed a steel distributing tank and pipes from force main to different sections and overflow pipes and drains. From Proc. Boston Soc. Civil Engrs.

Reinforced Concrete Reservoirs, Montevideo. Engineering, vol. 106, no. 2756, Oct. 25, 1918, pp. 453-455, 43 figs. Description of two 6,500,000-gal. reservoirs constructed for City of Montevideo, Uruguay, R. C. Parsons, Engineer. Drawings of principal features.

Scaffolds and Falsework. Safe Construction of Scaffolds and Falsework, T. F. Foltz. Contract Rec., vol. 32, no. 42, Oct. 16, 1918, pp. 826-829. Outlines general construction of pole, suspended, outrigger, carpenters' bracket and painters' scaffolds, and indicates their general construction requirements. Paper before Nat. Safety Council.

Submerged Structures. Essentials of Proper Construction, J. W. Rollins. Contract Rec., vol. 32, no. 44, Oct. 30, 1918, pp. 870-873. Requirements of Concrete for submerged structures.

EARTHWORK, ROCK, EXCAVATION, ETC.

Blasting. Drilling and Blasting in Construction of Halifax Ocean Terminals Railway Eng. & Contracting, vol. 50, no. 21, Nov. 20, 1918, pp. 480-481. Description of some features of work. From paper by B. H. Smith before Eng. Inst. of Canada.

Quarry Blasting with Electricity. A. S. Anderson. Du Pont Magazine, vol. 9, no. 6, Dec., 1918, pp. 26-27, 3 figs. Ways of producing current and precaution to be observed.

Park Construction. Construction Plans Developed for the Bronx River Parkway Reservation, L. G. Holleran. Eng. News-Rec., vol. 81, no. 20, Nov. 14, 1918, pp. 899-903, 4 figs. Designs of Park Commission contemplate development of 1400 acres by grading and planting; numerous structures proposed; work to be done by day labor.

HARBORS

Concrete Construction. The Use of Reinforced Concrete Construction in Harbor Work, A. F. Dyer. Jl., Eng. Inst. Can., vol. 1, no. 6, Oct. 1918, pp. 242-251, 11 figs. Descriptions derived from articles and papers published in technical journals and proceedings of technical societies. Also in Eng. & Contracting, vol. 50, no. 21, Nov. 20, 1918, pp. 483-485.

Piers. Compression Strengths of Large Brick Piers. Eng. & Cement World, vol. 13, no. 10, Nov. 15, 1918, p. 25. Summary of conclusions based on past records and recent investigation by Bureau of Standards, composed of tests on piers 2 ft. 6 in. sq. by 10 ft. high in which three grades of brick were used.

Ports. Railway Construction in Connection with the Halifax Ocean Terminals, R. H. Smith. Jl. Eng. Inst., Can., vol. 1, no. 6, Oct. 1918, pp. 281-288. Methods employed and difficulties overcome in construction operations which necessitated considerable excavation work and presented other difficulties.

St. John Harbor, Alex. Gray. Jl. Eng. Inst. Can., vol. 1, no. 6, Oct., 1918, pp. 273-278, 15 figs. Outstanding features in habor and type of construction used in wharves.

The Port of Honduras. Times Eng. Supp., no. 527, Sept. 1918, p. 193. Projected improvements.

Sea Walls. Drive Inclined Precast Concrete Slabs for Sea Wall. Eng. News-Rec., vol. 81, no. 20, Nov. 14, 1918, pp. 897-898, 3 figs. Account of new type of beach protection replacing vertical concrete wall at Long Beach, Cal.

Pneumatic Caisson Method of Quay Wall Construction at Halifax Eng. & Contracting, vol. 50, no. 21, Nov. 20, 1918, pp. 489-490, 2 figs. From paper by J. J. MacDonald before Eng. Inst. of Canada.

MATERIALS OF CONSTRUCTION

TIMBER. Decay in Mill-Roof Timber, R. J. Blair. Textile World Jl., vol. 54, no. 23, Dec. 7, 1918, pp. 95-101, 4 figs. How it occurs and how it can be prevented. (To be continued.)

ROADS AND PAVEMENTS

CANADA. Canadian Highway Construction, Harry Stewardson. Contract Rec., vol. 32, no. 46, Nov. 13, 1918, pp. 899-901. Considers how to distribute cost of construction and maintenance so that necessary money can be secured and necessary expense fairly placed upon people who use roads and communities which receive benefits.

Highway Work in Ontario. Good Roads, vol. 16, no. 20, Nov. 16, 1918, pp. 185-186 and 191. Progress made in Canadian Province.

Roadway Improvements in Ontario, W. A. MacLean. Contract Rec., vol. 32, no. 41, Oct. 9, 1918, pp. 813-819, 10 figs. Extracts from annual report of Department of Public Highways for 1917.

CONCRETE. Concrete Road Construction, William W. Cox. Good Roads, vol. 16, no. 18, Nov. 2, 1918, pp. 165-166 and 169, 1 fig. Precautions and care to be observed. Paper before Mich. State Good Roads Assn.

Vertical Movements in Concrete Pavements and a Suggestion Towards Their Elimination, J. W. Lowell. Eng. & Contracting, vol. 50, no. 19, Nov. 6, 1918, pp. 441-443, 4 figs. From paper before Am. Concrete Inst.

COST KEEPING. Better System of Highway Cost Keeping, J. J. Tobin and A. R. Losh. Contract Rec., vol. 32, nos. 44, 45 and 46, Oct. 30 and Nov. 6 and 13, 1918, pp. 866-869, 886-888 and 903-906, 4 figs. Study of principles governing cost keeping and application of these principles to highway work. Detail of cost accounts and necessary codes.

FRANCE. Principles Upon Which the French Highways Are Built, Frank W. Harris Eng. News-Rec., vol. 81, no. 21, Nov. 21, 1918, between strategic points followed; great attention is given to drainage.

LOCATION. Putting the Right Road in the Right Place, Rodman Wiley. Am. City, vol. 19, no. 5, Nov. 1918, pp. 356-358, 4 figs. European practice in locating road; importance of exercising good judgment in grading and surfacing. Paper before Ky. Highway Engrs. Assn.

MACADAM. Capacity of Macadam Roads for War Business Increased. Eng. News-Rec., vol. 81, no. 22, Nov. 28, 1918, pp. 990-992, 5 figs. Three-foot concrete shoulders added at each side without closing highways to traffic; war labor conserved by using convicts for construction.

Oiled Macadam Roads Resurfaced with Concrete, E. A. Burt. Eng. News-Rec., vol. 81, no. 21, Nov. 21, 1918, pp. 942-944, 3 figs. Los Angeles County, Calfornia, builds roads in two sections to keep traffic moving; centre joint keeps autos on own side; cost figures.

Tar-Macadam v. Granite Macadam. Ellis W. Jones. Surveyor, vol. 54, no. 1399, Nov. 8, 1918, p. 220. Author's experience and recommendation that roads which have to carry from 600 to 1,000 tons a day should be main tained wich tar-macadam.

MAINTENANCE. Motor Vehicles and Their Influence Upon Road Construction W. A. Maclean. Surveyor, vol. 54, no. 1399, Nov. 8, 1918, pp. 221-222., Record of Deputy Minister of Public Highwys for Ontario.

Road Maintenance Methods and Devices Effect Saving of Material Labor and Fuel. Eng. News-Rec.,vol. 81, no. 22, Nov. 28, 1918, pp. 981-984 5 figs. Bureau of Maintenance and Repair, New York State Highways Department, working through nine division engineers' endeavors to keep, war-time traffic roads open still conserve material.

MIXERS. Direct Charging of Concrete Mixers. Mun Jl., vol. 45, no. 20, Nov. 16, 1918, p. 392. Feature of construction of concrete pavement in ten-mile section of Delaware road.

Two Mixers on Variable Road Work. Eng. & Cement World, vol. 13, no. 10, Nov. 15, 1918, pp. 31-32, 2 figs. Methods followed in construcion of a Western road.

SNOW REMOVAL. Snow Removal on Trunk Line Highways, Chas. J. Bennett. Good Roads, vol. 16, no. 20, Nov. 16, 1918, pp. 188-189. Study of the problem and suggestion for its solution. Before conference On Snow Removal from Trunk High ways Automobile Club of America.

SURFACING. How to Get Best Surface on a Concrete Road, A. H. Hunter. Cement & Eng. News, vol. no. 11, Nov. 1918, pp. 25-28, 2 figs. Suggestione in regard to application of forms, building of expansion joints and use of roller and ball.

Resurfacing Part of Buffalo-Albany Turnpike with Concrete, A. S. Hinman, Cement & Eng. News, vol. 30, no. 11, Nov., 1918, pp. 35-36, 3 figs. Method of carrying on work without closing traffic.

WOOD ROADS. Gasoline Consumption Tests Demonstrate Value of Hard, Smooth-Surfaced Roads, A. N. Johnson. Eng. News-Rec., vol. 81, no. 19, Nov. 7, 1918, pp. 843-850, 8 figs. Gasoline saving which would pay for construction of hard surface in few years is indicated between earth and smooth concrete, where daily motor traffic of 500 can be expected. Results of some tests and description of methods employed.

Paved Roadways Aid Plant Efficiency, H. Colin Campbell. Indus. Management, vol. 56, no. 6, Dec., 1918, pp. 471-472, 4 figs. Plea for better roadways around factory buildings.

The Measure of a Good Road, Robert C. Barnett. Eng. & Contracting, vol. 50, no. 19, Nov. 6, 1918, pp. 438-440, 3 figs. Mathematical treatment of thesis. Assumptions of good road; 1. A straight line is shortest distance between two points; 2. A plane of uniform slope is best grade between two points; 3. A hard, smooth surface offers less tractive resistance than rough or yielding one.

The Vital Importance of the Highway, S. M. Williams. Am. City, vol. 19, no. 5, Nov. 1918, pp. 354-355, 1 fig. Plea for establishment of Federal Highway Commission.

WATER SUPPLY

CONSUMPTION. Water Consumption in New York State Cities and Its Effect on Coal Consumption. Am. City, vol. 19, no. 5, Nov. 1918, pp. 376-378. From a report compiled by the State Bureau of Municipal Information of the New York State Conference of Mayors.

MAINS IN WINTER. Waterworks Operation. Mun. Jl., vol. 45, no. 21, Nov. 23, 1918, pp. 408-410. Methods of thawing water mains and services.

POLLUTION. Sanitary Aspects of Water Supplies at Army Cantonments, James T. B. Bowles. Eng. & Contracting, vol. 50, no. 20, Nov. 13, 1918, p. 460. From Sept. Jl. of Am. Waterworks Assn.

RAILWAY WATER SUPPLY. New Water Treating Plants for the Burlington. Ry. Rev., vol. 63, no. 19, Nov. 9, 1918, pp. 661-666, 10 figs. Use of reinforced-concrete tanks on Casper division; various conditions of water supply: different types of construction.

Railway Water Supply from Wells. Ry. Rev., vol. 63, no. 19, Nov. 9, 1918, pp. 669-671. From report of committee on sources of railway water supply, to Am. Ry. Bridge and Building Assn., Chicago, Oct. 15, 1918, by C. R. Knowles, chairman.

SAND FILTERS. Coagulants Versus Sand Filters as Aid to Water Purification in the Field, H. S. Briggs and E. R. Marle. Contract Rec., vol. 32, no. 46, Nov. 13, 1918, pp. 906-908. Description of installation embodying alum process. From Roy. Engrs. Jl.

Drifting Sand Filter, Toronto Island, Geo. G. Nasmith and N. J. Howard. Can. Engr., vol. 35, no. 17, Oct. 24, 1918, pp. 359-364, 6 figs. Report of bacteriological and physical tests performed on section comprising five filter units.

Toronto's Drifting Sand Filter. Mun. Jl., vol. 45, no. 20, Nov. 16, 1918, pp. 390-392. Construction and operation: bacteriological and physical tests; conclusions as to efficiency of plant.

WATERWAYS

DAMS. High-Pressure Gates in Dams for Water-Works and Irrigation Reviewed. D. W. Cole. Eng. News-Rec., vol. 81, no. 20, Nov. 14, 1918, pp. 880-884, 5 figs. From sluice gates in Sudbury Dam of Boston Water-Works through various stages of gate development in high dams of U. S. Reclamation Service. From paper presented at Idaho conference of engineers in 1918.

Modifications in the Character of a Water Stream Produced by Construction of a Dam (Modifications apportées au régime d'un cours après l'établissement d'un barrage), K. Zorayan. Revue Générale de l'Electricité, vol. 4, no.7, Aug. 17, 1918, pp. 226-229, 5 figs. Chart for tracing output curve knowing the declivity of a water course and the height of water in dam.

GATES. Some Experiences with Large-Capacity Reservoir Outlets, James M. Gaylord. Eng. News-Rec., vol. 81, no. 21, Nov. 21, 1918, pp. 945-950, 2 figs. Specially designed gates control discharge of immense volumes of water under pressures above 200 ft.; difficulties and how they have been overcome. Paper before Colorado Assn. of members of Am. Soc. of Civil Engrs.

RUN-OFF. Progress Report of Committee on Run-Off. Jl. Boston Soc. Civil Engrs., vol. 5, no. 9, Nov., 1918, pp. 387-422, 3 figs. Use of the current meter in stream gaging; 0.2 and 0.8 method in power canals; precipitation, evaporation and run-off; effects of ice on river discharge; methods to be used in compilation of data.

STREAM REGULATION. Stream Regulations in Quebec Province, Olivier Lefebvre. Can. Engr., vol. 35, no. 19, Nov. 7, 1918, pp. 399-402 and 411, 5 figs. Account of increase in water power by using Lakes St. Francis and Aylmer as storage basins and indications of possible developments. From Annual Report of Quebec Streams Commission.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

REDUCTION OF METALS. Electric-Furnace Reduction of Certain Metals Susceptible of Industrial Utilization (Sur la préparation au four électrique de quelques métaux susceptibles d'utilisation industrielle), Jean Escard. Revue Générale de l'Electricité, vol. 4, no. 11, Sept. 14, 1918, pp. 375-386, 3 figs. Notes on reduction of barium, calcium, glucinum, cobalt, nickel, titanium, manganese, chromium, molybdenum, tungsten, vanadium.

ELECTROPHYSICS

DISTRIBUTION, ELECTROSTATIC. The Electron Theory of Metallic Conductors Applied to Electrostatic Distribution Problems, L. Silberstein. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 215, Nov., 1918, pp. 413-420. General expression for equilibrium distribution in terms of total charge and potential of external field, and application of general formula to cases of full spherical conductors and hollow sphere.

PERIODIC CURRENTS. Oscillating Energy (Energie oscillante), G. Szarvady. Revue Générale de l'Ectricité, vol. 4, no. 12, Sept. 21, 1918, pp. 411-422, 2 figs. Application of Ohm's law and Kirchoff's laws to watt currents and wattless components of electromotive forces and intensities of periodic currents.

SATURATION. On the Calculation of Magnetic and Electric Saturation Values, J. R. Ashworth. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 214, Oct., 1918, pp. 351-360. Deduces $I_o = \sqrt{(R/R^1)}$ where I_s is limiting intensity of magnetization, R the gas constant and R^1 the reciprocal of the product of susceptibility into absolute temperature; also ($i_o = \sqrt{(R/S)}$, where i_o is maximum current density a conductor can carry, S ratio of resistivity to absolute temperature and V the velocity of electron as it passes along conductor.

VACUUM PHENOMENA. Rectification by Vacuum Discharge, T. Kujirai. Denki Gakkwai Zasshi, no. 361, Aug. 31, 1918.

Theory of Coolidge Tube (Sur la théorie du fonctionnement du tube Coolidge à radiateur), A. Dauvillien. Revue Générale de l'Electricité, vol. 4, no. 13, Sept. 28, 1918, pp. 443-445. Explains increase in resistance by presence of large quantity of oxygen liberated at focus and by partial oxidation of filament, together with formation of double layer which diminishes electronic emission.

Vibration, Mechanical Generating Electrical Energy. Experiments on the Effect of the Vibration of a Stretched Wire Forming Part of a Closed Electric Circuit, Henry Jackson. Proc. Roy. Soc., vol. 95, no. A665, Sept. 2, 1918, pp. 51-57. Experiments with sensitive telephone detector which in author's judgment confirm Marran's suggestion that a mechanical vibration or note produces electricity.

GENERATING STATIONS

Alternators in Parallel. Synchronizing Alternators Coupled in Parallel (La mise en phase dans le couplage en parallèle des alternateurs). Elvind Styff. Revue Générale de l'Electricité, vol. 4, no. 13, Sept. 28, 1918, pp. 460-465, 11 figs. Schemes of connections and diagrams of electromotive forces. From Elektrotechnische Zeitschrift, vol. 38, Sept. 20, 1917, p. 461.

Turbo-Alternators. Accidents to Steam Turbo-Alternators (Au sujet des accidents aux turbo-alternateurs à vapeur), P. Boucherot. Revue Générale de l'Electricité, vol. 4, no. 13, Sept. 28, 1918, pp. 457-460. Report of Sub-Committee of Union of Electrical Syndicates proposing as a result of studies: (1) modifications in present designs of turbo-alternators, (2) modifications in usual specifications, and (3) dispositions to reduce loss when accident occurs.

The Production of Electricity by Steam Power, Alex. Dow. Elecn., vol. 81, no. 2111, Nov. 1, 1918, pp. 555-557. Abstract of address before Am. Electrochemical Soc.

GENERATORS AND MOTORS

Direct Current Motors. Weight of Direct Current Motors, A. Brunt. Elec. Eng., vol. 52, no. 2, Aug., 1918, pp. 28-29, 2 figs. Requirements of direct-current motors and graphs showing relation between weight and torque for commutating-pole and non-commutating-pole motors, and also between weight and torque for various-makes of apparatus.

Induction Motors. Changing Speed of Induction Motors. Power Plant Eng., vol. 22, no. 22, Nov. 15, 1918, pp. 926-928, 2 figs. Possible speed changes of induction motors to suit conditions in power plants.

Rolling-Mill Motors. Standardizing Large Rolling Mill Motors, K. Pauly. Blast Furnace, vol. 6, no. 10, Oct. 1918, pp. 411-414, 1 fig. Suggests motors be rated on continuous capacity at some particular temperature in order to avoid present difficulties of users of large rolling-mill motors. Paper before Assn. Iron & Steel Elec. Engrs.

Single-Phase Generators. Armature Reaction and Wave Form of a Single-Phase Generator (in Japanese), G. Shimizu. Denki Gakkwai Zasshi, no. 362, Sept. 10, 1918.

Starting Resistances. Method for Determining Resistance Used for Starting Various Types of Motors, B. W. Jones. Power, vol. 48, no. 21, Nov. 19, 1918, pp. 740-744, 6 figs. A simple method for determining the ohmic value of resistance used for starting series, shunt and compound-wound direct-current motors and wound-rotor induction motors under various load conditions.

Synchronous Motors. For and Against Synchronous Motors, Will Brown. Elec. World, vol. 72, no. 21, Nov. 23, 1918, pp. 982-984.4 figs. Four objections that that have been frequently made to using synchronous motors; discussion showing how conditions have changed; synchronous motors and unity power factors.

Temperature Rise. Guarantees for Temperature Rise in Electrical Machinery, with Special Reference to Large Turbo-Generators, A. E. Du Pasquier. Tran. South African Inst. Elec. Engrs., vol. 9, part 7, July 1918, pp. 127-137 and (discussion) pp. 137-140. Urges that there is no good reason for restricting temperature rises, providing suitable materials are obtainable for withstanding the heat conditions that may arise.

LIGHTING AND LAMP MANUFACTURE

Arc-Lamp Globes. Renovation of Discolored Arc-Lamp Globes, Alfred Herz. Elec. World, vol. 72, no. 20, Nov. 16, 1918, pp. 935-936, 2 figs. Description of a system of removing stain by heat treatment.

Need for Improved Lighting in the Leather Industry, F. H. Bernhard. Elec. Rev., vol. 73, no. 20, Nov. 16, 1918, pp. 759-765, 7 figs. Tenth of series of articles on lighting in industries.

Lighting (General). Daylight vs. Sunlight in Sawtooth-Roof Construction, W. S. Brown, Jl. Am. Soc. Mech. Engrs., vol. 40, no. 12, Dec. 1918, pp. 1025-1029, 5 figs. Empirical research of amount of direct sunlight and intensity of daylight to be admitted on working plane in sawtooth construction; equation to determine time of admission of direct sunlight and number of hours of its duration with given orientation of sawtooth buildings and slope of lighting area; influence of size and slope of sawtooth lighting area on relative intensity of daylight from northern sky; examples illustrating manner of computing amount of diffused light entering building under several conditions. Presented at annual meeting of the Soc.

Elements of Illuminating Engineering (III), Ward Harrison. Elec. Eng., vol. 52, no. 2, Aug. 1918, pp. 30-34, 4 figs. Essentials in illumination design—coefficients of utilization, location of light sources, and recommended minimum spacings and minimum heights above plan of illumination for various units.

Lighting in Its Relation to the Eye, C. E. Ferree and G. Rand. Proc. Am. Phil. Soc., vol. 57, no. 5, 1918, pp. 440-478, 9 figs. Report of work of sub-committee on Hygiene of the Eye of Am. Medical Assn., involving an extensive experimentation on effect of different lighting conditions on eye, and investigation of factors in lighting situation causing eye to lose in efficiency and experience discomfort.

Some Modern Methods of Lighting, Geo. H. Stickney. Nat. Engr., vol. 22, no. 10, Oct. 1918, pp. 469-477, 7 figs., and (discussion), pp. 477-479. Analysis of elements of lighting systems required by factories, offices and stores. Paper before Nat. Assn. of Stationary Engrs.

War Time Lighting Economics, Elec. World, vol. 72, no. 19, Nov. 9, pp. 885-887. Salient features of report prepared by War Service Committee of Illuminating Engineering Society for U. S. Fuel Administration; falacies to be avoided; making maximum use of daylight.

Reflecting and Diffusing Light. Reflecting and Diffusing Light, Ward Harrison. Textile World Jl., vol. 54, nos. 18, 20, 21 and 22, Nov. 2, 16, 23 and 30, 1918, pp. 61 and 71, 4 figs., 25-27, 1 fig., 59-63, 5 figs., and 33, 5 figs. Properties of accessories necessary for good industrial illumination.

Steel Mills. Better Lighting of Iron and Steel Mills and Fabricating Plants, F. H. Bernhard. Elec. Rev., vol. 73, no. 22, Nov. 30, 1918, pp. 841-845, 7 figs. Eleventh of series of articles on improvement of lighting in industries.

MEASUREMENTS AND TESTS

Galvanometers. The Einthoven Galvanometer, Samuel D. Cohen. Wireless World, vo.. 6, no. 68, Nov. 1918, pp. 437-438. Special simple construction of Einthoven type used by writer for measuring radio receiving currents. From Elec. Experimenter.

Insulation Measurement. Electrolytic Method of Measuring Electrostatic Field of Insulators (La mesure du champ électrostatic dans les isolateurs d'après la méthode électrolytique), W. Estorff. Revue Générale de l'Electricité, vol. 4, no. 12, Sept. 21, 1918, pp. 433-434, 1 fig. A small line is placed between electrodes in electrolyte and ratio of resistances of distances between line and each electrode is determined by Wheatstone bridge operating circuit with alternating current; correction coefficient for air values is determined in similar manner. From Elektrotechnische Zeitschrift, vol. 39, Feb. 7, 14 and 21, pp. 53, 62 and 76, 28 figs.

Some Notes on Leakage Indicators, G. W. Stubbings. Electricity, vol. 32, no. 1451, Aug. 30, 1918, pp. 453-454, 1 fig. Principle of instruments measuring state of insulation of a complete electrical system.

Meters. The Demand-Meter Situation, C. F. Mathes. Elec. World, vol. 72, no. 22, Nov. 30, 1918, pp. 1024-1026. Critical discussion of demand meters, pointing the advantages that are gained through use of well-known types of these instruments and remedies for some of the troubles encountered in their practical application.

Official Testing Laboratories. British Electrical Proving House. Times Eng. Supp., no. 527, Sept. 1918, p. 197. Essentials of schemed testing institution, with authoritative credentials, to deal with types of apparatus rather than with individual specimens.

Test Ring Method. Test Ring Method for Determining Transformer Ratio and Phase Error, H. S. Baker. Elec. Rev., vol. 73, no. 20, Nov. 16, 1918, pp. 766-769, 6 figs. Use of special watt meter and current transformer for current transformer testing. From paper before Am. Inst. of Elec. Engrs.

POWER APPLICATION

Cement Industry. Electric Motors in the Cement Industry. R. B. Williamson. Proc. Am. Inst. Elec. Engrs., vol. 37, no. 11, Nov. 1918, pp. 1237-1273, 9 figs Outline of various kinds of machinery used, and data as to power requirements; description of types of motor best suited to each application together with starting characteristics, overload capacity, torque and other features. Also in Elec. Rev., vol. 73, nos. 20 and 21, Nov. 23 and 26, 1918, pp. 770-771 and 813-814.

Coal Mining. Explosionproof Equipments of Colliery Motors and Accessories (in Japanese). Denki Gakkwai Zasshi, no. 363, Oct. 10, 1918.

The Use of Electric Power in the Mining of Anthracite Coal, J. B. Crane. Proc. Am. Inst. Elec. Engrs., vol. 37, no. 10, Oct. 1918, pp. 1197-1202, 7 figs. Power cost and current consumption of anthracite mines, also of bituminous mines; estimates of additional coal obtainable by electrification of anthracite mines, illustrations showing representative installations of electric drive.

Furnaces. Notes on Electric-Furnace Problems, J. L. McK. Yardley. Bul. Am. Inst. Min. Engrs., no. 142, Oct. 1918, pp. 1593-1598, 4 figs. Analysis made to determine maximum capacity and approximate performance of a new furnace designed to operate at 160 volts on a 60-cycle current.

Power Factor of the Electric-Arc Furnace -Fattore di potenza dei forni elettrici ad arco', O. Scarpa. Revista Tecnica d'Elettricita, no. 1891, Oct. 25, 1918, pp. 105-106. Presents formula for power factor of arc including power factor of furnace and ohmic resistance of electrodes.

Technical Analysis of Industrial Electric Furnaces; Classification, Choice of Apparatus, Installation and Operation (Considérations techniques sur les fours électriques industriels; classification choix des appareils, installation mode d'emploi et conduite) Jean Escard. Revue Générale de l'Electricité, vol. 4, no. 16, Oct. 19, 1918, pp. 575-591, 31 figs. Electric arc furnaces; electric resistance furnaces; induction furnaces; electrothermotic and aluminum furnaces.

The Electric Furnace After the War, Francis A. J. Fitzgerald. Elec. Rev., vol. 73, no. 19, Nov. 9, 1918, pp. 726-727, 2 figs. Effect of the war upon electric furnaces; new uses to replace war's needs; tendencies in furnace design.

Heating. Electric Heat for Drying and Baking, George J. Kirkgasser. Indus-Management, vol. 56, no. 6, Dec. 1918, pp. 489-495, 11 figs. Types of industrial apparatus that have had rapid development during past five years.

Electric Thermal Storage Heaters for Rooms, English Mechanic & World of Sci., vol. 108, no. 2796, Oct. 25, 1918, pp. 155-156. Summary of report used by Committee of Swiss Electrotechnical Union. From Schweizerischer Elektrotechnischer Verein, Bul., June 1918.

Electrically Heated Industrial Appliances and Devices, George J. Kirkgasser. Indus. Management, vol. 56, no. 5, Nov. 1918, pp. 417-423, 32 figs. Outlines most important applications classified for 18 different industries and shows many of simpler devices.

Iron Ore Mining. Central Station Service Used in Operation of New Jersey Iron Ore Mines, L. R. W. Allison. Elec. Rec., vol. 24, no. 4, Oct. 1918, pp. 24-26, 5 figs. Installation where energy generated at steam station is transmitted to mines at 33,000 volts for operation of pumps, air compressors, hoists, etc., involving consumption of 600,000 kw-hr. per month.

Lime Plant. A Modern Motor-Driven Lime Plant. Cement & Eng. News, vol. 30 no. 11, Nov. 1918, pp. 19-20, 4 figs. Processes in electrically driven plant utilizing waste marble.

Pumping. Electricity Supersedes Steam in Los Angeles, Eng. & Cement World, vol. 13, no. 10, Nov. 15, 1918, pp. 18-19, 3 figs. Electrical operation of pumping plants, it is said, will effect an annual saving of 18,000 bbl. of fuel oil. Also in Elec. Rev., vol. 73, no. 19, Nov. 9, 1918, pp. 723-725, 3 figs.

High Efficiencies Shown by Motor-Driven Water Works Pumps, Geo H. Gibson. Can. Engr., vol. 35, no. 19, Nov. 7, 1918, pp. 412-413, 2 figs. Data on two 12-in. centrifugal pumps.

Rolling Mills. Electrically Driven Mills at Bethlehem, J. T. Sturtevant. Blast Furnace, vol. 6, no. 10, Oct. 1918, pp. 417-419, 10 figs. Layout, equipment, power consumption and tonnage on eleven installations at Lehigh plant, where G. E. induction motors are used.

Ship Propulsion. Electricity's Part in Buildiug and Navigating of Ships, H. A. Hornor. Elec. Eng., vol. 52, no. 2, Aug. 1918, pp. 15-22, 20 figs. Considerations entering into selection of propulsion; commercial angle, first cost, efficiency, safety, upkeep, cost of operation, etc.; propelling machinery of various ships. (Concluded.)

Silk Industry. Electric Drive Applied to Silk Industry, Charles T. Guilford, Elec. Rev., vol. 73, no. 22, Nov. 30, 1918, pp. 855-857, 4 figs. Advantages of central-service for this work; selection of motors and drives; interesting data on present installations.

Sugar Mills. Complete Electrification of Sugar Mills, Clarence G. Hadley. Elec. World, vol. 72, no. 22, Nov. 30, 1918, pp. 1022-1024, 2 figs. Extensive application of motors in this industry of recent origin; satisfactory results obtained in new Cuban mills, showing possibilities that may arise in this field as it is developed.

TELEGRAPHY AND TELEPHONY

Radio Telegraphy and Telephony. A Combiuation Circuit for Tube and Crystal. Wireless Age, vol. 6, no. 2, Nov. 1918, p. 21, 1 fig. Combined or individual use of vacuum tube and crystal rectifier.

A New Protective Condenser. Wireless Age, vol. 6, no. 2, Nov. 1918, p. 34, 1 fig. Designed to protect electrical transmission lines from effect of high-frequency disturbances.

A Novel Radio Telegraph Aerial. Wireless Age, vol. 6, no. 2, Nov. 1918, p. 20, 1 fig. Type having series of coils inserted in antenna from earth to free end.

A Thermionic Valve Slopemeter, E. V. Appleton. Wireless World, vol. 6, no. 68, Nov. 1918, pp. 458-460, 3 figs. Derives formula to compute slopes of grid voltage-anode current and plate voltage-anode current curves at any particular operating plant.

Marconi's Improved Radio Transmitter. Wireless Age, vol. 6, no. 2, Nov. 1918, pp. 19-20, 3 figs. Method of producing continuous oscillations by overlapping wave trains.

Method for Exhausting Vacuum Tubes. Wireless Age, vol. 6, no. 2, Nov. 1918, pp. 20-21, 1 fig. Apparatus which provides for heating anode by vigorous bombardment of electrons without endangering filament, this being method to drive gases from plate.

Propagation of Electric Currents in an Antenna (Propagation des courants électriques dans une antenne), H. Chireix. Revue Générale de l'Electricité, vol. 4, no. 11, Sept. 14, 1918, pp. 363-374, 9 figs. Formulae (1) in general case of non-homogenous antennae, (2) when antenna consists of one branch, (3) when it consists of two, and (4) when it consists of three branches having different self-inductances and different capacities.

Solid-Contact Detectors (Contribution à l'étude des détecteurs à contacts solides). René Audubert. Journal de Physique, vol. 7, May-June 1918, pp. 127-128. Study of physical phenomena which probably take in the action of crystal detectors used in wireless telegraphy. (To be continued.)

Some Aspects of Radio Telephony in Japan, Eitaro Yokoyama. Wireless World, vol. 6, no. 68. Nov. 1918, pp. 430-435, 8 figs. Account of recent discoveries: Evolution of a rarefied gas discharger. (To be continued.)

The Radioelectric Installation at Stavanger, Norway (Stavanger Radio), Olaf Moe. Teknisk Ukeblad, year 65, no. 43, Oct. 25, 1918, pp. 595-514, 23 figs. (To be continued.)

Telephony (Wire). How to Locate Telephone Troubles. J. Beruard Hecht, Telephony, vol. 75, nos. 21, 22 and 23, Nov. 23, 30 and Dec. 7, 1918, pp. 32-34, 3 figs.: 13-16, 10 figs. and 16-18, 2 figs. Rural line telephones and their circuits. Suggestions to managers, wire chiefs and troublemen of local battery exchanges. (Continuation of serial.)

Wave-Length and Weakening of Telephone Circuits (Longueur d'onde et affaiblissement des circuits téléponiques), Pomey. Revue Générale de l'Electricité, vol. 4, no. 8, Aug. 24, 1918, pp. 251-253. Simplification of author's formula for constant B given in Aug. 3 issue.

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

Transformers, A. C. Study of the Calculations Involved in the Design of Large Capacity Transformers for Use with Electric Furnaces (Etude sur le calcul de transformateurs à forte intensité pour fours électriques), R. Jacquot. Revue Générale de l'Electricité, vol. 4, no. 15, Oct. 12, 1918, pp. 523-536, 9 figs. Explains sudden variations in efficiency and voltage drop by conditions of varying load and suggests practical and economical modifications. (To be continued.)

Rectifiers. Three-Phased Current Rectifier (Convertitore di correnti trifasi in correnti continue). O. M. Corbino. L'Elettrotecnica, vol. 5, no. 28, Oct. 5, 1918, pp. 392-394, 3 figs. Apparatus operating by rotary mercury jet.

Substations. Electric Railway Substations for Automatic Transformation (Sottostazioni di trasformazione automatiche per l'alimentazione de ferrovie elettriche), A. Gusmano. L'Elettrotecnica, vol. 5, no. 31, Nov. 5, 1918, pp. 444-446, 6 figs. Principles of system followed in America.

Transformers, D. C. Size and Working Cost of Machines for Continuous-Current Transformation, Thomas Carter. Elecn., vol. 81, no. 2108, Oct. 11, 1918. 4 figs. Methods of continuous-current transformation; differences between three schemes; conclusions in regard to cost and method of operation; curves of overall efficiency of transformer: schemes for variable-speed motors.

Frequency Changer. Radio Frequency Changers, E. E. Bucher. Wireless Age, vol. 6, no. 2, Nov. 1918, pp. 10-13, 8 figs. Reported progress in their application to wireless telegraphic and telephonic communication. (To be continued.)

TRANSMISSION, DISTRIBUTION, CONTROL

Distribution, Three-Phase. Economic increase Made in Distribution Capacity, S. Bingham Hood. Elec. World, vol. 72, no. 22, Nov. 30, 1918, pp. 1030-1032, 7 figs. Saving of copper and transformers by replacing old overloaded 2300-volt system with 2300-2400-volt star-connected, three-phase, common-neutral primary and interconnected secondary.

How to Remedy Inconveniences of Excessive Overload in Three-Phase Network (Comment peut-on remédier aux inconvénients d'une très forte surcharge dans un réseau triphasé), E. Piernet. Revue Générale de l'Electricité, vol 4, no. 15, Oct. 12, 1918, pp. 540-544, 2 figs. Proposes adjustment of step-up and step-down transformers so as to be able to dispose of voltage U so long as delivered power does not exceed a certain limit and of voltage $U\sqrt{3}$ when delivered power exceeds this limit.

Interconnection. More Light on New England Interconnection. Elec. World, vol. 72, no. 22, Nov. 30, 1918, pp. 1027-1029, 1 fig. Estimated savings to be exceeded; convenient energy-exchange arrangements; railroad electrification possible without buying new generators; price at which tie-line energy can be sold. From paper by L. L. Elden before Boston Section of Am. Inst. of Elec. Engrs.

Relays. Factors to Consider in Applying Relays, E. A. Hester, Elec. World, vol. 72, no. 20, Nov. 16, 1918, pp. 931-934, 9 figs. Determination of short-circuit current connections and settings suitable for radial and parallel feeder systems: protection against high-resistance grounds on balance systems.

Relay Protective Devices, C. J. Monk. Tran. South African Inst. Elec. Engrs., vol. 9, part 7, July 1918, pp. 140-143, 1 fig. Proposes short method of obtaining approximate circuit currents by observing voltage drop between two stations at normal load, according to equation; short-circuit current = Normal voltage times load current divided by voltage drop. Discussion of paper published in Jl. of Inst., Oct. 1917.

Substations. Permanence in Outdoor Substations, S. B. Hood. Elec. World, vol. 72, no. 20, Nov. 19, 1918, pp. 928-930, 6 figs. Discussion of standard design used in all sizes from 300 kva. to 2250 kva. in order to eliminate fire losses prevalent in modern structures; increase in cost to secure permanence held to be negligible.

Remote Controlled Substations Described, W. T. Snyder. Blast Furnace, vol. 6, no. 10, Oct. 1918, pp. 408-410, 2 figs. Control for central station and motor-generator substation located about 2200 ft. from main power station, feeding 250-volt direct-current transmission line. Paper before Assn. Iron & Steel Elec. Engrs.

Switches. An Automatic Three-Phase Switch, W. Ernst. Elecn., vol. 81, uo. 2108, Oct. 11, 1918, pp. 491, 4 figs. Abstract of article in Elektrotechnische Zeitschrift, No. 4, 1918.

Safety Features in Switching Installation, M. M. Samuels and F. Bechoff. Elec. World, vol. 72, no. 19, uov. 9, 1918, pp. 878-880, 9 figs. Review of existiug alarm systems used to indicate switch positions and overheating of apparatus; weak points in installations and suggestions designed to bring about their improvement.

Transmission Lines. Locating Troubles in Electric Lines (Note sur les essais et mesures relatifs aux lignes électriques), Louis Puget. Revue Générale de l'Electricité, vol. 4, no. 16, Oct. 19, 1918, pp. 563-565, 2 figs. Method for measuring resistance of line and locating a ground, which author claims to have found serviceable in his experience with underground lines. The methods given are applicable to overhead lines as well.

110,000-Volt Transmission Line over the St. Lawrence River, S. Svenningson. Proc. Am. Inst. Elec. Engrs., vol. 37, no. 11, Nov. 1918, pp. 1275-1284, 3 figs. Account of investigation leading to construction of 350-ft. towers to support transmission wires on a span of 4800 ft.; design of towers and insulators; provisions for protection from ice and method of sag calculations.

WIRING

House Wiring. Three- and Four-Way Switch Circuits, Terrell Croft. Elec. Eng., vol. 52, no. 2, Aug. 1918, pp. 23-25, 5 figs. Cottage wiring; unusual wiring: two-location control. (Concluded.)

GENERAL SCIENCE

CHEMISTRY

Electrolytic Conductivity. Electrolytic Conductivity in Non-Aqueous Solutions. The Electrical Conductance of Trimethyl-Para-Tolyl-Ammonium Iodide in Water and Several Organic Solvents, Henry Jermain, Maude Creighton and D. Herbert Way. Franklin Inst. Jl., vol. 186, no. 6, Dec. 1918, pp. 675-798, 7 figs. Investigations.

Elements. Automic Number and Frequency Differences in Spectral Series, Herbert Bell. Lond., Edinburg & Dublin Phil. Mag., vol. 36, no. 214, Oct. 1918, pp. 337-347, 2 figs. Numerical tests of Rydberg's law that square root of doublet and triplet differences is proportional to automic weights, substituting atomic number for atomic weight.

Elements in the Order of Their Atomic Weights, Raymond Szymanowitz. Chem. News, vol. 117, no. 3059, Oct. 25, 1918, pp. 339-340. Presents table which shows numbers follow scheme of sequence expressed by: X, $X + 3$, $X + 3 + 1$, $X + 3 + 1 + 3$, etc., adding 1 and 3 alternately.

SOLUTIONS. The Electrical Conductivity of Acids and Bases in Aqueous Solutions, Jnanendra Chandra Ghosh. Jl. of the Chem. Soc., vols. 113-114, no. 672, Oct. 1918, pp. 790-799. Explains abnormally high mobility of hydrogen and hydroxylions in aqueous solutions on assumption that electricity is partly carried by ordinary process of convection and partly propagated through water molecules undergoing alternate dissociation and recombination; apparently high activity of strong acids and bases is also traced to this cause; modifies Ostwald equation for electrolytes where degree of rissocation is less than one.

STRUCTURE OF MATTER. Atomic Structure from the Physico-Chemical Standpoint, Alfred W. Stewart. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 214, Oct. 1918, pp. 326-336, 1 fig. Model atom proposed as having a structure accounting for all the facts known concerning elements, including radioactive transformations.

Interfacial Tension and Complex Molecules, G. N. Autonoff. Lond., Edinburgh & Dublin, Phil. Mag., vol. 36, no. 215, Nov. 1918, pp. 377-396, 5 figs. Theory of molecular attraction based on modern representation of nature of atoms and molecules; explanation of phenomena of molecular attraction by action of forces which cause chemical affinity; deduction of relation between surface tension and molecular pressure.

VALENCY. Definition of Valency, F. H. Loring. Chem. News, vol. 117, no. 3058, Oct. 11, 1918, pp. 319-322. Simile to explain significance of term and nature of atoms which exercise variable valencies.

MATHEMATICS

ANALYTICAL FUNCTIONS. Factoring and Prolongation of Analytical Functions (Quelques remarques sur la décomposition en facteurs primaires et le prolongement des fonctions analytiques), Emile Picard. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 12, Sept. 16, 1918, pp. 405-408. Further comment on Weierstrass' method of decomposition. In Comptes rendus, vol. 92, 1881, p. 690, author showed application of this method to uniform functions whose roots approach indefinitely a given line.

DIVERGENT SERIES. A Conspectus of the Modern Theory of Divergent Series, Walter B. Ford. Bul. Am. Math. Soc., vol. 25, no. 1, Oct. 1918, pp. 1-15. Review of modern theory of divergent series in regard to (1) the question as to how a sum may be assigned to a divergent series in general, and (2) the functional properties of asymptotic series; proposed limitations to form a consistent general theory of summation.

EQUATIONS. Simultaneous Linear Differential Equations Involving Partial Derivatives and Reduction of Hyper-Geometric Functions of Two Variables (Sur des équations linéares simultanées aux dérivées partielles et sur des cas de réduction des fonctions hyper-géométriques de deux variables), Paul Appell. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 12, Sept. 16, 1918, pp. 408-413.

Solution of Partial-Derivative Equations by Means of Hermite's Polynomials (Sur les équations aux dérivées partielles vérinées par les polynomies d'Hermite, déduits d'une exponentielle), Pierre Humbert. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 15, Oct. 7, 1918, pp. 522-525. Application of Appell's method (Comptes rendus, vol. 167, 1918, p. 309) to variables obtained from differentiation of exponential function whose exponent is of quadratic form in X and Y.

Solutions of Differential Equations as Functions of the Constants of Integration, Gilbert Ames Bliss. Bul. Am. Math. Soc., vol. 25, no. 1, Oct. 1918, pp. 15-26. Proposes method.

Treatment of Partial-Derivative equations by Hyperspherical Polynomials (Sur les systèmes d'équations aux dérivées particlles vérifiés par les polynomes -hypersphériques). J. Kampé de Fériet. Comptes-rendus des séances de l'Académie des Sciences, vol. 167, no. 15, Oct. 7, 1918, pp. 519-522. Study of case of n linear equations involving partial derivatives of second order.

ISOGENEOUS COMPLEX FUNCTIONS. Note in Isogenous Complex Functions of Curves, W. C. Graustein. Bul. Am. Math. Soc., vol. 24, no. 10, July 1918, pp. 473-477.

ORTHOGONAL SUBSTITUTION. Note on the Construction of an Orthogonant, Thomas Muir. Proc. Roy. Soc. of Edinburgh, vol. 38, part 2, session 1917-1918, pp. 146-153. Comments of and addition of theorems to Cayley's mode of forming an orthogonal substitution.

PROBABILITY. An Elementary Derivation of the Probability Function, Albert A. Bennett. Bul. Am. Math. Soc., vol. 24, no. 10, July 1918, pp. 477-481. Derives by means of elementary considerations equation of probability from sequence of binomial coefficients

PHYSICS

FLAME PROPAGATION. The Propagation of Flame through Tubes of Small Diameter. William Payman and Richard Vernon Wheeler. Jl. Chem. Soc., vols. 113 & 114, no. 670, Aug. 1918, pp. 656-666, 3 figs. Report of experiments, performed in connection with work on construction of miners' safety lamp, on speed of uniform movement during propagation of flame in mixtures of methane and air through tubes of small diameter on the passage of flame through similar tubes filled with mixtures of methane and air and open at both ends and on the passage or projection of flame through short tubes of small diameter.

FLUORESCENCE. On the Phenomena of Fluorescence, Desmond Geoghegan. Chem. News, vol. 117, no. 3058, Oct. 11, 1918 p. 322 Suggests experiment which, it is said, will prove that rays of light passed through a sufficient thickness of a fluorescent substance lose thereby power of exciting fluorescence when they are passed through a second layer of same substance.

MAGNETO-THERMO PHENOMENA. Magneto-thermal Phenomena (Le phénomène magnétocalorique), Pierre Weiss and Auguste Picard. Journal de Physique, vol. 7, May-June 1917, pp. 103-109, 1 fig. Account of pronounced changes in temperature which were observed in course of experimental measurements preliminary to plotting set of isothermals for nickel. Near Curie's point temperature increased 0.7 deg. on establishing field of 15,000 gausses.

OPTICS. The Correction of Telescopic Objectives, T. Smith. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 215, Nov. 1918, pp. 405-412. Criticism of expressions for constructional data for small objectives as given by A. O. Allen in Phil. Mag., June 1918.

The Scattering of Light by Air Molecules, R. J. Srutt. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 214, Oct. 1918, pp. 320-321. Supplements former account of experiments (Proc. Roy. Soc. A., vol. 44, p. 453, 1918) by answering inquiry from R. W. Wood (Phil. Mag., vol. 36, p. 272, Sept. 1918) in regard to precautions taken for drying air in experiments.

QUANTA LAW Researches on the Limit of the Continuous Spectrum of X-Rays (Recherches sur la limite du spectra continu des rayons X), Alex. Muller. Archives des Sciences Physiques et Naturelles, year 123, vol. 46, Aug. 1918, pp. 63-73, 1 fig. Theoretical and experimental verification of Planck's law of quanta as generalized by Einstein by confirming the relation $\epsilon V = h\nu$ in the case of the continuous spectrum of X-rays, and for an interval from 14 to 28 kilovolts.

RADIUM. On Some Properties of the Active Deposit of Radium, S. Ratner. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 215, Nov. 1918, pp. 397-405, 2 figs. Experimental research which leads author to question whether phenomenon of recoil of RaC from RaB has ever been observed, also that proportion of recoil atoms of RaB carrying negative charge in less than 1 to 100,000.

RELATIVITY. On the Essence of Physical Relativity, Joseph Larmor. Proc. Nat. Academy of Sci., vol. 4, no. 11, Nov. 1918, pp. 334-337. Offers objection to Leigh Page's expression (no 4, p. 46) for translatory force required to sustain assigned varying velocity in electrostatic system of type usually investigated as model of electron.

SEMI-FLUIDS. Mechanics of Semi-Fluids (Mécanique des semi-fluides). Comptes Rendus des Séances de l'Académie des Sciences, vol. 167, no. 7, Aug. 12, 1918, pp. 253-256. Discusses possibility of disregarding tangential action of central cylinder on annular part of the limiting surfaces.

VIBRATIONS AND WAVE MOTIONS. Diffraction of Plane Waves by a Screen Bounded by a Straight Edge, F. J. W. Whipple. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 215, Nov. 1918, pp. 420-424. Adaptation of R. Hargreaves' method for simple harmonic wave (Phil. Mag., vol. 36, p. 191), to diffraction of waves of arbitrary type.

Periodic Irrotational Waves of Finite Height T. H. Havelock. Proc. Roy. Soc., vol. 95, no. A665, Sept. 2, 1918, pp. 38-51. Extension of Mitchell's form for highest wave and its generalization by means of surface conditions; method of approximation for coefficient, calculation for highest wave.

The Interferometry of Vibrating Systems, C. Barus. Proc. Nat. Academy of Sci., vol. 4, no. 11, Nov. 1918, pp. 328-333, 4 figs. Report of experimental work.

The Sount Waves and Other Air Waves of the East London Explosion of January 19, 1917, Charles Davison. Proc. Roy. Soc. of Edinburgh, vol. 38, part 2, session 1917-1918, pp. 115-129, 1 fig. Construction of paths followed by air waves and sound waves; offered explanation for fact that inaudible air waves were observed beyond limits of sound areas by reason of their more nearly horizontal path.

ORGANIZATION AND MANAGEMENT

ACCOUNTING

ARMY. Accounting Systems in Army Camps, E. J. Holmes. Jl. Actcy., vol. 26, no. 6, Dec. 1918, pp. 429-435. Explains the system used by the U. S. Army in connection with the disbursement of funds appropriated by Congress.

Carrying on with the Accountants in the American Expeditionary Forces, C. B. Holloway. Jl. Actcy., vol. 26, no. 6, Dec. 1918, pp. 412-416. Specific operations carried on by the accounting personnel.

COST ACCOUNTING. Cost Accounting to Aid Production (III), G. Charter Harrison. Indus. Management, vol. 56, nos. 5 and 6, Nov. and Dec. 1918, pp. 456-463, 2 figs. and 391-398, 1 fig. Emphasizes necessity of cost-accounting system and illustrates its planning with diagram showing basic features of simple system for a business manufacturing various kinds of standard machines. (Continuation of serial.)

Duties of a Factory Cost Accountant, Joseph Gill. Jl. Actcy., vol. 26, no. 6, Dec. 1918, pp. 441-449. A thesis presented at the May examinations of the Am. Inst. of Accountants. Routine work of cost accountants.

Setting Production Standards for Industrial Accounting and Engineering, F. J. Knieppel. Jl. of Accountancy, vol. 26, no. 5, Nov. 1918, pp. 361-375. Explains methods of determining four basic standards.

INVENTORIES. Verification of Inventories, A. L. Philbrick. Jl. Actcy., vol. 26, no. 6, Dec. 1918, pp. 417-428. Briefly outlines the work of the auditor and his responsibilities. Difficulties involved in the verification of the inventory.

MAIL ORDER. Mail Order Accounting, Harry L. Cavanagh. Jl. Actcy., vol. 26, no. 6, Dec. 1918, pp. 436-440. A thesis presented at the May examinations of the Am. Inst. of Accountants.

POWER HOUSE. Economics of the Power House, L. W. Alwyn-Schmidt. Power Plant Eng., vol. 22, no. 23, Dec. 1, 1918, pp. 949-952. Problem of Power-house accounting approached from point of view of economist.

EDUCATION

TRAINING OF EMPLOYEES. Packard Training Schools for Employees, D. G. Stanbrough. Indus. Management, vol. 56, no. 5, Nov. 1918, pp. 378-382, 13 figs. Four schools operated; for men, women, instructors for women and for job setters and foremen.

Vestibule School of Lincoln Motor Co., J. M. Eaton. Indus. Management, vol.. 56, no. 6, Dec. 1918, pp. 452-455, 10 figs. Equipment of training rooms; system of instruction in machine-shop practice.

SOLDIERS. Vocational Training for Returned Soldiers. Jl. Eng. Inst. Can., vol. 1, no. 7, Nov. 1918, pp. 333-334. Work being done at Toronto and McGill Universities.

UNIVERSITY. The Khaki University. Can. Min. Inst., bul. no. 80, Dec. 1918, pp. 985-989. Letter from F. D. Adams giving an account of the work and plans for future development.

FACTORY MANAGEMENT

BOILER SHOP. Business Equipment in the Boiler Shop, Edwin L. Seabrook. Boiler Maker, vol. 18, no. 11, Nov. 1918, pp. 305-307. Suggests items of business conduct in boiler making plant.

EMPLOYMENT MANAGER. The Employment Manager, Edward D. Jones, Wood-Worker, vol. 37, no. 9, Nov. 1918, pp. 38-39. Organization and direction of course offered gratis to representatives of manufacturers by Management Division of War Industries Board.

The Employment Manager in Our Shipyards, Edward B. Jones. Int. Mar. Eng., vol. 23, no. 11, Nov. 1918, pp. 612-614. Duties of general executive; importance of schools; wage system and ideal service; psychology of mass action.

FOREMEN. Instructions to Assistant Foremen, George H. Shepard. Indus. Man., vol. 56, no. 5, Nov. 1918, pp. 403-407. Prepared by plant working extensively on governmental orders to inspire and guide minor executives.

INDUSTRIAL ORGANIZATION. After-War Economics of Engineering. Times Eng. Supp., no. 529, Nov. 1918, pp. 225-226. Suggests that plants review their methods of manufacture and adopt convenient modifications when necessary. Illustrations of practical procedure by reference to foundry work.

Industrial Organization as it Affects Executives and Workers, Charles E. Knoeppel. Jl. Am. Soc. Engrs., vol. 40, no. 12, Dec. 1918, pp. 1031-1033. Proposes rules of efficient organization for practical guidance of executives in developing system of industrial relationship. Presented at annual meeting of the Sos.

Management — The Solution of the Shipbuilding Problem, W. L. Churchill. Indus. Management, vol. 56, no. 5, Nov. 1918, pp. 361-366, 2 figs. Based on study of conditions in 20 shipyards aud pointing to management as developed recently in other industries as proper solution to problems.

Practical System in Factory Operations, M. H. Potter. Can. Machy., vol. 20, no. 20, Nov. 14, 1918, pp. 559-560, 6 figs. Forms of charts developed from investigation of actual case.

Scientific Management Simplified. Malcolm Keir. Sci. Monthly, vol. 7, no. 6, Dec. 1918, pp. 525-529. Adaptability of scientific management to industry; fundamental elements of scientific management.

INDUSTRIES. New Industries, H. W. Gepp. Aust. Min. Std., vol. 60, no. 1564, Oct. 31, 1918, pp. 686-688. Address with discussion before Soc. of Chem. Ind., Melbourne. Essential factors in the successful development of new industries in a young country.

MECHANICAL DEPARTMENT. Coordination in the Mechanical Department, W. U. Appleton. Ry. Rev., vol. 63, no. 22, Nov. 30, 1918, pp. 73-774. Recommendations for system and harmony within department and with other departments. Paper before Canadian Ry. Club, Oct. 1918.

RATE SETTING. Mastering Power Production, Walter N. Polakov. Ind. Man., vol. 56, no. 5, Nov. 1918, pp. 399-403, 6 figs. Conservation of labor, power and fuel in relation to rates. Tenth article.

Time Studies for Rate Settings on Gisholt Boring Mills, Dwight V. Merrick. Indus. Management, vol. 56, no. 5, Nov. 1918, pp. 409-411, 1 fig. Fifth article.

ROUTING. About the Handling of Mill Work (II), Chas. Cloukey. Wood-Worker, vol. 37, no. 9, Nov. 1918, pp. 23-24, 1 fig. Part which routing of work through mill has in economical production.

TASK SETTING. The Human Factor in Task Setting, W. E. Camp. Indus. Management, vol. 56, no. 5, Nov. 1918, pp. 372-374, 1 fig. Chief conditions that affect factor; how they are evaluated; how to predetermine proper allowance.

TOOL DEPARTMENT. Continuous Tooling. Times Eng. Supp., no. 527, Sept. 1918, p. 183. Suggests a means of obtaining increased output from machine-shop tools.

Tool Department of Winchester Works. Iron Age, vol. 102, no. 19, Nov. 7, 1918, pp. 1129-1133, 4 figs. Virtually on factory production basis, workers being trained for single type operation; preparation section's important functions.

FINANCE AND COST

CAPITAL. Capital: Its Waste and Its Conservation, Archibald P. Main. Gas Jl., vol. 144, no. 2894, Oct. 29, 1918, pp. 249-251, and (discussion) pp. 251-252. Means by which author judges British industry can make best use of available credit and financial accommodation. Paper before Soc. of British Gas Industries.

INSPECTION

GRAPHIC CONTROL. Graphic Production Control, C. E. Knoeppel. Indus. Management, vol. 56, nos. 5 and 6, Nov. and Dec. 1918, pp. 383-390, 17 figs., 496-502, 14 figs. Controlling materials and operations. Fourth Article.

PRODUCTION RECORDS. Keeping Close Track of Shop Operation, Robert I. Clegg. Iron Age, vol. 102, no. 21, Nov. 21, 1918, pp. 1251-1253, 6 figs. Records of production and labor bulletined to management; reports with alarm-clock attachment.

SUPERVISION. Mechanical Department Supervision, Frank McManamy. Ry. Mach. Eng., vol. 92, no. 11, Nov. 1918, pp. 597-598. Better supervision and more of it needed to keep up shop output. From paper before New York Ry. Club.

LABOR

BARGAINING (INCLUDING COLLECTIVE SYSTEMS). Agreement vs. Bargaining, Harry Tipper. Automotive Ind., vol. 39, no. 19, Nov. 7, 1918, pp. 784-785. Claims confidence between employer and employee is impossible so long as both basc their relations upon their ability to take advantage of a bargain.

Handling Employment Relations Without Help from the Outside. Automotive Ind., vol. 39, no. 17, Oct. 24, 1918, pp. 722-723, 1 fig. Collective-bargaining plan for handling all matters relating to wages, hours of labor, discipline, discharges aud grievances.

Important Phases of the Labor Problem, Magnus W. Alexander. Iron Age, vol. 102, nos. 21 and 22, Nov. 21 and 28, 1918, pp. 1258-1325. Problems of pensions and insurance; profit sharing in industry; adjustment of labor disputes; working conditions; hours of work. Nov. 21: Recruiting of men; collective bargaining discussed.

BONUSES. Paying Bonuses to Power Plant Employees, Frederick L. Ray. Nat. Engr., vol. 22, no. 10, Oct. 1918, pp. 495-495, and (discussion) pp. 495-497. Account of system followed by Milwaukee Elec. Ry. & Light Co. Paper before Nat. Assn. of Stationary Engrs.

BRITISH LABOR ADMINISTRATION. Labor Administration, Edward T. Elbourne, Engineer, vol. 126, nos. 3276, 3278, 3279, 3280, Oct. 11 and 25, Nov. 1 and 8, 1918, pp. 299-300, 348-350, 2 figs., 365-367, 4 figs., 388-390, 1 fig. Oct. 25: Women; Nov. 1: Time office (men); Nov. 8: Methods of Remuneration.

DILUTION. Labor Dilution as a National Necessity, Frederick A. Waldron. Jl. Am. Soc. Mech. Engrs., vol. 40, no. 12, Dec. 1918, pp. 1033-1035. After referring to work done by British Bureau of Labor, the writer outlines the scope of labor dilution as necessary application to national resources of U. S. Presented at annual meeting of society.

EMPLOYMENT DEPARTMENT. Employment Department Routine of the Curtiss Aeroplane & Motor Corp., Charles E. Fouhy. Ind. Man., vol. 56, no. 5, Nov. 1918, pp. 412-416, 17 figs. Routine and forms of employment department.

INDUSTRIAL RELATIONS. Employment of Labor, Dudley R. Kennedy. Jl. Am. Soc. Mech. Engrs., vol. 40, no. 12, Dec. 1918, pp. 1030-1031. Activities of Industrial Relations Department of Hog Island plant in connection with securing and maintaining a force of 35,000 employees and providing for their needs and comfort. Presented at the annual meeting of society.

Fundamental Factors in Sound Industrial Relations, H. T. Waller. Ind. Management, vol. 56, no. 5, Nov. 1918, pp. 367-371, 8 figs. Seven factors discussed by author and illustrated by cartoons interpreting vital truth.

Use of Non-Financial Incentives in Industry, Robert B. Wolf. Jl. Am. Soc. Mech. Engrs., vol. 40, no. 12, Dec. 1918, pp. 1035-1038, 2 figs. Account of instances where personal interest has been developed in workmen by supplying foremen with information upon costs, methods of operation, possibilities in direction of economy and efficiency, etc. Presented at annual meeting of the A. S. M. E.

LUNCH ROOMS. Feeding Employees at a Steel Plant. Iron Age, vol. 102, no. 19, Nov. 7, 1918, pp. 1136-1138, 2 figs. Reasons for abolishing dinner pail; management of lunchroom; auxiliary room for foreigners; commissary.

NATIONAL WAR LABOR BOARD. The War Labor Board aud the Living Wage, Frank P. Walsh. Survey, vol. 41, no. 10, Dec. 7, 1918, pp. 301-303. Account of origin of National War Labor Board, its purpose and achievements.

PROFIT SHARING. A Tested Profit Sharing Plan, Dale Wolf. Indus. Management, vol. 56, no. 6, Dec. 1918, pp. 486-488, 3 figs. Average of 46 per cent of company's profits are distributed to employees.

SOLDIERS. Returned Soldiers Make Very Good Welders, W. F. Sutherland. Can. Machy., vol. 20, no. 22, Nov. 28, 1918, pp. 618-619, 2 figs. Outline of work done by training school.

The Employment of the Returned Soldier. Can. Machy., vol. 20, no. 20, Nov. 14, 1918, pp. 561-562. Résumé of problem as viewed by English correspondent. From Times Eng. Supp.

The Industrial Restoration of Disabled Soldiers, Bert. J. Morris. Indus. Management, vo.. 56, no. 6, Dec. 1918, pp. 477-481, 4 figs. Review of accomplishments of other nations and notes on organizations preparing to re-educate American soldiers.

TURNOVER. Interpretating Labor Turnover, Luther D. Burlingame. Am. Mach., vol. 49, no. 19, Nov. 7, 1918, pp. 855-858, 1 fig. Discusses real meaning and how it should be computed.

WOMEN. Women in the Machine Shop, S. A. Hand. Am. Mach., vol. 49, no. 23, Dec. 5, 1918, pp. 1035-1037, 9 figs. Successful experience of large firm of machine tool builders in employment of women workers.

WOMEN WORKERS. Women in the Service of the Railways, Pauline Goldmark. Ry. Age, vol. 65, no. 23, Dec. 6, 1918, pp. 1016-1018. Used in a great variety of work. Address before Labor Reconstruction Conference, Academy of Political Science, N. Y.

LEGAL

Boiler Contracts. Construing Boiler Contracts, A. L. H. Street. Power, vol. 48, no. 22, Nov. 26, 1918, pp. 765-766. Case reported in the Maryland Court of Appeals, bearing on obligations of manufacturer under contract for installation of boilers according to particular specifications.

Casual Employment. What Constitutes Casual Employment ? Chesla C. Sherlock. Am. Mach., vol. 49, no. 19, Nov. 7. 1918, pp. 850-852. Discussion of certain legal interpretations.

Contributor in Negligence. Disobedience of Orders by Employees and Its Relation to Compensation. Chesla C. Sherlock. Am. Mach., vol. 49, no. 22, Nov. 28, 1918, pp. 980-982. Review of some court decisions.

Floors, Slippery (accidents from). Injuries Caused by Slippery Floors, Chesla C. Sherlock. Power, vol. 48, no. 22, Nov. 26, 1918, pp. 790. Some court decisions.

Simple Tools (accidents from). Liability in the Use of Simple Tools, Chesla C. Sherlock. Am. Mach., vol. 49, no. 21, Nov. 21, 1918, pp. 939-940. Some legal aspects of employers' liability in use of simple tools.

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REDUCTION GEARING. Italian Reduction-Geared Turbine Cargo-Steamship "Ansaldo I." Shipbuilding & Shipping Rec., vol. 12, nos. 19 and 20, Nov. 7, and 14, 1918, pp. 447-450, 13 figs., 470-471, 4 figs. Principal dimensions, plans and photographs.

RESISTANCE. Effect of Appendages on Resistance and Propulsion. Shipbuilding & Shipping Rec., vol. 12, no. 19, Nov. 7, 1918, pp. 452-453, 2 figs. Account of Luke's experiments with various angles of bossing, with outward- and inward-turning screws; values of wake fractions and hull efficiencies; resistance compared with resistance of naked model. (Concluded.)

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TOW BOATS. Plans and Specifications of New Wood Tow Boats. Inst. Mar. Eng., vol. 23, no. 12, Dec. 1918, pp. 673-674, plate, 1 fig. Built for hard service.

WOODEN SHIPS. Building Wooden Ships for the Emergency Fleet Corporation, E. A. Suverkrop. Am. Mach., vol. 49, no. 20, Nov. 14, 1918, pp. 383-387, 11 figs. Planking and interior work. Third article.

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CANADA. Canadian Vickers Shipbuilding Works at Montreal. Engineering, vol. 106, no. 2754, Oct. 11, 1918, pp. 395-396, 12 figs. Illustrated description of shipbuilding in Canada.

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New Lake Shipyard has Side-Launching Ways Under Cover. Eng. News-Rec., vol. 81, no. 19, Nov. 7, 1918, pp. 839-841, 3 figs. Ships built at Ferguson yard fabricated in company's shops two miles away; berths covered with cantilever roof served by semi-gantry crane.

GREAT LAKES. Great Lakes Yards Lead Coast Districts in Building Ocean-Going Ships. Eng. News-Rec., vol. 81, no. 22, Nov. 28, 1918, pp. 978-980, 4 figs. Canal-size steamers produced in large numbers; spirit of co-operation; yard capacity doubled; no outside fabrication; equipment of varied character; labor shortage.

SHOOTER'S ISLAND. Methods Used at Shooter's Island for Constructing Standard Ships, Charles M. Horton. Int. Mar. Eng., vol. 23, no. 11, Nov. 1918, pp. 618-624, 13 figs. Serving individual ways; method for increasing output; well-lighted boiler shop; handy plate-lifting clamp.

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AIR MACHINERY

AIR CONDITIONING. Air Conditioning, Charles L. Hubbard. Domestic Eng., vol. 85, nos. 3 and 4, Oct. 19 and 26, 1918, pp. 82-84, 2 figs. and 118-120, 5 figs. Possibilities of this branch of heating and ventilating engineering and how it may save coal and raise efficiency of employees in industrial plant.

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Proportioning the Materials of Mortars and Concretes by Surface Areas of Aggregates, L. N. Edwards. Surveyor, vol. 54, no. 1398, No. 1, 1918, pp. 209-210. Results of tests made by Toronto Department of Works with object of developing surface-area method of proportioning and securing information relative to (1) surface area of aggregates of varying granulometric composition, (2) quantity of water necessary to produce a "normal" uniform consistency of mortar for varying sands and cement constant, and (3) strength of mortar attained by varying proportion of cement in mix. Paper before Am. Soc. for Testing Materials.

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COLD-WEATHER CONCRETING. Cold Weather Concreting. Eng. & Cement World, vol. 13, no. 10, Nov. 15, 1918, pp. 20-24, 8 figs. Effect of low temperatures on concrete work; suggestions of Portland Cement Assn. in regard to heating materials and protecting work.

DISINTEGRATION. Conclusions on Causes of Concrete Disintegration, A. Blackie. Eng. & Contracting, vol. 50, no. 21, Nov. 20, 1918, pp. 503-505. From paper before Eng. Ins. of Canada.

FORM UNITS. One Set of Tool Forms Used Three Times Completes Concrete Foundry, J. M. Villadsen. Eng. News-Rec., vol. 81, no. 21, Nov. 21, 1918, pp. 950-951, 3 figs. Form units assembled on ground with reinforcement in place erected by derrick; concrete placed by telescoping chute.

FRANCOIS AND PORTIER CEMENTATION PROCESSES. Cementation Processes of Francois and Portier, A. H. Krynauw. Contract Rec., vol. 52, no. 44, Oct. 30, 1918, pp. 864-865. Conditions most suitable for hard setting in shortest time when cement is pumped under pressure into fissures; cases in which cementation has been successfully applied; comparison between two processes. Paper before Chem. Metallurgical & Min. Soc.

MOISTURE. Effect of Water on Strength of Concrete. Contract Rec., vo.. 52, no. 44, Oct. 30, 1918, p. 865, 1 fig. Diagram presenting amount of water used in per cent of quantity giving maximum strength against per cent of maximum strength. Drawn from results of experimental tests.

Saturation of Concrete Reduces Strength and Elasticity, M. B. Lagaard. Eng. News-Rec., vo.. 81, no. 20, Nov. 14, 1918, pp. 908-910, 6 figs. Tests, made at University of Minnesota, show that moisture content of specimens serves to counteract benefits of moist curing.

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A Case of Corrosion Caused by Electrolytic Action in a Westinghouse-Leblanc Air Pump (Un cas de corrosion à allure électrolytique dans une pompe à air Westinghouse-Leblanc), L. Conge. Revue Générale de l'Electricité, vol. 4, no. 15, Oct. 12, 1918, pp. 539-540, 2 figs. States that no pipe or machine element intended to operate exposed to direct action of any kind of water should be composed of metals capable of forming a voltaic couple.

FOUNDRIES

BRASS FOUNDRY. A Brass Foundry With Automatic Ventilation, Charles Vickers. Foundry, vol. 46, no. 316, Dec. 1918, pp. 568-574, 11 figs. Description of foundry with its ventilation arrangements.

COREROOM. Modern Coreroom for Malleable Foundry, Donald S. Barrows. Iron Age, vol. 102, no. 21, Nov. 21, 1918, pp. 1254-1255, 5 figs. Designed and constructed for 50,000-ton foundry, provides for economical handling of raw materials and finished cores. Abstract of paper before Am. Foundrymen's Assn., Oct. 1918. Also in Foundry, vol. 46, no. 316, Dec. 1918, pp. 577-578, 5 figs.

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Pit Molding an Intricate Condenser Casting. Foundry, vol. 46, no. 316, Dec. 1918, pp. 552-557, 10 figs. Structural difficulties, experienced more generally in light work, attended production of this 34,900-lb. casting.

PATTERNS. The Engineer in Relation to the Foundry, E. S. Carman. Iron Age, vol. 102, no. 20, Nov. 14, 1918, pp. 1200-1202, 13 figs. Machine designs not adapted to advanced foundry practice; comparison of correct and incorrect patterns for floor molding. From paper before Am. Foundrymen's Assn., Milwaukee, Oct. 1918.

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SAND. Improving Foundry Sand Mixtures, Henry B. Haneley. Iron Age, vol. 102, no. 19, Nov. 7, 1918, pp. 1146-1148, 3 figs. Use of sand-mixing machine; time required for mixing; effect of sea coal and fireclay. From paper before Am. Fdrys. Assoc., Milwaukee, October 1918. Also in Foundry, vol. 46, no. 316, Dec. 1918, pp. 559-562, 5 figs.

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Urgent Shell Need Found Foundries Ready. Foundry, vol. 46, no. 316, Dec. 1918, pp. 581-587, 15 figs. Manufacturing operations and practices developed in American foundries would have furnished tonnage of semi-steel shell beyond all prospective requirements.

SUPERVISION. A Foundry Supervision System, Paul R. Ramp. Iron Age, vol. 102, no. 23, Dec. 5, 1918, pp. 1383-1385, 2 figs. Routine set of reports designed to provide quick and accurate gage of current costs and operations. From paper before Am. Foundrymen's Assn., Milwaukee, Oct. 1918.

FUELS AND FIRING

ASH. Clinker and Ash in Fuel. Times Eng. Supp. no. 527, Sept. 1918, p. 186 Methods employed for curtailing labor entailed in removing large and hard masses of clinker.
The Fusibility of Coal Ash and the Determination of the Softening Temperature, Arno C. Fieldner, Albert E. Hall and Alexander L. Field. Department of Interior, Bureau of Mines, Bul. 129, 1918, 146 pp., 38 figs. Review of literature on subject; effect of various oxidizing, reducing, and neutral atmospheres such as are found in various parts of fuel bed on softening temperature of ash when molded in form of Seger cones; development of method for determining fusibility whereby ash is caused to soften and form slags in which iron exists in approximately same state of oxidation as when in fuel-bed clinkers.

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Generation of Heat and Its Absorption by Boiler, Henry Misostow. Nat. Engr., vol. 22, no. 10, Oct. 1918, pp. 518-522, 4 figs., and (discussion) pp. 522-525. Conditions which will realize an efficient commercial combustion and suggestions to utilize-heat indications in securing good performance in boiler room. Paper before Nat. Assn. of Stationary Engrs.
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Fuel Regulation during the War, P. R. Noyes and D. M. Myers. Nat. Engr., vol. 22, no. 10, Oct. 1918, pp. 481-492. Discussion by Federal Government officials before Nat. Assn. of Stationary Engrs.
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Proposed Coal-Rationing Rules for the United States. Heat. & Vent. Mag., vol. 15, no. 11, Nov. 1918, pp. 21-23. Allowances designed for heating, cooking and hot-water service in residences, flats and apartment houses. Final draft of report of Committee on Fuel Conservation, Am. Soc. of Heating and Vent. Engrs.

Rational Utilization of Commercial Fuels (Sur l'utilisation rationnelle des combustibles dont dispose actuellement l'industrie). Revue Générale de l'Electricité, vol. 4, no. 14, Oct. 5, 1918, pp. 505-511. Report of the Ministry of Armament and War Manufactures. From Bulletin des Usines de Guerre, Aug. 26 and Sept. 2, 1918, pp. 137-149 and 145-147.

GASOLINE. Substitute for Gasoline Tested. Motor Age, vol. 34, no. 23, Dec. 5, 1918, p. 15. Excerpts of tests made by Bureau of Standards on secret product said to be composed of inexpensive and easily obtainable materials.

HAND-FIRED PLANTS. Fuel Economy in Hand-Fired Power Plants. Power Plant Eng., vol. 22, no. 23, Dec. 1, 1918, pp. 953-956, 4 figs. Settings, stacks and breechings. Fourth article.

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OIL FUEL. California Petroleum as a Fuel Oil, Thomas J. Royer. Nat. Engr., vol. 22, no. 10, Oct. 1918, pp. 525-533, 13 figs., and (discussion) pp. 533-534. Account of development; study of use in steam-boiler practice and suggestions for satisfactory operation; test in a water-works pumping station. Paper before Nat. Assn. of Stationary Engrs.

PULVERIZED COAL. First Pulverized Coal Installation in Western Canada, H. R. Collins. Min. & Eng. Rec., vol. 23, nos. 17 and 18, Sept. 30, 1918, pp. 177-179. Features of pulverizing plant.
Pulverized Fuel, E. R. Knowles. Steam, vol. 22, no. 5, Nov. 1918, pp. 128-133, 10 figs. Temperatures attainable; disadvantages of pulverized coal as fuel; requirements for successful burning. (Concluded.)
Pulverized Fuel in the Oneida Street Plant of the Milwaukee Elec. Ry. & Light Co., F. Dornbrook. Nat. Engr., vol. 22, no. 10, Oct. 1918, pp. 535-537, and (discussion) pp. 537-539. Results obtained with trial installation. Paper before Nat. Assn. of Stationary Engrs.
Pulverizing Coal, J. Cunliffe. Eng. & Cement World, vol. 13, no. 10, Nov. 15, 1918, pp. 56-58. Waste resulting from burning coal in lumps; preparation, application and burning of pulverized coal.

WASTE HEAT. Waste Heat from Steel Furnaces, Thomas B. Mackenzie. Times Eng. Supp., no. 527, Sept. 1918, p. 195. Method of utilizing waste heat from open-hearth furnaces in generation of steam. Paper before Iron & Steel Inst.

HANDLING OF MATERIALS

COAL. Coal Handling Plant of Virginian Railway, E. F. Case. Ry. Rev., vol. 63, no. 21, Nov. 23, 1918, pp. 731-735, 9 figs. Account of extensive additions to this railroad's plant at Sewall's Point, Va.

EXCAVATION MATERIAL. Comparison of Excavation Haulage by Motor Trucks, Industrial Railways and Teams. Eng. News-Rec., vol. 81, no. 22, Nov. 28, 1918, pp. 993-996. 1 fig. Detailed cost accounts on construction of Brooklyn Army Supply Base show that trucks are more economical than teams and less economical but more flexible than railways.

GRAIN. Car Equipment for Loading or Unloading Grain (Installations pour le transport des grains montées sur wagons). Génie Civil, vol. 73, no. 14, Oct. 5, 1918, pp. 261-263, 11 figs. Two systems; by air pressure, and by suction.

ORE. Large Ore Storage in a Limited Space, F. L. Prentiss. Iron Age, vol. 102, no. 22, Nov. 28, 1918, pp. 1311-1313, 4 figs. Double bin system of Iroquois Iron Co solves material-handling problems and results in short haul to skip cars.

SAND. Pneumatic Car Provides Efficient Method of Handling Sand, W. L. Whitlock. Elec. Ry. Jl., vol. 52, no. 22, Nov. 30, 1918, pp. 967-968, 5 figs. By use of new sand car, crew of regular car takes care of sand transportation which formerly required services of three additional men.

HEAT TREATING

MALLEABLE CAST IRON. Experiments in Annealing Malleable Cast-Iron, H. E. Diller. Foundry, vol. 46, no. 316, Dec. 1918, pp. 564-566, 4 figs. Results of several laboratory experiments show that malleable iron can be annealed in tunnel furnace in 48 hours or les. From paper before Am. Foundrymen's Assn., Milwaukee, Oct. 1918.

QUENCHING STEEL. Warping of Steel by Repeated Quenching, J. H. Whiteley. Iron Age, vol. 102, no. 21, Nov. 21, 1918, pp. 1256-1257, 6 figs. How the metal contracts; direction of its flow; interesting features revealed by microscope. From paper before Iron and Steel Inst., London, Sept. 1918.

HEATING AND VENTILATION

EQUIPMENT. Care of Heating and Ventilating Equipment, Harold L. Alt. Power, vol. 48, no. 21, Nov. 19, 1918, pp. 736-738, 3 figs. Down-draft furnace. Also in Power, vol. 48, no. 23, Dec. 3, 1918, pp. 801-803, 5 figs.

FACTORY HEATING. Factory Heating, Charles L. Hubbard. Steam, vol. 22, no. 5, Nov. 1918, pp. 123-127, 9 figs. System of heating with hot water under forced circulation. (To be continued.)
Some Factory Heating Problems, B. C. Moore. Wood-Worker, vol. 37, no. 9, Nov. 1918, pp. 26-27. Considerations of the economical value of keeping a factory heated night and day.

HOT AIR FURNACE. How to Improve the Hot-Air Furnace, Charles Whiting Baker. Department of Interior, Bureau of Mines, Tech. Paper 208, 20 figs. Recommends practice of adding auxiliary cold-air duct by which air supply to furnace may be taken from inside the house, instead of from outdoors, during very cold or windy weather.

HOUSE HEATING. Economical Heating of Cottages and Small Houses, Frederick Grant. Domestic Eng., vol. 85, no. 5, Nov. 2, 1918, pp. 160-162, 4 figs. Suggests features of design for both hot-water and steam-heating systems.

OFFICE BUILDING HEATING. Fuel Economy in the Singer Building, Norman King. Power, vol. 48, no. 20, Nov. 12, 1918, pp. 710-711. Some figures on costs and economies.

VAPOR HEATING. Modern Practice in Vapor Heating. Heat. & Vent. Mag., vol. 15, no. 11, Nov. 1918, pp. 44-46, 5 figs. The Moline System. Sixth article.

VENTILATION. A Discussion of Ventilating Practices, Charles A. Mitke. Coal Industry, vol. 1, no. 10, Oct. 1918, pp. 379-381. Analysis of working conditions as affected by ventilation; installation of mechanical ventilation. Paper before Nat. Safety Congress.

No Quarrel Necessary Between Natural and Mechanical Ventilation Advocates. Heat. & Vent. Mag., vol. 15, no. 11, Nov. 1918, pp. 37-40. Clear and well-defined field for each method depending upon required air conditions with given type of occupancy and occupation. From reply by E. Vernon Hill to newspaper article.

HOISTING AND CONVEYING

CRANES. Handling Shipbuilding Material at Atlanta Shipyard. Eng. News-Rec., vol. 81, no. 23, Dec. 5, 1918, pp. 1020-1022, 8 figs. Planned for direct routing; three craneways in fabricating yard; shape shop in open; turret cranes at shipbuilding berths; assembly yard.

Hoisting and Conveying Machinery (Des appareils de manutention dans l'industrie en général), F. Séba. Revue Générale de l'Electricité, vol. 4, nos. 12 and 14, Sept. 21, and Oct. 5, 1918, pp. 423-433 and 493-501, 39 figs. Sept. 21: construction and arrangement of bridge cranes, traversing jib hoists, ceiling hoists and foundry hoists. Oct. 5, traveling cranes with auxiliary crab, rollers, rails, gear shafts, drums, cables and grab hoists.

Some Heavy Fitting-Out Cranes—I. Fixed Cranes at Kearny and Hog Island Yards. Eng. News-Rec., vol. 81, nos. 20 and 21, Nov. 14 and 21, 1918, pp. 885-890, 6 figs.; 937-941, 6 figs. 100-ton trolley bridge spanning slipway supplemented by portal cranes; platform derrick of unusual capacity and reach uses single-motor hoisting engine at Hell Gate arch-erection plant. Nov. 21: II. Cantilever and Jib Travelers at Newark Bay and Bristol; double cantilever bridge traveling along pier commands line of ships on either side; provision for extension; friction draft gear buffers; tower jib crane fitted with special safety devices.

DRUMS. Drum Shapes as Affecting the Mine Hoist Duty Cycle and Motor Rating, F. L. Stone. Proc. Am. Inst. Elec. Engrs., vol. 37, no. 10, Oct. 1918, pp. 1203-1221, 22 figs. Points out that the problem of drum shape consists in varying diameter of different parts of winding drum so that load may be accelerated and retarded at beginning and end of its travel with minimum consumption of power, and gives numerical examples of performance of various drum shapes under assumed conditions.

ELECTRIC HOISTING MACHINES. Electric Hoisting Machines (Les machines d'extraction à commande électrique), G. Rouet, Revue Générale de l'Electricité, vol. 4, no. 13, Sept. 28, 1918, pp. 451-457, 9 figs. Comparison between Léonard and three-phase types.

ROPES. Ropes for Hoisting Coal from Mines, M. W. Reed. Coal Industry, vol. 1, no. 10, Oct. 1918, pp. 388-391. Discussion concerning strength, elasticity, bending stress, starting, stopping, corrosion, clips and sockets for hoisting ropes; care and life of hoisting ropes. Paper before Nat. Safety Congress.

HYDRAULIC MACHINERY

FLOW OF WATER. A Proposed Hydraulic Experiment, Lord Rayleigh. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 214, Oct. 1918, pp. 315-316, 1 fig. Observation of flow of liquid between two cylinders revolving about their axes in opposite directions for the purpose of testing Froude's explanation regarding phenomena which take place when fluid passing along uniform pipe arrives at place where pipe expands.

Flow of Water in Wash Water Troughs for Rapid Sand Filters. Eng. & Contracting, vol. 50, no. 20, Nov. 13, 1918, pp. 461-462, 2 figs. From description in Cornell Civil Engineer of experiments made by Ernest C. Fortier and Frank V. Fields to determine surface curves for flow of water in wash water troughs and to develop formula for assistance of designers of troughs.

Flow of Water Through One- and One-Half-Inch Pipe and Valves, Frederick W. Greve, Jr., Purdue Univ., Bul. 1, Eng. Experiment Station, vol. 2, no. 2, July 1918, 21 pp. 16 figs. Tables and formulae for determining head losses incurred with use of pipes and valves.

Hydraulic Experiments with Valves, Orifices, Hose, Nozzles, and Orifice Buckets, Arthur N. Talbot, Fred B. Seely, Virgil R. Fleming and Melvin L. Enger. Univ. of Illinois Bul., vol. 15, no. 37, May 13, 1918, Bul. 105, 80 pp., 28 figs. Loss of hydraulic head in small valves; flow of water through submerged orifices; fire streams from small hose and nozzles; orifice bucket for measuring water.

TIDES. Power from the Tides, J. O. Boving. Times Eng. Supp., no. 529, Nov. 1918, pp. 232-233, 6 figs. Design of turbines which author thinks will render utilization of tidal power economically feasible.

WATER HAMMER. Causes of Shock in Hydraulic Mains, Alfred Towler. Machy. Market, no. 942, Nov. 22, 1918, pp. 17-18. Broad consideration of cause and effect in principle of violent collision as determined by momentum. Paper before Leeds Assn. Engrs.

Maxima Excess Pressures Produced by Water Hammer (Etude sur les maxima de surpression dans les phénomènes de coups de bélier), Maurice Gariel. Revue Générale de l'Electricité, vol. 4, nos. 11 and 12, Sept. 21 and Oct. 5, 1918, pp. 403-411, 6 figs., and 483, 490, 4 figs. Analysis of modern theory of water hammer leads author to establish that Michaud's formula for maximum excess pressure applies to great majority of turbine installations; that Joukowski-Alliévi's formula applies to conduits of uniform dimensions when opening closes in less than $2 L/a$ (where L is length in meters and a velocity of propagation of wave; and Sparre's formula in cases of non-uniform conduits and extremely rapid shut-off. Oct. 5: Investigations of phenomena of pressure waves developed in conduit by sudden release at opening and account of experimental verification of theoretical conclusions.

WATERWHEELS. Principles of Waterwheel Design. David R. Shearer. Power, vol. 48, no. 21, Nov. 19, 1918, pp. 732-734, 5 figs. Some of underlying principles simply illustrated, referring particularly to relation between velocity of water and the peripheral velocity of wheel.

INTERNAL COMBUSTION ENGINES

HEAVY OIL ENGINES. The Diesel Engine, Its Fuels and Uses, Herbert Haas. Automotive Eng., vol. 3, no. 9, Oct. 1918, pp. 418-424. General characteristics of oil engines; three general types; various cycles and comparison of advantages of each; comparative economies; detail of construction. (To be continued.) Also in Jl. Soc. Automotive Engrs., vol. 3, no. 5, Nov. 1918, pp. 299-308, 5 figs.

The Heavy Oil Engine, Charles E. Lucke, Int. Mar. Eng., vol. 23, no. 11, Nov. 1918, pp. 625-629 (Conclusion of article.)

The Semi-Diesel Engine. Times Eng. Supp., no. 529, Nov. 1918, p. 245. Characterisitics and design.

The Semi-Diesel Oil Engine, James Richardson. Engineering, vol. 106, no. 2756, Oct. 25, 1918, pp. 461-464, 12 figs. Review of mny types of semi-Diesel engines. Paper before Diesel Engine Users' Asso. Oct. 24, 1918.

HIGH SPEED ENGINE. Modern Types of Engines, Harry R. Ricardo. Machy. Market, no. 941, Nov. 15, 1918, pp. 17-18. Features of high-speed engine design and points upon which designers have concentrated their attention. Paper before North-East Coast Instn. of Engrs. & Shipbuilders. (To be continued.) Also in Int. Mar. Engr., vol. 23, no. 11, Nov. 1918, pp. 650-651.

MAGNETOS. Operation of Internal-Combustion-Engine Magnetos (Sul Funzionamento dei magneti di accensione dei motori a scoppio), Emilio Biffi. l'Electrotecnica, vol. 5, nos. 22, 24 and 28, Aug. 5 and 25, Oct. 5, 1918, pp. 302-306, 326-332 and 386-392, 26 figs. Aug. 5 and 25; theory of the magneto-generator. Oct. 5: theory of formation of spark in secondary coil. (To be continued.)

MARINE ENGINES. Two versus Four-Cycle Internal Combustion Marine Engines. Giovanni Chiesa. Engineering, vol. 106, no. 2757, Nov. 1, 1918, pp. 482, 486, 6 figs. Purpose of article is to coordinate arguments which have been alleged for and against both types in their best form of construction and to endeavor to draw conclusion after careful consideration of all points of question.

MIXTURE. Mixing the Mixture, Robert Miller. Motor Boat, vol. 15, no. 22, Nov. 25, 1918, pp. 11-14, 6 figs. Points out importance of securing uniform mixture in cylinder in order to secure chemical combination and considers the problem of direct injection.

PISTONS. Piston Design, Harry R. Ricardo. Automobile Engr., vol. 8, no. 119 Oct. 1918, pp. 274-278, 12 figs. Design in which connection between ring-carrying portion of piston and slipper surface is severed, so that heat can only be conductd to slipper surfaces by way of main webs, these being so constructed that heat from crown is distributed evenly over surface of slippers. Also in Autocar, vol. 41, no. 1201, Oct. 26, 1918, pp. 409-410, 3 figs.

LUBRICATION

CRANES, ELECTRIC. Electric Crane Lubrication, Geo. R. Rowland. Lubrication, vol. 5, no. 12, Oct. 1918, pp. 2-10, 10 figs. Ring oiling system which consists of oil reservoir and brass ring attached to and revolving with shaft.

CUTTING TOOLS. Cutting lubricants and Cooling Liquids. Shipbuilding & Shipping Rec., vol. 12, no. 19, Nov. 7, 1918, pp. 445-446. Enumeration of factors upon which selection of suitable cutting lubricant or cooling liquid depends and suggestions in regard to their manipulation. From report issued by Advisory Council of Department of Scientific & Indus. Research.

ECONOMY. Lubricant Economy, D. Street. Can. Machy., vol. 20, no. 22, Nov. 28, 1918, p. 617. Necessity for practicing economy and suggestions for reducing waste.

STEAM CYLINDERS. Problems of Steam Cylinder Lubrication (III), W. F. Osborne. Blast Furnace, vol. 6, no. 10, Oct. 1918, pp. 414-416. Factors affecting operation and lubrication of compound engines.

MACHINE ELEMENTS AND DESIGN

BEARINGS. Saving Power by Efficient Bearings, F. H. Lenox. Textile World Jl., vol. 54, no. 23, Dec. 7, 1918, pp. 91-95, 4 figs. Equipment method and results of experiments to determine power required to overcome friction of shaft bearings.

BOLTS AND SCREWS. S. A. E. Standard Screws and Bolts. Jl. Soc. Automotive Engrs., vol. 3, no. 5, Nov. 1918, pp. 333-335, 1 fig. Brief account of development of standards and comparison of standard screw-thread pitches used in five-inch systems most generally adopted in American and British practice,—B. W. S., B. S. F., U. S. S., S. A. E. Reg., S. A. E. Fine.

CRANKSHAFTS. Problems of Crankshaft Design, Otto M. Burkhardt. Aerial Age, vol. 8, no. 7, Oct. 28, 1918, pp. 376-379, 15 figs. Mathematical analysis of three groups of forces necessary to induce and maintain speeds of 3000 r.p.m. or more; pressures due to gaseous mixture, inertia forces and centrifugal forces. Paper before Eng. Soc. of Buffalo.

GEARS. The Internal Gear. Pamphlet published by Fellows Gear Shaper Co., 92 pp., 55 figs. Popular presentation of the comparative tooth action of internal and external gear teeth, together with directions for cutting, and samples of applications .

MACHINE SHOP

TOOL MAKING. Tooling Up Single Spindle Automatics and Lathes. Can. Machy, vol. 20, no. 19, Nov. 7, 1918, pp. 536-537, 6 figs. Operations for British 101 fuse body.

GRINDING. Grinding; Its Utility in the Modern Shop, D. Street. Can. Machy., vol. 20, no. 22, Nov. 28, 1918, p. 623. Convenience of substituting grinding for tooling in certain machine operations.

BELTING. Belting Speeds; Saw Speeds; Bearing Alloys, G. F. Cosgove. Wood-Worker, vol. 37, no. 9, Nov. 1918, pp. 28-29. Account of experiments made with gang ripping machines with saws located above stock to be ripped, feed being by means of a grooved traveling bed which carries the stock beneath saws.

DRILL SHARPENING. Central Plant for Sharpening Drill Steels Saves Money in Quarrying. Eng. News-Rec., vol. 81, no. 21, Nov. 21, 1918, pp. 929-930, 3 figs. Sharpening shop with two men replaces five smithies; steel conveyor, oil-fired furnaces and concrete quenching vat.

GAGES. Making Thread Gages, T. H. Fenner. Can. Machy., vo.. 20, no. 19, Nov. 7, 1918, pp. 529-532, 7 figs. Description of plant and methods of a Canadian firm.

MILLING. Continuous Milling, A. Thomas. Automobile Engr., vol. 8, no. 119, Oct. 1918, pp. 296-298, 12 figs. Notes on operation of Becker machine.

OPERATION. Scientific Organization of the Machine Shop (Organisation Scientifique de l'usinage), P. Denis. Génie Civil, vol. 73, nos. 12, 13 and 14, Sept. 21, 28 and Oct. 5, 1918, pp. 227-230, 246-251 and 268-271, 23 figs. Methodical execution of turning, countersinking and drilling. Sept. 21: selectin of most economical cutting speed by construction of individual tool curves showing cutting speed against volume of material removed by tool at that speed before it needs resharpening. Sept. 28: further study of tool curves and their utilization in determining the most effective thermal treatment for tools used in cutting operations. Oct. 5: numerical illustrations and résumé of conclusions reached.

PUNCH PRESS. Safe Punch Press Operation, W. W. Roach. Safety Eng., vol. 36, no. 4, Oct. 1918, pp. 231-233. Discusses installation and use of mechanical guards, introduction of safe practices and education of press operators. From Proc. Seventh Annual Safety Congress.

SQUARE HOLES. Generating a Square Hole with a Gear Shaper Cutter, Douglas T. Hamilton. Am. Mach., vol. 49, no. 21, Nov. 21, 1918, pp. 949-950, 2 figs.

TOOL DEPARTMENT. Supervising a Large Tool Department, C. W. Starker. Indus. Management, vol. 56, no. 6, Dec. 1918, pp. 481-486. Step toward greater economy in tool department. Methods developed in tool department to coordinate requirements and minimize tool expense.

MACHINERY, METAL WORKING

BORING BAR. Making Boring Bars for Big Guns, M. E. Hoag. Am. Mach., vol. 49, no. 22, Nov. 28, 1918, pp. 987-988, 4 figs. Describing boring of hole 42 feet long 1¼ inches in diameter.

GRINDER. Heald Cylinder Grinder. Am. Mach., vol. 49, no. 23, Dec. 5, 1918, pp. 1053-1054, 2 figs. Description of machine built by Heald Machine Co., Worcester, Mass., with principal dimensions.

LATHE. Amalgamated Shell-Turning Lathe. Am. Mach., vol. 49, no. 19, Nov. 17 1918, p. 869, 1 fig. Short description with principal dimensions.

SLOTTING MACHINE. A New Slotting Machine of the Milling Type, J. V. Hunter. Am. Mach., vol. 49, no. 21, 1918, pp. 953- 56, 9 figs. Description with principal data of new machine tool brought out by Racine Tool and Machine Co., Racine, Wis.

MACHINERY, SPECIAL

CLOCKS. Studies in Clocks and Time-Keeping: No. 1. Theory of the Maintenance of Motion, R. A. Sampson. Proc. Roy. Soc. of Edinburgh, vol. 38, part 1 and 2, session 1917-1918, pp. 75-114, 11 figs., and 169-128. Practical details of three clocks, Riefler, synchronome, and Cottingham; theoretical discussions on maintenance of motion, air resistance, barometric error, escapement error, temperature compensation, and other points connected with exact timekeeping. No. 2: Tables of the Circular Equation.

EVAPORATORS. Lillie Multiple Evaporator. Steam, vol. 22, no. 5, Nov. 1918, pp. 142-143, 3 figs. Evaporator in which liquid is spread over heating surfaces in thin films.

HOISTING JACKS. Hydraulic Car Lift Gives Increased Output to Shops, Homer MacNutt. Elec. Ry. Jl., vol. 52, no. 21, Nov. 23, 1918, pp. 927-928, 4 figs Description with illustrations of hydraulic hoisting jack.

QUARRYING MACHINES. Labor-Saving Methods and Machines in Limestone Quarrying. Eng. & Contracting, vol. 50, no. 21, Nov. 20, 1918, pp. 478-479. From pamphlet by Oliver Bowles issued by U. S. Bureau of Mines.

QUENCHING MACHINE. A Quenching Machine for Hardening Small Drawing Dies. Am. Mach., vol. 49, no. 23, Dec. 5, 1918, pp. 1045-1046, 4 figs. Description of machine developed by S. A. Potter Tool and Machine Works, 70 East 130th St., New York.

ROAD FINISHER. Road Finisher Produces Denser Concrete. Cement & Eng. News, vol. 30, no. 1, Nov. 1918, p. 34, 2 figs. Machine which subjects mixture to continuous agitation by tamper.

SCALES. Modern 150-Ton Track Scale Now in Use, Frank C. Perkins. Can. Machy., vol. 20, no. 19, Nov. 7, 1918, pp. 544-547, 9 figs. Mechanism of design in which plate-steel fulcrums are used.

SCREENS, GRAVEL. Comparative Analysis of Gravel Screens, Raymond W. Dull. Cement & Eng. News, vol.30, no. 11, Nov. 1918, pp. 21-23, 10 figs. Considers gravity, cylinder, overhung conical and inclined conical types.

TOOL-SETTER. Alignment-Tester and Microscopic Tool-Setter. Engineering, vol. 106, no. 2754, Oct. 11, 1918, pp. 398-399, 7 figs. Description of an instrument constructed by Cambridge Scientific Instrument Company, Limited Cambridge.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

ASPHALT. Standardization of Required Consistency for Asphalt, J. R. Draney. Contract Rec., vol. 32, no. 46, Nov. 13, 1918, p. 910, Quotes present variations and suggests possible specifications.

BOILER PLATE. Materials of Steam Boiler Construction, A. J. Dixon. Boiler Maker, vol. 18, no. 11, Nov. 1918, pp. 317-319. Action of carbon in boiler plate; dangers of free use of cast iron; laminar structure of wrought iron. From Power.

CRACKS. Prevention of Season and Corrosion Cracks, W. B. Price. Am. Machy., vol. 49, no. 19, Nov. 7, 1918, pp. 848-850, 7 figs. Paper before Am. Soc. for Testing Materials, Atlantic City, June 1918.

MONEL METAL. Note on Monel Metal, John Arnott. Engineering, vol. 106, no. 2756, Oct. 25, 1918, p. 451, 3 figs. Composition, microstructure, strength or rolled materials, effect of annealing, strength at high temperature, use.

SILICA BRICK. Silica Brick Tests. Eng. & Cement World. vol. 13, no. 10, Nov. 15, 1918, p. 62. Brief report of experiments conducted in France which revealed that notable quantities of iron oxide do not sensibly lower fusing point of silica, even when lime is present.

MEASUREMENTS AND MEASURING APPARATUS

DEPTH GAUGE. A Micrometer Depth Gauge, C. H. Copland. Model Engr., vol. 39, no. 914, Oct. 31, 1918, pp. 239-240, 6 figs. General arrangement and details of gage intended for use on munition or other fine work.

HARDNESS. The Institution of Mechanical Engineers. Engineering, vol. 106, no. 2756, Oct. 25, 1918, pp. 469-472, 5 figs. Discussion of three papers on hardness testing, "A Law Governing the Resistance to Penetration of Metals When Tested with a 10-mm. Steel Ball; and a New Hardness Scale in Energy Units, by Prof. C. A. Edwards, "The Value of the Indentation Method in the Determination of Hardness," by H. G. C. Batson, and "The Ludwick Hardness Test," by W. C. Unwin, all read at meeting of Inst., Oct. 1918.

The Ludwik Hardness Test, W. C. Unwin. Engineering, vol. 106, no. 2756, Oct. 25, 1918, p. 478. Paper before Inst. of Mech. Engrs., Oct. 1918.

The Resistance of Metals to Penetration Under Impact, C. A. Edwards, Engineering, vol. 126, no. 3276, Oct. 11, 1918, pp. 314. Abstract of paper before Inst. of Mech. Engrs., June 1918.

Value of the Indentation Method in the Determination of Hardness; R. G. C. Batson. Engineering, vol. 106, no. 2756, Oct. 25, 1918, pp. 475-477, 6 figs. Paper before Inst. of Mech. Engrs., Oct. 1918.

HEAT-MEASUREMENT. Heat-Measuring Instruments, C. E. Clewell. Am. Mach., vol. 49, no. 23, Dec. 5, 1918, pp. 1021-1025, 12 figs. Principal types of pyrometers; features connected with their use; typical uses; cases of practical installations of pyrometers illustrated.

INDICATORS. Indicator Cord Connections, R. T. Strohm, Southern Engr., vol. 30, no. 4, Dec. 1918, pp. 40-41, 7 figs. Collection of methods used by engineers to connect cord to reducing motion.

MINIMETER. The Minimeter for Fine Measuring, Frank C. Perkins. Can. Machy., vol. 20, no. 21, Nov. 21, 1918, pp. 592-593, 5 figs. Principle and forms of Hirth apparatus for measuring threads, balls, cylindrical parts and grooves, also for inside measuring of various diameters.

PERMEABILITY. Determination of Permeability of Balloon Fabrics, Junius David Edwards. Aeronautics, vol. 15, no. 261, Oct. 16, 1918, pp. 358-364, 7 figs. Theory of process; volume-loss methods; penetration methods; experimental apparatus; effect of experimental conditions on apparent permeability; operating directions and calculations. From Aviation & Aeronautical Eng.

VARIANCE. Variance of Measuring Instruments and Its Relation to Accuracy and Sensitivity, Frederick J. Schlink. Jl. Franklin Inst., vol. 186, no. 6, Dec. 1918, pp. 743-747. Abstract of notes from U. S. Bureau of Standards.

VISCOSITY. On the Measurement of the Viscosity of Liquids (Sur la mesure de la viscosité des huiles), C. Chéneveau. Journal de Physique, vol. 7, May-June 1917, pp. 109-114, 1 fig. Apparatus for measuring absolute viscosity by application of Poiseuille's law.

MECHANICS

BEAMS. Curved Beams, James J. Guest. Proc. Roy. Soc., vol. 95, no. A665, Sept. 2, 1918, pp. 1-21, 6 figs. Determination of stresses produced by bending moment in uniform curved beams of several special sections; method of estimating maximum stress applicable to sections considered and approximately to any other section not having extraordinary features.

The Buckling of Deep Beams, J. Prescott. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 214, Oct. 1918, pp. 297-314, 7 figs. Attempt to develop mathematical theory of side buckling of beam having a depth much greater than its breadth by assuming buckling has actually occurred and finding value of couples at end which will maintain buckled state of beam..

ELASTICITY. Elastic Solids Under Body Forces, D. N. Mallik. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 214, Oct. 1918, pp. 321-326. Derives from equation of equilibrium of isotropic solid under body forces mathematical expression for its displacement.

Theory of Elastic Phenomena Taking Place in Punching and Drawing of Plastic Blocks (Théorie du poinçonnage et de l'écoulement des blocs plastiques; phase élastique de ces phénomènes), J. Boussinesq. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 15, Oct. 7, 1918, pp. 505-510. Studies general case of cylindrical block. Supplement to four previous communications (Comptes rendus, vol. 167, July 29, Aug. 5, 12, 19, pp. 186, 221, 253, 285) on the verification of Trosca's formulæ.

SPRINGS. A New Theory of Plate Springs. David Landau and Percy H. Parr. Jl. Franklin Inst., vol. 186, no. 6, Dec. 1918, pp. 699-721, 8 figs. Mathematical study of effect of tapering ends of leaves on strength of spring. Continued from vol. 185, April 1918, p. 481. (To be continued.)

TUBES. Contribution to Our Knowledge on Calculation of Stresses in Tubes (Bidrag till Kännedom om tubers beräkning). Folke L:son Grange. Teknisk Tidskrift, Väg—och Vatten-Byggnadskonsl, year 48, no. 10, Oct. 1918, pp. 145-147, 4 figs.

MOTOR CAR ENGINEERING

DESIGN. Aeronautical Experience Will Profoundly Affect Motor Car Practice, A. A. Remington. Automotive Ind., vol. 39, no. 18, Oct. 31, 1918, p. 776. Emphasizes necessity for greater standardization and more research work. Presidential address before British Instn. Automobile Engrs.

Post-War Chassis. Automobile Engr., vol. 8, no. 119, Oct. 1918, pp. 279-280. Possible effects of aircraft engine experience and other factors bearing upon design. (To be continued.)

ENGINES GASOLINE. The "American", Sleeve-Valve Motor. Auto, vol. 23, no. 44, Nov. 1, 1918, pp. 820-822, 6 figs. How sleeves are operated; suggestion to overcome tendency not to get rid of exhaust, by offsetting forward sleeve exhaust port from its present direct opposition to inlet and narrowing and deepening both it and others corresponding in cylinder wall and in head.

ENGINES, KEROSENE. Beaver Kerosene Tractor Engines. Automotive Industries, vol. 39, no. 20, Nov. 14, 1918, pp. 839 and 862, 2 figs. Horsepower and torque curves of 4¾ x 6-in. engine and record of 5-hr. endurance test on full-open throttle at 900 r.p.m.

FUEL CONSUMPTION. Tests for Reducing Fuel Consumption on Motor Vehicles (Forsog paa Besparelse af Brændselsolie ved Automobilkorsel), Paul Bergsoe. Ingenioren, year 27, no. 85, Oct. 23, 1918, pp. 557-558.

GAS FUEL. Coal Gas for Motor Vehicles. Times Eng. Supp., no. 527, Sept., 1918, p. 187. Modifications for running under compressed charges introduced by London General Omnibus Co.

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The Bellem-Bregeras Kerosene Atomizer, Auto, vol. 23, no. 45, Nov. 8 1918, p. 845, 2 figs. Theoretical value and practical performance results.

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Single-Feed System Oils Car from Scat. Automotive Ind., vol. 39, no. 17, Oct. 24, 1918, p. 719. Multiple-plunger hand pump and reservoir constructed to supply oil under pressure to all points on chassis.

STEAM VEHICLES. Solid Fuels for Steam Vehicles. Motor Traction, vol. 27, no. 709, Oct. 2, 1918, pp. 243-244. Review of tests conducted by coal controller to prove that other fuels than Welsh coal could be used.

TRACTORS. Heider Friction Drive Tractor. Automotive Industries, vol. 39, no. 20, Nov. 14, 1918, pp. 831-832, 4 figs. Friction drive which enables a considerable number of tractor speeds and belt speeds to be obtained without use of shifting gears.

WHEELS. Front Wheel Wobble, Walter Boyle. Motor Traction, vol. 27, no. 712, Oct. 23, 1918, pp. 305-306, 2 figs. Sketch of method to give trailing effort to front wheels by tilting steering heads.

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TILE. Tile Pipe Versus Iron Pipe for Drains, Osborne Smith. Contract Rec., vol. 32, no. 44, Oct. 30, 1819, p. 873. Brief account of author's experience and suggestions in regard to jointing.

POWER GENERATION

CANADA. Utilizing Canada's Water Powers, J. B. Challies. Can. Mfr., vol. 38, no. 8, Aug. 1918, pp. 25-27. Future possibilities and requirements for their realization. From paper before Can. Soc. Civil Engrs.

POWER PLANTS

BOILER INSPECTION. Ontario Boiler Inspection Office. Power, vol. 48, no. 20, Nov. 12, 1918, pp. 698-699, 13 figs. Examples of dangerous conditions found in boilers described and illustrated.

BOILER OPERATION. Boiler Room Efficiency, A. H. Blackburn. Power Plant Eng., vol. 22, no. 22, Nov. 15, 1918, pp. 919-920. Analysis of fuel; losses in boiler room; instruments; coal handling. Abstract of paper before Annual Convention of Smoke Prevention Assn.

Economic Operation of Steam Turbo-Electric Stations, C. T. Hirshfeld and C. L. Karr. Department of Interior, Bureau of Mines, Tech. Paper 204, 29 pp., 5 figs. Analysis of methods used in boiler from for producing steam required and distributing load between main units available. Discussion of economic source for auxiliary power and conclusion that auxiliary power in excess of that obtainable with exhaust steam absorption can be procured from main generators in electrical form at lower thermal cost than in any other way.

Economical Working of Boiler Plant, P. D. Kirkman. Machy. Market no. 942, Nov. 22, 1918, p. 18. List of modern efficiency apparatus and of items to be studied in connection with waste and efficiency. Address to Manchester Branch of British Assn. of Textile Mgrs.

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BOILER SETTINGS. Boiler Setting Radiation and Air Leakage, E. S. Hight. Elec World, vol. 72, no. 21, Nov. 23, 1918, pp. 974-975, 1 fig. Results of experiments to determine best method of covering boiler settings to bring about reduction in radiation and escape of air; type of covering which saves $1000 per 500-hp. battery per year.

CENTRAL STATIONS. A Kilowatt Hour and the Coal Required to Produce It, B. H. Blaisdell. Elec. Eng., vol. 52, no. 2, Aug. 1918, pp. 26-28. Waste inherent in present system of generating power and remarks on some of the losses due to imperfect manipulation. Paper before Manila Section of Nat. Elec. Light Assn.

Increasing the Economy of Central Station Operation, J. W. Andree. Elec. World, vol. 72, no. 19, Nov. 9, 1918, pp. 881-882. Overhauling water conduits and prime movers; burning natural gas to save fuel oil; other proved methods.

COKE OVEN PLANTS. Power Plants at By-Product Coke-Ovens, F. E. Harris. Jr. & Cl. Trds. Rev., vol. 96, no. 26117, April 26, 1918, pp. 450-452, 2 figs. Discusses requirements and how to obtain satisfactory results.

CONDENSERS. Condensers and Condenser Engineering Practice, D. D. Pendleton. Power, vol. 48, no. 20 and 21, Nov. 12 and 19, 1918, pp. 720-722 and 756-757. Abstract of paper presented at twelfth annual convention of Assn. of Iron and Steel Elec. En ., Baltimore, Sept. 1918.

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EFFICIENCY. Steam Plant Efficiency. Coal Trade Jl., year 50, no. 49, Dec. 4, 1918 pp. 1433-1434. Suggestions addressed operating officers, superintendents, chief engineers, motive power department officials and men in charge of stationary power, heating and pumping plants by U. S. Railroad Administration.

EXHAUST STEAM. Maintenance of a Proper Heat Balance, R. N. Ehrhart. Power, vol. 48, no. 20, Nov. 12, 1918, pp. 692-694, 4 figs. Describing hand and automatic control of exhaust steam from auxiliaries so that quantity of exhaust steam available for feed heating may at all times bo proportioned to. load on main units, thus preventing waste of exhaust at light loads.

HIGH PRESSURE STEAM. The Use of High-Pressure and High-Temperature Steam in Large Power Stations, J. H. Shaw. Inst. E. E., Nov. 1918, pp. 1-10 5 figs. From the point of view of the engineer interested in the generation of electricity. Also in Machy. Market, no. 942, Nov. 22, 1918, pp. 19-20.

INDIVIDUAL PLANTS. New General Electric Steam Turbine Shop, F. L. Prentiss. Iron Ag , vol. 102, no. 20, Nov. 14, 1918, pp. 1195-1199, 6 figs. Construction and other features in large plant designed for heavy machine work; production methods followed.

Plant Arrangement and Cost of Construction. Elec. World, vol. 72, no. 19, Nov. 9, 1918, pp. 888-890, 3 figs. Features of latest station of Turners Falls Power & Electric Co., may become one of most important steam plants in New England. (Second article.)

POWER INDUSTRY. Conditions in the Power Industry, Ludwig W. Schmidt. Power vol. 48, no. 23, Dec. 3, 1918, pp. 798-800. Digest of reports of U. S. consuls on power situation in various parts of world and influence of war upon this industry.

The Power Plant Problem in South China, Harold B. Wilson. Power, vol. 48, no. 21, Nov. 19, 1918, pp. 747-748. Only pioneer work has been done and there is opportunity for America in this field.

SCALE. Heat Loss Due to Scale. Can. Mfr., vol. 38, no. 8, Aug. 1918, p. 31, 1 fig Chart showing approximate annual loss with coal at different prices.

SCREENS, WATER. Screening Condensing Water Efficiently and Economically, Henry J. Edsall. Steam, vol. 22, no. 5, Nov. 1918, pp. 133-137, 7 figs. Describds traveling screens with automatic cleaning features.

STACK LOSSES. Steam Plant Efficiency, Henry Kreisinger. Coal Trade Jl., year 50, no. 47, Nov. 20, 1918, pp. 1392-1393. Causes of high ash loss; methods of determining stack losses; causes of large excess of air and remedy. (To be concluded.)

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WATER SOFTENING. Home-Made Water Softening Plant, H. D. Odell. Power, vol. 48, no. 21, Nov. 19, 1918, pp. 728-731, 3 figs Description of home-made water-softening plant and experiences with it.

WIRE MAKING PLANTS. Power Generation for Wire Making. Power Plant Eng., vol. 22, no. 22, Nov. 15, 1918, pp. 907-914, 15 figs. Description of plant of John A. Roebling Sons Co., Trenton, N. J.

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GEARS. Saving Coal at the Gear and Wheel Tread, C. W. Squier. Elec. Ry. Jl., vol. 52, no. 20, Nov. 16, 1918, pp. 876-878, 7 figs. Discussion of losses in gearing; showing how correct gear ratio with low armature speed will save power; comparing gearless and geared motors and two and four motor equipments.

PRODUCER GAS

Machine Shop for Gas Producer Work. Iron Age, vol. 102, no. 23, Dec. 5, 1918, pp. 1373-1378, 14 figs. Features of new plant of Smith Gas Engineering Co., Dayton, Ohio. Producer operation for poewr purposes.

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AMMONIA COMPRESSION. Improving a Refrigerating Plant, E. W. Miller. Refrigerating World, vol. 53, no. 9, Sept. 1918, pp. 25-26, 1 fig. Account to work done in installation consisting of a 50-ton horizontal double-acting compressor, a 150-up. combination fire- and water-tube boiler, pumps and a 50-kw. generating unit.

The Ammonia Compression Refrigerating System (XXII), W. S. Doan. Refrigerating World, vol. 53, no. 9 and 10, Sept. and Oct. 1918, pp. 31-32, 3 figs. Troubles likely to develop in piston-rod stuffing box and manner of overcoming them.

AMMONIA LEAKAGE. Finding "Lost" Ammonia in Refrigerating Plants, E. W. Miller. Power, vol. 48, no. 21, Nov. 19, 1918, pp. 734-735. Common causes for leakage of ammonia.

ICE PLANTS. Ice Plant Troubles, E. W. Miller. Southern Engr., vol. 30, no. 4, Dec. 1918, pp. 48-50. Outline of conditions in actual case and suggestions on economical operation.

OPERATION. Making a Neglected Refrigerating Plant Give Capacity, E. W. Miller. Power, vol. 48, no. 23, Dec. 3, 1918, pp. 810-811, 1 fig. What was done to make comparatively new plant give rated capacity.

SMALL MACHINE. Small Refrigerating Machines, John E. Starr. Refrigerating World, vol. 53, no. 9, Sept. 1918, pp. 11-12. Difficulties presented by small machines in addition to the difficulties existing in all machines.

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The National Engineering Societies and the National Research Council, Geo. Ellery Hale, Proc. Am. Inst. Elec. Engrs., vol. 37, no. 10, Oct. 1918, pp. 1223-1236. War duties; present organization of research information service; international cooperation in research.

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METRIC SYSTEM. The Metric System, Harry Allcock. Surveyor, vol. 54, no. 1399, Nov. 8, 1918, p. 227. Criticism of arguments presented by Committee on Commercial and Industrial Policy After the War in their report against early introduction of metric system.

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SCREW THREADS. Inaugural Presidential Address to the Manchester Association of Engineers. Steamship, vol. 20, no. 353, Nov. 1918, pp. 112-115. Consideration of various aspects of problem of standardizing screw threads and other industrial products.

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BOILERS. Safe Working Pressure for Steam Boilers, H. F. Gauss. Power, vol. 48, no. 22, Nov. 26, 1918, pp. 772-774. Simple treatment dealing with efficiency of riveted-joints, bursting and safe working pressures for boilers, and permissible pressure on stayed surfaces.

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Turbine Gives Additional Line Shaft Power. Blast Furnace, vol. 6, no. 10, Oct. 1918, pp. 430-432, 1 fig. Possiblities for expansion by use of exhaust steam in low-pressure turbines; efficiency of reduction gears.

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TURBINES. Avoiding Distortion in Turbine Operation, Webster Tallmadge. Power, vol. 48, no. 22, Nov. 26, 1918, pp. 762-765, 8 figs. Explaining some of careless treatments afforded steam turbines through ignorance and thoughtlessness and how to avoid them.

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The Steam Turbine (IX). Southern Engr., vol. 30, no. 4, Dec. 1918, pp. 52-53, 3 figs. Installation, operation and maintenance of Terry steam turbine. (To be continued.)

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ELECTRIC WELDING. A New Type of Portable Arc Welder. Eng. & Cement World, vol. 13, no. 10, Nov. 15, 1918, p. 64, 2 figs. Arrangement consisting of Lincoln 150-ampere arc-welding generator direct-connected to Wington G. L. 5 gasoline engine and intended for mounting on automobile truck.

Boiler and Other Repairs by Electric Welding. Can. Machy., vol. 20, no. 21, Nov. 21, 1918, pp. 596-599, 4 figs. Development of art and conditions necessary to insure satisfactery results. Paper before Inst. of Marine Engrs.

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Electric Welding Nomenclature and Symbols. Ry. Rev., vol. 63, no. 20, Nov. 16, 1918, pp. 702-707, 34 figs. Scheme developed for Emergency Fleet Corporation to indicate types of welds in ship construction.

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BOILER. How to Design and Lay Out a Boiler (1), Wm. C. Strott. Boiler Maker, vol. 18, no. 11, Nov. 1918, pp. 311-313, 4 figs. Formula for safe working pressure; maximum ultimate tensile strength for steel; factors of safety. (To be continued.)

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Electric Rolling Mill Plant. Engineer, vol. 126, no. 3276, Oct. 11, 1918, pp. 312-314, 17 figs. Principles of speed control.

The Predetermination of Power Demands of Rolling Mills (Om bestämning och förutheräkning av energiatgangen vid valsverk), Frithiof Holmgren. Bihand till Jern-Kontorets Annaler, year 19, no. 10, Oct. 15, 1918, pp. 489-515, 6 figs.

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The Manufacture of Diamond Transmission Chain, J. V. Hunter. Am. Mach., vol. 49, nos. 19 and 23, Nov. 7 and Dec. 5, 1918, pp. 845-848, 9 figs., and 1027-1031, 16 figs. Making rollers; Dec. 5: Making block chain.

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COPPER

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Mill Practice at Flotation Plant of Utah Leasing Co., H. H. Adams. Salt Lake Min. Rev., vol. 20, no. 15, Nov. 15, 1918, pp. 21-25, 4 figs. Work of reclaiming metal contents from old tailing dumps.

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Gases in Metals. Times Eng. Supp., no. 529, Nov. 1918, p. 243. Influence on mechanical properties; opinions of scientists, industrial research workers and manufacturers. Conference of Faraday Soc.

WASTE RECUPERATION

Recuperation and Utilization of Waste or Copper, Zinc, Lead, Tin, Aluminum and Their Alloys (La récupération et l'utilisation des déchets de cuivre, zinc, plomb, étain, aluminium et de leurs alliages), Paul Raous. Génie Civil, vol. 73, no. 13, Sept. 28, 1918, pp. 251-255, 5 figs. Electrolytic processes for recuperation of tin; recuperation of aluminum; electrolytic separation of metals entering in an alloy. (Concluded.)

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ELECTRIC FURNACE. Two-Ton Electric Furnace Makes Alloys. Can. Machy., vol. 20, no. 20, Nov. 14, 1918, pp. 563-565, 10 figs. Equipment of plant using Héroult furnaces for non-ferrous alloys.

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SERPENTINE. The Origin of Serpentine, an Historical and Comparative Study, W. N. Benson. Am. Jl., of Sci., vol. 46, Dec. 1918, pp. 693-731, 4 figs. Concludes from examination of geological data that ultrabasic masses in chrysolite or antigorite-serpentine are alteration product or originally intrusive peridotite often more or less pyroxenic, and that in some cases the hydration was brought about by agency of waters emanating from same magna that produced periodite, the change having been completed by end of one orogenic period of vulcanity.

COAL AND COKE

ANTHRACITE. Anthracite Production and Resources of the United States, Eli T. Connor. Can. Min. Inst., bul. no. 80, Dec. 1918, pp. 1001-1005. Map. Excerpts from address at 20th annual meeting of the Institute. Progress of the anthracite industry since 1895.

BREAKERS AND WASHERIES. Hazards and Safeguards in Anthracite Breakers and Washeries, D. K. Glover. Safety Eng., vol. 36, no. 4, Oct. 1918, pp. 234-236. Recommends clearance of 7 ft. from center of track on each side. From Proc. Seventh Annual Safety Congress.

COKE OVENS. Economic Considerations in Coke-Oven Practice, W. Colquhoun. Ir. & Cl. Trds. Rev., vol. 97, no. 2646, Nov. 15, 1918, pp. 541-543. Advantages of by-product coke-ovens. Abstract of paper and discussion read before Midland Inst. of Min., Civ. & Mech. Engrs.

INSTANTANEOUS COMBUSTION. Instantaneous Combustion of Coal and Gas at Bedford Collieries, Leigh, F. N. Siddall. Trans. Manchester Geol. & Min. Soc., vol. 35, part 10, Aug. 1918, pp. 318-325, 3 figs., and (discussion) pp. 325-327. Account of conditions in shaft before and after occurrence of an outburst.

KENTUCKY. The Hazard Coal Field, P. M. Sherwin. Cl. Age, vol. 14, no. 23, Dec. 5, 1918, pp. 1031-1034, 11 figs. Known chiefly for its hardness and low ash content. Describes region.

SHOVELING MACHINES. Shoveling Machines for Coal Mines. Coal Industry, vol. 1, no. 10, Oct. 1918, pp. 382-384, 4 figs. Development of mines; method of operating shoveling machines; tests under different conditions.

EXPLOSIVES

Permissible Explosives for Mine Use, J. H. Squires. Coal Industry, vol 1, no. 10, Oct. 1918, pp. 375-379, 9 figs. Definition of permissible explosives and description of tests and appliances-necessary to determine classification.

IRON

ALSACE-LORRAINE. Iron Ore Supplies of Alsace-Lorraine, Sidney Paige. Iron Age, vol. 102, no. 19, Nov. 7, 1918, pp. 1149-1150. From symposium on "Certain Ore Resources of the World" prepared for meeting of Iron and Steel section. Am. Inst. of Min. Engrs., Milwaukee, October 1918.

BRIQUETTING. Present Knowledge and Practice in Briquetting Iron Ores (V), Guy Barrett and T. B. Rogerson. Automotive Eng., vol. 3, no. 9, Oct. 1918, p. 425. The Greenwalt, West and other general processes; general observations on briquetting, its applications, cost under various processes, disadvantages and possiblities. (Concluded.)

LEAD

FLOTATION. The Development of Galena Flotation at the Central Mine, Broken Hill, R. J. Harvey. Instn. Min. & Met., bul. 170, Nov. 14, 1918, pp. 1-17, 7 figs. Experimental work and results.

MAJOR INDUSTRIAL MATERIALS

MANGANESE. Manganese Deposits in the Colorado River Region. Salt Lake Min. Rev., vol. 20, no. 15, Nov. 15, 1918, p. 30. Replacement deposits; methods and cost of mining. (Concluded.)

SULPHUR. Sulphur Deposits of the Trans Pecos Region in Texas, Kirby Thomas. Eng. & Min. Jl., vol. 106, no. 23, Dec. 7, 1918, pp. 979-981, 3 figs. Origin, character of deposits, methods of mining, etc.

MINES AND MINING

BOUNCES. An Unsual Bounce Condition, A. C. Watts. Cl. Age. vol. 14, no. 23, Dec. 5, 1918, pp. 1028-1030, 4 figs. Bounces occurred with annoying frequences. A fault was driven through and analysis made of existing conditions.

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FIELD TESTS. Field Tests for the Common Metals in Minerals. Univ. Ariz., bul. no. 93, Min. Tech. Series, no. 21, pp. 1-20. Compiled to be used as a text for lectures on "Prospector's Mineralogy."

GAS DETECTOR. Improved Mine-Gas Detector. Min. & Eng. Rec., vol. 23, nos. 17 & 18, Sept. 30, 1918, pp. 180-181, 1 fig. Apparatus, developed by Bureau of Mines, for determining presence of inflammable gases and proportion of gas present.

MINE TIMBERS. Preservative Treatment of Mine Timbers as a Conservation Measure Kurt C. Barth. Cl. Age, vol. 14, no. 23, Dec. 5, 1918, pp. 1025-1027. Three methods of application available.

MINERALS CONTROL ACT. Will the Government Fulfill Its Obligations to Those Who Undertook Mineral Developments at Its Request? Mfrs. Rec., vol. 74, no. 23, Dec. 5, 1918, pp. 73-74. Discusses the Minerals Control Act and necessary protection to make the United States more self-sustained as a nation.

RESCUE APPARATUS. New Form of Oxygen Mine Rescue Apparatus, H. V. Manning. Min. & Eng. Rec., vol. 23, nos. 17 & 18, Sept. 30, 1918, pp. 179-180, 2 figs. Apparatus, developed by Bureau of Mines, for use poisonous or irrespirable atmospheres in mines after fires or explosions.

STONE DUST REMOVAL. Sprayer for Stone-Dusting in Mines. A. Rushton. Tran. Manchester Geol. & Min. Soc., vol. 35, part 10, Aug. 1918, pp. 327-329. Features of ejector which blows stone dust into atmosphere of mine by-means of compressed air. Stone dust is carried from atmosphere of mine in the same way as coal dust.

TEMPERATURE MEASUREMENTS. Measurement of Temperature at Great Depths (Mesure de la temperature dans les sondages à toute profondeur). M. Verzat. L'Echo des Mines et de la Métallurgie, no. 2582, July 14, 1918, p. 343. Account of the measurement of temperature at a depth of 1616 meters made by the Cie. des Mines du Sud de la Mure.

TIMBERING. Safe and Efficient Mine Timbering, Robert Z. Virgin. Coal Industry, vol. 1, no. 10, Oct. 1918, pp. 369-372, 12 figs. Explains and illustrates different methods and analyzes each with regard to safety and efficiency.

TRANSFER CHUTES. Driving and Timbering Transfer Chutes, C. T. Rice. Eng. & Min. Jl., vol. 106, no. 23, Dec. 7, 1918, pp. 991-993, 3 figs. Method employed the Coeur d'Alene district.

MINOR INDUSTRIAL MATERIALS

ANTIMONY, STRONTIUM, ETC. Antimony, Graphite, Nickel, Potash, Strontium, Tin, E. S. Boalich and W. O. Castello, Cal. State Min. Bur., report no. 5, Mar. 1918, 44 pp. Properties, occurrence and uses of these substances.

TUNGSTEN. Tungsten, Molybdenum and Vanadium, E. S. Boalich and W. O. Castello. Cal. State Min. Bur., report no. 4, Mar. 1918, 34 pp. Properties, ores, occurrence and uses of these minerals.

Wolfram Ore and Tungsten. Chem. News, vol. 117, no. 3059, Oct. 25, 1918, pp. 337-338. Report of Departmental Committee on the Eng. Trades after the War. From Jl. Roy Soc. of Arts, vol. 66, no. 3436.

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WATER TROUBLES. Water Troubles in the Mid-Continent Oil Fields and Their Remedies, Dorsey Hager and G. W. McPherson. Bul. Am. Inst. Min. Engrs., no. 142, Oct. 1918, pp. 1620-1627, 2 figs. Classification of troubles and account of results obtained by shutting off water.

PRECIOUS MINERALS

KALGOORLIE. Kalgoorlie Goldfield. Aust. Min. Std., vol. 60, no. 1564, Oct. 31, 1918, pp. 705 and 707. Report of J. B. Jaquet on circumstances connected with certain earth tremors, presence of methane gas, systems of working, etc.

RARE MINERALS

WILSONIUM. Wilsonium, Henry Bonaparte. Min. & Eng. Rec., vol. 23, nos. 17 and 18, Sept. 30, 1918, pp. 176-177. Chemical and physical nature and occurrence of new mineral named in honor of President Wilson by its discoverer Franklin Heath.

TIN

METALLURGY. Effect of Heating and Heating and Quenching Cornish Tin Ores Before Crushing Arthur Yates. Inst. Min. of Met., bul. 170, Nov. 14, 14, 1913, pp. 1-3. Summary of investigation made in the laboratories of the Royal School of Mines.

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TIN CONSERVATION. A Symposium on the Conservation of Tin. A.I.M.E. bul. no. 144, Dec. 1918, pp. 1729-1764. Eight short papers.

Conserving Tin in Different Solder Mixtures, Milton L. Lissberger. Foundry, vol. 46, no. 316, Dec. 1918, pp. 579-580. Experiments indicate that the ideal alloy should contain . . per cent tin and 54 per cent lead; preventing tin waste. From paper before Milwaukee meeting of Inst. of Metals Division of Am. Inst. of Min. Engrs.

TRANSPORTATION

DUMP CARS. Dumps and Dump Hoppers, C. L. Miller. Coal Industry, vol. 1, no. 10, Oct. 1918, pp. 373-374, 2 figs. Suggestions for making layouts addressed to mining engineers having no other data at hand than details of mine car.

MUNICIPAL ENGINEERING

DILUTION. Sewage Disposal by Dilution. Times Eng. Supp., no. 527, Sept. 1918, p. 188. Experimental investigation of Royal Commission on Sewage Disposal into self-purifying capacity of rivers.

DIRECT OXIDATION. Sewage Treatment in Easton. Mun. Jl., vol. 45, no. 20, Nov. 16, 1918, pp. 386-388, 4 figs. Details and method of operation of plant of 1,000,000 gal. capacity of "direct oxidation" type.

SEWER PIPE. Incrustation in Vancouver Sewer Pipe, A. G. Dalzell. Can. Engr., vol. 35, no. 19, Nov. 7, 1918, pp. 403-406, 3 figs. Objectionable features which have developed in machine-made concrete pipe, 8 to 30 in. in diameter.

SLUDGE DEWATERING. Two important Sludge Problems, Arthur J. Martin. Contract Rec., vol. 32, no. 48, Nov. 27, 1918, pp. 941-942. Suggestions in regard to use of compressed air and removal of water contained in sludge.

TOWN PLANNING. The Problem of City Development, An Economic Survey, A. G. Dalzell. Jl. Eng. Inst. Can., vol. 1, no. 7, Nov. 1918, pp. 319-330, 16 figs. Comparison of rectangular and diagonal systems of city outline and study of conditions in Vancouver.

Town Planning in Halifax and Vicinity, H. L. Seymour. Jl. Eng. Inst. Can., vol. 1, no. 6, Oct. 1918, pp. 262-268, 3 figs. Schemes indicating width of streets, open spaces, building lines and character of buildings.

MUNITIONS AND MILITARY ENGINEERING

BALLISTICS. A Field Ballistic Problem, Meade Wildrick. Jl. U. S. Artillery, vol. 49, no. 3, May-Aug. 1918, pp. 159-186, 9 figs. Numerical illustration of (1) construction of range table, (2) construction of range correction curves, (3) construction of deflection correction chart, (4) correction for variation in muzzle velocity due to a variation in weight of projectile, and (5) correction for variation in temperature of powdered charge.

Effect of the Earth's Rotation Upon the Point of Fall, Fred M. Green and C. W. Green. Jl. U. S. Artillery, vol. 49, no. 3, May-Aug. 1918, pp. 192-204, 10 figs. Derives from consideration of effect of difference in velocity of gun and target due to earth's rotation, approximate expressions for corrections required in trajectory of projectile fired at long range.

Notes on Inclined Trajectories, F. M. Green and C. W. Green. Jl. U. S. Artillery, vol. 49, no. 3, May-Aug. 1918, pp. 187-191, 1 fig.

Simpson's Resection, Stanley H. Simpson. Jl. U. S. Artillery, vol. 49, no. 3, May-Aug. 1918, pp. 208-214, 3 figs. Explains method in which, angles being measured in mils, instead of plotting actual arcs, short chords of these arcs are plotted on a scale large enough to make chords practically coincident with arcs.

The Elliptic Trajectory Over the Earth, G. Greenhill. Engineering, vol. 106, no. 2754, Oct. 11, 1918. A mathematical article.

BULLETS. Explosive, Expansive and Perforating Bullets, Claude Pernelle. Sci. Am. Supp., vol. 86, no. 2238, Nov. 23, 1918, pp. 332-333, 5 figs. Types used by German and Austrian armies. Translated from La Nature.

HOWITZERS. How the 155-Mm. Howitzer is Made, J. V. Hunter. Am. Mach., vol. 49, nos. 21 and 22, Nov. 21 and 28, 1918, pp. 941-945, 17 figs., and 983-986, 14 figs. Work on howitzer jacket after it has been rough-machined and heat-treated, Nov. 28: Making the tube.

MOBILE BATTERIES. Railroad Men Man Mobile Battery for Navy. Ry. Age, vol. 65, no. 22, Nov. 29, 1918, pp. 967-969, 4 figs. Description of 14-inch naval guns on railway mounts which worked destruction behind German lines.

Ordnance Manufacture. Finding the "Choke Points" of Ordnance, John H. Van Deventer. Am. Mach., vol. 49, no. 22, Nov. 28, 1918, pp. 967-971, 6 figs. One of series of articles on work of Ordnance Dept.

Munitions Production by British Railways. Ry. Rev., vol. 63, no. 19, Nov. 9, 1918, pp. 671-672. Account of reorganization of railway shops in Great Britain to become one of England's chief sources of supply for munitions of war. Adapted from Board of Trade Journal, London.

The Manufacture of Guns (La fabrication des canons), Ch. Dantin. Génie Civil, vol. 73, no. 1875, July 20, 1918, pp. 41-47, 21 figs. Considerations governing choice of metal and description of manufacturing process.

What Ordnance Is and Does, John H. Van Deventer. Am. Mach., vol. 49, no. 20, Nov. 14, 1918, pp. 876-881, 7 figs. Organization of Ordnance Department and what it does. First article.

Ordnance Plant. A War-Time American Ordnance Plant. Iron Age, vol. 102, no. 22, Nov. 28, 1918, pp. 1326-1328, 5 figs. Description of new plant of Tacony Ordnance Corporation.

Shells. The Manufacture of Semi-Steel Sheels. Iron Age, vol. 102, no. 22, Nov. 28, 1918, pp. 1317-1321, 32 figs. Practice as recommended by Ordnance Department; chemical metallurgical, molding and machining details.

Spotting Board. Spotting Board, G. R. Meyer. Jl. U. S. Artillery, vol. 49, no. 3, May-Aug. 1918, pp. 205-207, 1 fig. Constructed to furnish battery commander with information as to longtitudinal deviation of his shots.

RAILROAD ENGINEERING

BRITISH

British Railways. British Railways Under War Conditions. Engineer, vol. 126, no. 3280, Nov. 8, 1918, pp. 390-391. What they cost the country. Eighth article.

ELECTRIC RAILROADS

(Not including Street and Interurban Lines)

Argentine Railways. Electric Traction on the Central Argentine Railway. Ry. Gaz., vol. 29, no. 18, Nov. 1, 1918, pp. 466-469, 4 figs. Cables; substations. (Continuation of serial.) Also in Engineer, vol. 126, no. 3279, Nov. 1, 1918, pp. 367-370, 12 figs.

Energy Consumption. Energy Consumption of Cars Is Affected by Temperature Changes, M. B. Rosevear. Elec. Ry. Jl., vol. 52, no. 22, Nov. 30, 1918, pp. 958-960, 2 figs. That power required for car operation is affected by variations in schedule speed, number of passengers carried and temperature ir shown by extended study-made by Public Service Railway, Newark, N.J.

Substations. Automatic Substations and Direct-Current Railway Systems (Les sous-stations automatiques et les réseaux de traction à courant continu). Revue Générale de l'Electricité, vol. 4, no. 11, Sept. 14, 1918, pp. 386-392, 7 figs. Details of operation; scheme of connections for 600-volt systems; tables of results obtained in actual installations.

ELECTRIFICATION

Montreal Tunnel. Montreal Tunnel Zone Electrification, William G. Gordon. Elec. Ry. Jl., vol. 52, no. 22, Nov. 30, 1918, pp. 962-965, 5 figs. Summary of details of rolling stock, overhead and substation equipment; design and construction problems. Abstract of paper before Am. Inst. of Elec. Engrs. Toronto, Nov. 1918.

EQUIPMENT

Ditcher. Electrically Operated Ditcher Effects Big Saving, Charles W. Ford. Elec. Ry. Jl., vol. 52, no. 22, Nov. 30, 1918, pp. 960-961, 5 figs. This is first electric-machine built for ditching purposes; operates at 1200 or 1500 volts with 30-hp. motor.

LABOR

British Railways. British Railways Under War Conditions. Engineer, vol. 126, no. 3279, Nov. 1, 1918, pp. 371-372. Railwaymen's war bonus. Seventh article.

MAINTENANCE

Maintenance of Way Records and Reports. Ry. Rev., vol. 63, no. 19, Nov. 9, 1918, pp. 667-668. Methods being worked out by Railroad Administration for establishing accurate records; will standardize reports.

Pacific Electric's New Car Storage and Repair Facilities, Clifford A. Elliott. Elec. Ry. Jl., vol. 52, no. 21, Nov. 23, 1918, pp. 914-917, 11 figs Description of three divisional storage track layouts with car houses and repair shops.

LOCOMOTIVE

Boiler for Mallet Locomotive. Large Boiler for New Mallet Locomotive. Boiler Maker, vol. 18, no. 11, Nov. 1918, pp. 303-304, 4 figs. Sections and elevations of boiler built for heavy grades, having firebox length of 181 1-16 in. and desined for 215-lb. working pressure.

Feed Water Heating. Locomotive Feed Water Heating, H. S. Vincent. Ry Mech. Engr., vol. 92, no. 12, Dec. 1918, serial 1st part, pp. 645-649, 8 figs. Discussion of exhaust steam and waste gas methods of preheating.

French Compound. Recent Locomotives for the French State Railways, F. C. Coleman. Ry. Age, vol. 65, no. 20, Nov. 15, 1918, pp. 861-863, 4 figs. Principal data and decriptions of four-cylinder compound pacific type and simple consolidation type built in Great Britain.

Rock Island Heavy. 2-10-2 Type Locomotive for the Rock Island Lines. Ry. Age, vol. 65, no. 23, Dec. 6, 1918, pp. 992-994, 6 figs. Novel and interesting features.

Santa Fe Heavy. A. T. & S. F. 4-8-2 Type of Locomotives. Ry. Mech. Engr. vol. 92, no. 12, Dec. 1918, pp. 649-652, 3 figs. Heaviest of type yet built. Principal dimensions and data.

Santa Fe Passenger. Mountain Type Locomotive for the Santa Fe. Ry. Rev., vol. 63, no. 20, Nov. 16, 1918, pp. 697-698, 3 figs. Description and principal data of heavy fast passenger locomotive. Also in Ry. Age, vol. 65, no. 22, Nov. 29, 1918, pp. 957-959, 1 fig.

Standard. Data for Standard Locomotives. Ry. Mech. Eng. vol. 92, no. 11, Nov. 1918, pp. 607-610, 12 figs. Tonnage rating charts and clearance and weight diagrams for government locomotives now built.

Standard Switcher. Standard Six-Wheel Switcher. Ry. Mech. Eng., vol. 92. no. 11, Nov. 1918, pp. 593-596, 5 figs. Principal data and description with drawings.

Superheating. Superheater Locomotive Performance. Ry. Mech. Engr., vol. 92, no. 12, Dec. 1918, pp. 652-655, 1 fig. Abstract of committee report presented at the 1918 Convention of the Traveling Engrs. Assn., with discussion.

Virginian Heavy Grade Pusher. Virginian 2-10-10-2 Locomotives. Ry. Mech Eng., vol. 92, no. 11, Nov. 1918, pp. 600-604, 6 figs. Principal data and description with drawings. Built for heavy grade pusher service.

NEW CONSTRUCTION

American-Built Railroad Cutoff will Relieve Traffic Congestion in France, Robert K. Tomlin, Jr. Eng. News-Rec., vol. 81, no. 19, Nov. 7. 1918, pp. 832-835, 14 figs. A 5¼ mile double-track line for Expeditionary forces; big embankment chief feature; bridge half a mile long.

OPERATION AND MANAGEMENT

British Operation. Presidential Address to the Institution of Civil Engineers, John A. F. Aspinall. Ry. Gaz., vol. 29, no. 19, Nov. 8, 1918, pp. 487-494. British railway engineering and operation; immediate problems to be faced.

Fuel Conservation. Conservation of Fuel on the Railroads. Ry. Age, vol. 65, no. 21, Nov. 22, 1918, pp. 913-916. Abstracts of papers presented by railway men before New York Ry. Club.

Work of the Fuel Conservation Section, E. C. Schmidt. Ry. Rev., vol. 63, no. 22, Nov. 30, 1918, pp. 769-772. Organization and work of this department of Railroad Administration.

Supervision of Locomotives, British. District Supervision of Locomotives on British Railways, W. Patterson. Ry. Gaz., vol. 29, no. 18, Nov. 1, 1918, pp. 469-471. Review of work in a typical district with a staff of about 500 persons and sheds to which are allotted 150 engines.

Traffic Control. Controlling the Freight Traffic, North-Eastern Railway. Engineer, vol. 126, no. 3276, Oct. 11, 1918, pp. 305-306, 3 figs. Description of traffic control of North-Eastern Railway, and control board.

PERMANENT WAY AND BUILDINGS

Floor Slabs and Culverts. Railway Practice in Design of Concrete Floor Slabs and Flat Top Culverts. Eng. & Contracting, vol. 50, no. 21, Nov. 20, 1918, pp. 511-512. Results of questionnaire by George H. Tinker. From Oct. Bulletin of Am. Ry. Eng. Assn.

Relocation of Lines. New York Central Relocates Lines to Cross Barge Canal at the Tonawandas. Eng. News-Rec., vol. 81, no. 20, Nov. 14, 1918, pp. 893-896, 2 figs. Detour two miles long around hearts of cities at once combines bridges over waterways and solves difficult problem of eliminating grade crossings and occupation of main business streets.

RAILS

Tranverse Fissures. Tranverse Fissures and Phosphorus Streaks in Rails, G. F. Comstock. Ry. Age, vol. 65, no. 22, Nov. 29, 1918, pp. 961-963, 2 figs. New evidence of influence of segregation and of advantage of reheating blooms. Abstract of paper before Am. Inst. of Min. Engrs.

Transverse Fissures Cause Rail Failures. Ry. Age. vol. 65, no. 23, Dec. 6, 1918, pp. 1007-1009. Abstract of James E. Howard's report of the rail failure at Central Islip, N. Y.

ROLLING STOCK

Cleaning. Passenger Car Cleaning on the Canadian Pacific Railway, E. Eley. Can. Ry. Club, vol. 17, no. 6, Sept. 1918, pp. 19-22, and (discussion) pp. 23-31. Nature and amount of work required by different classes of cars.

Coal Cars. Design of Seventy-Ton Coal Car with Tandem Hoppers. Ry. Mech. Eng., vol. 92, no. 11, Nov. 1918, pp. 611-613, 5 figs. Principal data with description and drawings.

Flat Cars. Shipping Large Marine Boilers. Boiler Maker, vol. 18, no. 11, Nov. 1918, p. 307, 1 fig. Describes special flat car for shipping Scotch boilers. From Marine Jl.

Lighting. Standards of Passenger Car Lighting. Ry. Rev., vol. 63, no. 19, Nov. 9, 1918, pp. 672-673. Specifications prepared by mechanical department of United States Railroad Administration for electric lighting of passengers equipment cars hereafter to be purchased by administration for use of roads under its control.

Refrigerator Cars. Standard U. S. R. A. Refrigerator. Ry. Mech. Engr., vol. 92, no. 12, Dec. 1918, pp. 663-668, 7 figs. Latest practices in design. Also in Ry. Age, vol. 65, no. 21, Nov. 22, 1918, pp. 906-910, 4 figs.

SAFETY AND SIGNALLING SYSTEMS

COUPLING AND UNCOUPLING. Prevention of Accidents Due to Coupling and Uncoupling Cars. E. M. Switzer. Safety Eng., vol. 36, no. 4, Oct 191. pp. 262-264. From Proc. Seventh Annual Safety Congress.

INTERLOCKING. Single Line Interlocking on the New South Wales Railways. Ry. Gaz., vol. 29, no. 19, Nov. 8, 1918, pp. 495-597, 4 figs. Outline of system of interlocking and signalling line stations.

PLANT RAILROAD HAZARDS. Plant Railroad Hazards, C. H. Baltzell. Safety Eng., vol. 36, no. 4, Oct. 1918, pp. 252-256, 2 figs. Possibilities of personal injuries in plants situated on main line tracks and manner of avoiding them. From Proc. Seventh Annual Safety Congress.

SIGNALLING. Proceedings, Annual Meeting, New York, N. Y., Sept. 19-20, 1918, Ry. Signal Assn., Jl. 23d year. No. 4, Dec. 1918, pp. 313-420, 4 figs. Addresses, committee reports, etc.

SHOPS

BOILER TUBE FITTING. Modern Locomotive Boiler Tube Practice at Doncaster Works, Great Northern Railway. Ry. Gaz., vol. 29, no. 19, Nov. 8, 1918, pp. 499-500, 4 figs. Methods employed for fitting and expanding boiler tubes and superheater flues.

CAR REPAIRS. Car Department of the Milwaukee. Ry. Mech. Eng., vol. 92, no. 11, Nov. 1918, pp. 615-620, 9 figs. Organization and methods of handling light and heavy car repairs with samples of forms used.

GRINDING. Grinding in Locomotive Shops, M. H. Williams. Ry. Mech. Eng., vol. 92, no. 11, Nov. 1918, pp. 629-632, 4 figs. Uses to which internal, cylindrical and surface grinding machines may be put with success.

LOCOMOTIVE REPAIRS. Accuracy in Locomotive Repairs, M. H. Williams. Ry Mech. Engr., vol. 92, no. 12, Dec. 1918, pp. 673-677, 8 figs. Methods of making and fitting-men and repair parts for locomotives with gages and micrometers.

REPAIR SHOPS. American Railroad Repair Shops in France, Robert K Tomlin, Jr. Am. Mach., vol. 49, no. 21, Nov. 21, pp. 933-938, 7 figs. How these shops were built by American engineers in France

SPECIAL LINES

LOGGING ROADS. Soldiers Build Logging Roads in Spruce Forests, W. A. Welch Ry. Age, vol. 65, no. 19, Nov. 8, 1918, pp. 805-807, 6 figs. Description of construction of over 350 miles of new railway in Northwest for carrying airplane lumber to mills.

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‡J. G. SULLIVAN, Winnipeg
*ARTHUR SURVEYER, Montreal
‡L. A. THORNTON, Regina
†JAMES WHITE, Ottawa

* For 1918 † For 1918-19 ‡ For 1918-19-20

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c/o Canadian Westinghouse Co., Hamilton
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KINGSTON
Activities discontinued until the close of the war.

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K. B. THORNTON
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Secretary, J. B. CHALLIES
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Executive, S. J. FORTIN
J. H. McLAREN
E. B. JOST
C. N. MONSARRAT
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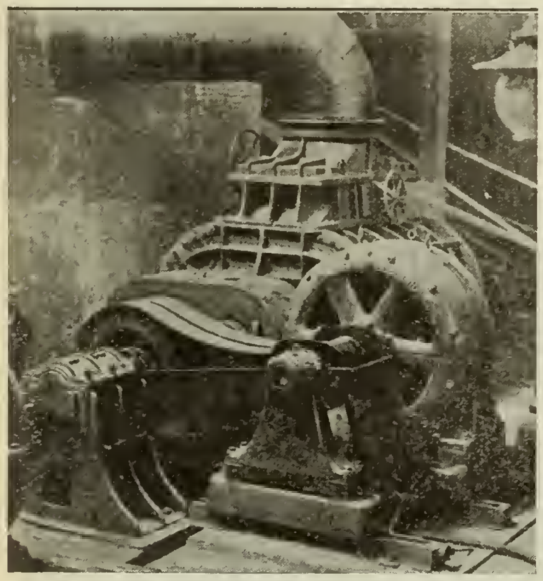

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THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

"TO FACILITATE THE ACQUIREMENT AND INTERCHANGE OF PROFESSIONAL KNOWLEDGE AMONG ITS MEMBERS, TO PROMOTE THEIR PROFESSIONAL INTERESTS, TO ENCOURAGE ORIGINAL RESEARCH, TO DEVELOP AND MAINTAIN HIGH STANDARDS IN THE ENGINEERING PROFESSION AND TO ENHANCE THE USEFULNESS OF THE PROFESSION TO THE PUBLIC."

ANNUAL GENERAL MEETING AND PROFESSIONAL MEETING

OTTAWA, FEBRUARY 11th, 12th, 13th.

FEBRUARY 1919

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February, 1919

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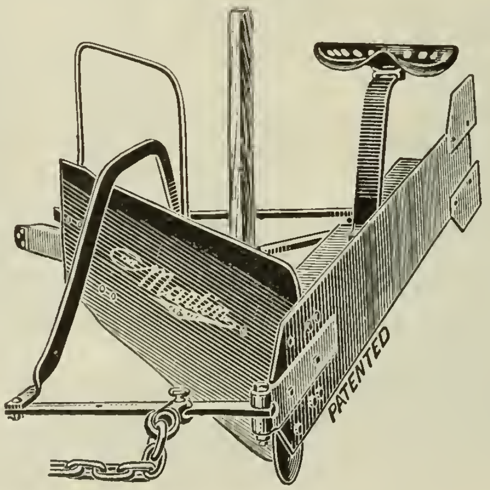

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

A MONTHLY JOURNAL

PUBLISHED BY

THE ENGINEERING INSTITUTE OF CANADA

INCORPORATED IN 1887 AS

THE CANADIAN SOCIETY OF CIVIL ENGINEERS

VOLUME II | FEBRUARY 1919 | NUMBER 2

REPORT OF COUNCIL FOR THE YEAR 1918

In presenting its report for the year Nineteen Hundred and Eighteen, the Council of *The Engineering Institute of Canada* does so with a sense of satisfaction in the progress that has taken place in Institute affairs during the year just past, which, as in the history of the world, also marks an epoch in the affairs of the engineers of Canada.

It is with a spirit of thankfulness that Council is able to record the termination of the devastating world struggle and with a conscious but permissible pride to pay a tribute to the gallant men of the engineering profession of Canada who have taken such a notable part in the war and who have been a factor in contributing to its success. A large number of our overseas members, unfortunately, will not return but their memories will always be cherished A few are with us again and it is hoped that all shall have arrived in Canada before many months have passed.

During the year the new By-Laws, proposed by the Committee on Society Affairs, were finally adopted and have become the official By-Laws of *The Institute.*

The former name, The Canadian Society of Civil Engineers, has been changed by Act of Parliament to *The Engineering Institute of Canada*, and with the change has come a broader outlook and wider possibilities for the organization.

The inauguration of professional meetings and the successful convening of three during the year, one in Toronto, one in Saskatoon and one in Halifax, has given rise to a stronger bond of fellowship and has afforded an additional opportunity of enabling the members to become acquainted, so that these meetings, judging from the results of those held during the year, are bound to knit more closely together the fabric of *The Institute.* The President has been in attendance and has presided at all the professional meetings, which precedent it is hoped will be continued by succeeding Presidents.

Four new Branches have been established, all of them in a flourishing condition, at Montreal, Hamilton, Halifax and St. John. Shortly after their formation, the Halifax and St. John Branches co-operated in arranging for a professional meeting, which has greatly stimulated engineering activities in the Maritime Provinces. In the Montreal Branch, mechanical, electrical, civil and industrial sections have been created, thus increasing the interest of the members in every branch of the profession and enabling all to take an active part in the meetings.

As the result of an earnest desire to place the engineering profession on a higher plane and to give its members the recognition to which they are entitled, the question of legislation has become an active issue in the various Branches in the Dominion. A definite proposal to secure provincial legislation, originated with the western provinces and is being discussed by every Branch. Council has approved of the principle of securing legislation for raising the status of the profession and has encouraged discussion of the subject in order that the various Branches may come to an agreement whereby similar legislation would be sought in every province. While giving every encouragement, Council has felt that its great importance demands that no precipitate action be taken.

With the inauguration of *The Journal* of *The Engineering Institute* there has been established a medium of intercommunication which, from its first issue has received the hearty approval and commendation of the membership. It has been designed to include the engineering literature of Canada, which, naturally, largely originates from the membership of this *Institute;* the papers read at professional meetings or at Branches and any discussion thereon; all news of Branch activity; correspondence; monthly Report of Council; items of personal interest; an employment bureau to bring to the attention of the members positions available and an engineering index. This latter feature comprises a review of eleven hundred engineering and technical magazines every month by a group of experts on the staff of the American Society of Mechanical Engineers, through whose courtesy the index has been made available to our members for a nominal sum. This service also includes the availability of photostat copies of any of these articles through the Engineering Societies Library, whose director, Dr. Harrison W. Craver, has accorded our members the privileges of their magnificent library.

As in 1917 a Tobacco Fund was created and over five hundred members overseas, whose addresses were available, have received Christmas greetings and cigarettes.

Of no small importance to the members is the interest which the Council has taken in advancing the status of the individual. A committee of the Council interviewed the Civil Service Commission and was asked to make recommendations regarding salaries. This has been done, and if accepted, as has been promised, will be a powerful factor in raising the standard of engineers' salaries throughout the Dominion.

A review of the past year would not be complete without recording the marked spirit of loyalty to *The Institute*, which is in evidence in every part of the Dominion, by the individual members and by our splendid Branch organizations and noting the general willingness of the members of every grade to closely co-operate in all matters relating to the affairs of the Institute or designed to promote the welfare of the profession.

H. H. VAUGHAN, President.
FRASER S. KEITH, Secretary.

December 31st, 1918.

ROLL OF THE INSTITUTE.

Elections during the year resulted in the following additions to the Roll: thirty-eight Members; one hundred and two Associate Members; twenty-five Juniors; seven Students and three Associates.

The following transfers were made: twenty-four Associate Members and one Associate to the class of Member; twenty-three Juniors and four Students to the class of Associate Member and eighteen Students to the class of Junior.

There have been removed from the rolls by resignation or on account of non-payment of dues: eight Members; ten Associate Members; one Associate and two Students. A detailed list of resignations accepted is as follows:—

Members:

Burpee, Tyler Coburn.
Crockard, F. H.
Dupont, Victor H.
Harris, William Dale.
Kimball, H. S.
Maunsell, George S.
Mayer, Joseph.
Parent, Paul Etienne.

Associate Members:

Baker, Mason H.
Bankson, E.E.
Buell, W. E.
Corman, W. E.
Glassco, A. P. S.
Grant, William F.
Jacques, H. S.
Mendelssohn, Joseph.
Mulville, John C.
Walker, N. de C.

Associate:

Grant, William H.

Students:

Hooper, Ronald H.
Mathews, J. E.

The following deaths, fifty-three in number have been reported, of which number seventeen were killed in action.

Members.... Beullac, Marcel C. J.
Breen, Thomas.
Brophy, John Byrne.
Bruce, A. H. N.
Carre, Henry.
Darey, Laurence A.
Davis, William Mahlon.
Donaldson, Morley.
Earle, William Zobeski.
Edwards, Prof. William Muir.
Hill, Albert James.
MacLeod, Henry A. F.
Millidge, Edwin Gilpin.
Murray, T. Aird.
Schreiber, Sir Collingwood.
Sidenius, Harry.
Smith, Henry Badeley.
Thibaudeau, W.

Associate Members.... Bayfield, Henry Arthur.
Bodwell, Howard L.
Bromley-Smith, A.
Clarke, Leonard Oswald.
Cowan, William A.
Cronk, Francis Joseph.
Galbraith, William John.
Greenwood, Walter Kendall.
Hyde, Wm. Herbert.
Kemp, Melville A.
O'Donnell, Hugh.
Rainboth, John.
Wood, J. Russell.

Juniors.... Grenier, Hector.
Randall, Henry Edward.

Students.... Boright, George K.
Wilson, Calvin P.

Killed in action, or died while on Active Service:

Members.... Winslow, Rainsford-Hannay.

Associate Members.... Booth, Patrick D.
Henderson, Thomas D.
Kent, Victor J.
McQueen, Howard R.
Meade, Alfred de Courcy.
Richardson, Francis A.
Sailman, Robert T. H. (L.) (1917).

Juniors	Ferguson, L. L.
	Middleton, James R. (1917).
	Milot, J. Adelard (1917).
	Willson, F. J. (1917).
Students	MacLean, Donald Gordon.
	O'Rielly, Richard H.
	Peck, H. M.
	Scott, George M.
	Wilson, William James (1917).

At present the membership stands as follows:

Honorary Members	9
Members	752
Associate Members	1,548
Juniors	373
Students	488
Associates	33
Total	3,203

The membership of the Branches as at December 31st, 1918, is as follows:—

	Members	Assoc. Members	Juniors	Students	Associates	Affiliates
Quebec	18	55	17	14	—	1
Ottawa	65	124	35	29	—	2
Toronto	66	144	34	69	—	5
Manitoba	40	93	26	20	—	1
Vancouver	47	72	7	4	—	—
Kingston	Activities discontinued until the close of the war.					
Victoria	22	30	3	—	—	2
Calgary	21	37	5	—		1
Edmonton	11	31	7	8		-
Saskatchewan	9	67	3	5	1	6
Montreal, H.M. 3	136	250	71	168		11
Halifax	25	30	5	3		—
St. John	13	21	8		—	1
Hamilton	4	18	7	8	—	—

MEETINGS.

(The Montreal Branch took over the meetings at Headquarters in February.)

There have been nine meetings at which the following papers were read:—

"Quebec Bridge," by G. H. Duggan, M. E. I. C.

"Recent Advances in Canadian Metallurgy," by Dr. A. Stansfield.

"Tests of the Chain Fenders in the Locks of the Panama Canal," by Henry Goldmark, M. E. I. C.

"Datum Planes Related to the Tide," by Dr. W. Bell Dawson, M. E. I. C.

"Engineering Activities in Connection with the Navy," by Commander Skentelbery.

"Nicu Steel," by Col. R. W. Leonard, M. E. I. C.

"Kettle Rapids Bridge," by W. Chase Thomson, M. E. I. C.

"Varnish Manufacture," by Norman Holland.

"Champlain Dry Dock for Quebec Harbour," by U. Valiquet, M. E. I. C.

Address on Military matters by Lieut. Ashworth.

INSTITUTE COMMITTEES FOR 1918.

Executive Committee of Council:

Vaughan, H. H., Chairman.

Fairbairn, J. M. R.	Francis, Walter J.
Safford, H. R.	Surveyer, Arthur.
Ross, R. A.	Brown, Ernest.

Finance:

Ross, R. A., Chairman.

Duggan, G. H.	Monsarrat, C. N.
Marceau, Ernest.	Robertson, J. M.

Library and House:

Safford, H. R., Chairman.

Surveyer, Arthur.	Shearwood, F. P.
Frigon, A.	McGuigan, F. H., Jr.

By-Laws:

Safford, H. R., Chairman.

Francis, Walter J.	Brown, Ernest.

Papers (June 1918-19):

Francis, Walter J., Chairman.

Matheson, E. G.	Doucet, A. E.
Duff, W. Arch'd.	Macintyre, R. W.
Gillespie, Peter.	Elliot, L. B.
Gale, G. Gordon.	Mackie, G. D.

Publications:

Brown, Ernest, Chairman.

Robertson, J. M.	French, R. deL.
Thomson, W. Chase.	DeCew, J. A.

Engineering Standards:

Duggan, G. H.	Herdt, L. A.

Electro-Technical:

Herdt, L. A., Chairman.

Gill, L. W.	Lambe, A. B.
Barnes, H. T.	Rosebrugh, T. R.
Higman, O.	Murphy, J.
Kynoch, J.	

Board of Examiners and Education:

MacKay, H. M., Chairman.

Surveyer, A., Secretary.	French, R. deL.
Brown, Ernest.	Lea, R. S.
Robertson, J. M.	Roberts, A. R.

Board of Examiners—Quebec Act:

Surveyer, Arthur, Chairman.

Fairbairn, J. M. R.	Brown, Frederick. B.

MacKay, H. M., McGill University representative.
Surveyer, Arthur, Laval University representative.

Committee on Gzowski Medal and Students' Prizes:

Duggan, G. H., Chairman.

Ambrose, J. R. W.	St. Laurent, A.
Lewis, D. O.	Wilson, R. M.

Honor Roll:

Monsarrat, C. N.	Keith, Fraser S.

Nominating :

Saskatchewan..............MacKenzie, H. R.
Victoria..................Marriott, E. G.
Manitoba..................Chace, W. G.
Toronto...................Harkness, A. H.
Quebec....................Oliver, S. S.
Ottawa....................Dion, A. A.
Montreal..................Tye, W. F.
Lefebvre, O.
Vancouver.................Ker, Newton J.
Calgary...................Porter, Sam. G.
Edmonton..................Gibb, R. J.

Fuel Power:

Murphy, John, Chairman.

Ross, R. A.	Dick, W. J.
Francis, Walter J.	Surveyer, Arthur.
Challies, J. B.	

Steel Bridge Specifications :

Motley, P. B., Chairman.

Monsarrat, C. N.	Thomson, W. Chase.
Stuart, H. B.	Bowden, W. A.
Boden, H. P.	LeGrand, J. G.
Shearwood, F. P.	Craig, George W.
Duggan, G. H.	Cole, F. T.
Johnson, Allan E.	Lyons, M. A.
Montgomery, E. G. W.	Harkness, A. H.
Icke, H. A.	

Steam Boiler Specifications :

Arkley, L. M., Chairman.

Chace, W. G.	Robb, D. W.
Clark, F. G.	Vaughan, H. H.
Durley, R. J.	Waterous, Logan M.

Roads and Pavements: :

McLean, W. A., Chairman.

Brereton, W. P.	MacPherson, A. J.
Duchastel, J.	Mercier, P. E.
Griffith, J. E.	Near, W. P.
Henry, G.	Powell, G. G.
James, E. A.	Rust, C. H.
MaCallum, A. F.	Doane, F. W. W.

LEGISLATION COMMITTEE

Representing Council :

Surveyer, Arthur, Chairman.

Robertson, J. M.	Francis, Walter J.

Representing Branches :

Toronto...................Haultain, H. E. T.
Kerry, J. G. G.
Oliver, E. W.
Calgary...................Dawson, A. S.
Peters, F. H.
Porter, S. G.
Victoria..................MacIntyre, R. W.
Lewis, D. O.
Davis, E.
Ottawa....................Dion, A. A.
MaCallum, A. B.
McRae, J. B.
Manitoba..................Duff, W. Arch'd.
Henry, M. G.
Sauer, M. V.
Saskatchewan..............Thornton, L. A.
Makie, G. D.
Stein, J. N. de.
Quebec....................Decary, A. R.
Doucet, A. E.
Gibault, J. E.
Edmonton..................Cote, J. L.
Fraser, A. T.
Thornton, N. M.
Vancouver.................Kennedy, J. H.
Ker. Newton, J.
White, T. H.

The following is a detailed statement of elections and tranfers which have taken place during the year. These are not included in the official membership roll until acceptances have been received.

January 29th, 1918

Members:

Gore, Wm.

Associate Members:

Cooke, E. F.	Murphy, T. R. H.
Hamilton, G. M.	Newhall, V. A.
Meindl, J. A.	Todd, E. D.
Morris, D.	Wilkinson, J. B.

Transferred from the Class of Associate Member to that of Member:

Goodspeed, F. G.	Winslow, R. H.
Powell, W. H.	

Transferred from the Class of Student to that of Junior:

Flett, F. P.

March 19th, 1918

Associate Members:

Gray, A. W.	Lowden, N.
Greene, J. F.	Swain, R. J.

Transferred from the Class of Associate Member to that of Member:

Atkinson, M. B.	Jones, L. M.
Brereton, W. P.	Meyers, A. J.
Foreman, A. E.	

Transferred from the Class of Junior to that of Associate Member:

Cowley, F. P. V.

Transferred from the Class of Student to that of Junior:

Easton, L. I.	Ross-Ross, D. deC.

April 23rd, 1918

Members:

Bell, F. J.	Johnson, C.
Guy, G. L.	Rindal, H.
Haanel, B. F. C.	

Associate Members:

Campbell, W. G.
Gillies, W. C.
Meade, J. C.
Prevost, R. deM.
Smith, F. G.
Townsend, F. W.
Wotherspoon, W.

Transferred from the Class of Associate Member to that of Member:

Dick, W. J.
Miles, E. L.
Waddell, N. E.

Transferred from the Class of Sudent to that of Associate Member:

Erskine, J.

May 21st, 1918

Members:

Collins, C. D.
Crockard, F. H.
Faibairn, R. P.
Jacobson, E. A.
Smaill, W.
Stansfield, E.

Associate Members:

Adamson, E. K.
Brown, D. M.
Cummings, A.
Hanson, E. C. A.
King, J. A. S.
Marshall, J.
Pratt, G. R.
Puntin, J. H.
Rannie, J. L.
Reilly, F. B.
Smith, W. R.
Warren, W. R.

Juniors:

Allen, R. W.
Bothwell, R. S. C.
Bridges, F. J.
Cassidy, J. F.
Collins, L. E.
Kendall, R.
Wright, W. G.

Transferred from the Class of Associate Member to that of Member:

Hogarth, Geo.

Transferred from the Class of Junior to that of Associate Member:

Somers, N. L.

Transferred from the Class of Student to that of Associate Member:

McKenzie, J. E.

Transferred from the elass of Student to that of Junior:

Bishop, J. M.

June 25th, 1918

Members:

Alexander, K.
Brown, J. E.
Colvocoresses, G. M.
Hamilton, C. B.

Associate Members:

Button, S. A.
Kester, F. H.
Longley, E. H.
Markham, E. A.
Walker, C. M.

Junior:

Mooney, J. P.

Transferred from the Class of Associate Member to that of Member:

Corriveau, R. deB.
Stewart, R. B.

Transferred from the Class of Junior to that of Associate Member:

Bonn, W. E.
Brickenden, F. M.

Transferred from the Class of Student to that of Junior:

Neilson, S. A.

July 23rd, 1918

Members:

Ayars, W. S.
Charlesworth, L. C.
Halford, A.
Wright, C. H.

Associate Members:

Brunton, R.
Corbett, A. H.
Davis, W. E.
Dyer, A. F.
Hackner, J. W.
Horsfall, H.
Hayward, C.
MacKay, R.
Mackenzie, C. G.
McHugh, J.
O'Kelly, E. G.
Rogers, G. W.
Wilshaw, J. H.

Juniors:

Dickinson, J. A.
Gordon, J. M.
Scott, C. R.

Transferred from the Class of Junior to that of Associate Member:

Ross, R. W.

Transferred from the Class of Student to that of Junior:

Bertrand, H.
Browne, E. F.
Greatrex, W. K.
McCully, R. C.

August 28th, 1918

Members:

Chambers, C.
Faulkner, F. R.
MacNab, I. P.
McArthur, J. J.
Stockton, R. S.

Associate Members:

Ayer, K. R.
Ireland, W. J.
McKean, H. S.
Yarrow, N. A.

Juniors:

Ells, J. C.
Penrose, J. M.

Transferred from the Class of Associate Member to that of Member:

Porter, J. W.
Wilson, J. M.

Transferred from the Class of Junior to that of Associate Member:

Grove, H. S.

Transferred from the Class of Student to that of Junior:

Slinn, W. H.

October 22nd, 1918

Members :

Hart, P. E.
Hays, D. W.
Kipp, T. Jr.
Robb, A. G.
Ross, Sir Charles, Bart.
Waters, W. L.
Winfield, J. H.

Associate Members:

Armstrong, H. W.	Macdonald, G. C.
Bateman, E. F.	Mackenzie, W. D.
Belliveau, J. E.	McColough, R. W.
Chown, R. C. F.	Peden, F.
Davies, G. V.	Rome, R.
DeWolf, A. H.	Rowlands, J. F.
Hein, O. J.	Smith, F. R.
Jack, R. T. G.	Wakefield, J. A.
Joyce, W. E.	Wyand, D.
Lamarque, E. C. W.	

Juniors:

Calvert, D. G.	Morrison, J. H. T.
Crossing, W. B.	Nehin, F. O'B.
McKenzie, R. J.	Smith, W. W.
Mifflen, S. C.	

Transferred from the Class of Associate Member to that of Member:

Burnett, A.	Dalziel, N. P.
Freeman, J. R.	French, R. deL.

Transferred from the Class of Associate to that of Member:

Stansfield, A.

Transferred from the Class of Junior to that of Associate Member:

Bernier, J. A.	Jette, J. C. H.
Cox, O. S.	Kendall, L. E.
Dawson, S. G.	Lamont, A. W.
Fredette, J. F.	Lavigne, E. J. T.
Goldman, H. A.	Wall, A. F.
Jamieson, W. T.	Young, R. B.

Transferred from the Class of Student to that of Associate Member:

Hemmerick, G.

Transferred from the Class of Student to that of Junior:

Cimon, J. M. H.	Snider, A. M.
Lake, N. J.	Weldon, R. L.
Milne, A. H.	

November 26th, 1918

Members:

Barnes, J. W.	Roland, J. W.
Misener, J. S.	

Associate Members:

Booker, G. E.	MacNab, S. D.
Boyle, A. J.	McDougall, J. J.
Chisholm, K. G.	Montague, J. R.
Johnson, K. P.	Rochetti, J.
Kent, E. S.	Warren, H. de laG.
Leaver, C. B.	

Junior:

Bowman, C. M.

Student:

Comeau, J.

Associate:

Carmichael, T.

Transferred from the Class of Associate Member to that of Member:

Doncaster, P. E.

Transferred from the Class of Student to that of Associate Member:

Massue, Huet.

Transferred from the Class of Student to that of Junior:

King, W. W.

December 17th, 1918

Members:

Campbell, A. D.	Moodie, W. T.
Jeffrey, G. J.	Russell, H. A.
McLaren, W. F.	Stairs, J. A.

Associate Members:

Berney, K. C.	Lewis, D.
Cameron, J. G.	Markham, E.
Cosser, W. F. J.	Morse, E. H.
Galletly, J. S.	Newton, C. A.
Harris, H. W.	Palmer, R. F.
Ker, F. I.	Scholefield, F. W. B.
Kerr, A. E.	Stuart, W. J.
Levvy, A.	Tait, I. J.

Juniors:

Holland, H. D.	Smart, H.
Sissons, T. E. G.	Swan, A. W.

Students:

Brown, W. J.	Henderson, C. R. D.
Donaldson, A.	Kennedy, C. L.
Fortin, G. L.	Salamis, B. K.

Transferred from the Class of Associate Member to that of Member:

Carson, W. H.	Mackie, G. D.
Johnson, C. V.	

Transferred from the Class of Junior to that of Associate Member:

Crowell, S. W.	McEwen, A. B.
Mahon, H. W.	Scott, P.
Smith, B. O.	

Transferred from the Class of Student to that of Junior:

Harkom, J. F.	Rolland, J. O.

List of Members on Honour Roll.

The following is a statement in regard to the members of *The Institute* who have so far, as information has been received, enlisted for overseas service during the period of the war:—

Honorary members	1
Members	90
Associate Members	379
Juniors	167
Students	231
Associates	3
Making a total of	871

Of these there have been killed in action or died of wounds:—

Members	1
Associate Members	6
Juniors	4
Students	5
In all	16

Report of the Library and House Committee

Safford, H. R., Chairman.
Surveyer, Arthur. Frigon, A.
Shearwood, F. P. McGuigan, F. H. Jr.

To the Council
of the Engineering Institute
of Canada:

I beg leave to present on behalf of the Committee on Library and House, our report for the year just ended.

The following additions in the way of publications were received by the Secretary during the current year:—

By H. H. Vaughan, M. E. I. C.
Photographic Volume, Victoria Bridge (1860).
By E. D. Gray, A. M. E. I. C.
Petroleum in Canada, by Victor Ross.
By John W. LeB. Ross, M. E. I. C.
Statistical Report of Lake Commerce.
By F. W. Cowie, M. E. I. C.
Annual Reports, Harbour Commissioners of Montreal, 1916-17.
By Fraser S. Keith, A. M. E. I. C.
The Honourable Peter White.
By Charles F. Bristol, A. M. E. I. C.
Electric Furnaces in the Iron and Steel Industry, by Rodenhauser, Shoenawa and Von Baur.
By F. A. Bowman, M. E. I. C.
The Monthly Bulletin of the Maritime Telephone and Telegraph Company Limited.
By Walter J. Francis & Company.
1 vol. Annual Report, 1915, Public Service Commission, Massachusetts.
1 vol. Annual Report, 1916, Public Service Commission, Maryland.
2 vols. Annual Report, 1914, 1915, Public Service Commission, Indiana.
1 vol. Annual Report, 1915, Public Service Commission, New Hampshire.
3 vols. Annual Report, 1914, Public Service Commission, New York, 1st District.
1 vol. Annual Report, 1915, Public Service Commission, New York, 2nd District.
3 vols. Annual Report, 1915-1916, Public Utilities Commission, District of Columbia.
1 vol. Annual Report, 1916, Public Utilities Commission, Connecticut.
1 vol. Annual Report, 1916, Public Utilities Commission, Ohio.
1 vol. Annual Report, 1914-1915, Public Utilities Commission, Idaho.
1 vol. Annual Report, 1915, Public Utilities Commission, New Jersey.
1 vol. Annual Report, 1916, Public Utilities Commission, Maine.
1 vol. Annual Report, 1914, Public Utilities Commission, Illinois.
2 vols. Annual Report, 1915, Railroad Commission, Wisconsin.
1 vol. Annual Report, 1915, Railroad Commission, Iowa.
1 vol. Annual Report, 1916, Railroad Commission, Nebraska.
1 vol. Annual Report, 1915, Railroad Commission, Michigan.
1 vol. Annual Report, 1915-1916, Railroad Commission, California.
1 vol. Statistics of Railways in the United States, 1914, Interstate Commerce Commission.
1 vol. Statistics of Common Barriers, 1916, Interstate Commerce Commission.
1 vol. Central Electric Light and Power Stations and Street and Electric Railways, United States, Department of Commerce, 1912.
By Wm. Pearce, M. E. I. C.
Blueprint Giving Coal Statistics on the Colonization and Development Branch for the Canadian Pacific Railway.
By J. J. Salmond, A. E. I. C.
Bound Volume of Canadian Engineer Vol. 34.
By A. E. Doucet, M. E. I. C.
Voyages en Egypte, Volume 1 and 2, and Planches de Voyages dans la Basse et la Haute Egypte, by V. Denon.
By McGraw-Hill Book Company.
Mechanical and Electrical Cost Data, by Gilette and Dana.
By Noel Olgivie, M. E. I. C.
Publication Number One of the Geodetic Survey of Canada, Precise Levelling.
By Lawrence Burpee, Secretary International Joint Commission.

The Application of the St. Lawrence River Power Company.

Interim Order and Opinion, and Opinion, by Mr. Powell.

The works which have been purchased are:

Proceedings of the Twenty-ninth Convention, National Association of Railway Commissioners held at Washington, October, 1917.

The Engineering Index Annual, 1917.

The following additions were made in exchange of transactions:

"Chimie & Industrie," Paris, France.
"Le Génie Civil," Paris, France.
"La Houille Blanche," Lyon, France.

During the year the Committee undertook the preparation of an Engineering Index for the Library, and after consulting with the Librarian of the American Society of Civil Engineers in New York, the Librarian of the United Engineering Societies of New York, the index used by the American Railway Engineering Association, and others, decided to adopt a system quite similar in character to that used in the American Society Library, in New York.

In reaching this conclusion the Committee was guided by two primary considerations:

First, the application of a system which had been well developed after an intensive study in connection with conditions which were not dissimilar to our problem;

Second, the convenience which will result from a membership of so many engineers in both *The Engineering Institute of Canada* and the United Engineering Societies in the United States; and

Third, the moderate expense which would accompany the installation of this system in *The Engineering Isntitute of Canada.*

Arrangements were made with the Librarian of McGill University for assistance to carry out this work, which was done here, the books being all indexed in accordance with the system adopted by the Committee.

During the year an arrangement was made for publishing from month to month, the titles of current engineering papers with name of author, source, and a brief extract of the more important, which is designed to give the members of *The Institute* a survey of all important articles relating to the profession.

This arrangement, we are glad to say, was made in co-operation with the United Engineering Societies, and it is felt it will be extremely helpful to its members.

Respectfully submitted,

H. R. Safford,
Chairman.

Report of Publications Committee

Brown, Ernest, Chairman.

Robertson, J. M.	French, R. deL.
Thomson, W. Chase.	De Cew, J. A.

The past year has been one of transition in regard to publications. The publication of volumes of Transactions has been suspended temporarily by the Council, and attention focussed upon the monthly *Journal*, the first number of which appeared in May last. Some papers read at Montreal, and accepted for publication in the Transactions of the Canadian Society of Civil Engineers before the re-organization of the Society took place, still await publication in final form. It is expected that the series of papers on the Quebec Bridge will be issued as a separate volume of Transactions.

With the return of our membership from overseas' and the establishment of *The Monthly Journal* on a paying basis, the finances of *The Institute* will enable the publication of Transactions to be resumed and brought up to date. Meanwhile, *The Journal* has been the medium through which papers have been issued to the membership, and the Publications Committee has assisted the Secretary in passing upon papers submitted for publication. The normal function of the Publications Committee in future will be to select from the large number of papers published in *The Journal*, such papers and discussions thereon as are worthy of being embodied in permanent form in the Transactions of *The Engineering Institute of Canada.*

E. Brown,
Chairman.

Jan. 2nd, 1919.

Report of Board of Examiners and Education.

MacKay, H. M., Chairman.

Surveyer, Arthur, Secretary.	French, R. de L.
Brown, Ernest.	Lea, R. S.
Robertson, J. M.	Roberts, A. R.

The Board of Examiners and Education has as usual examined the educational qualifications of a large number of candidates for admission, and has transmitted its findings to Council. The number of candidates presenting themselves for the semi-annual examinations during the year was as follows:—

	Examined	Passed
Theory and Practice of Engineering	4	3
Hydraulic Engineering..........	1	1
Mechanical Engineering..........	1	1
Railway Engineering.............	1	1
Total..................	7	6

With the approval of Council, examiners will in future be authorized to set two papers in the professional subjects embraced in schedule C. One of these is to be a paper on the underlying principles, the examination in which is to be conducted under the ordinary rules. For the second paper the candidate may avail himself of handbooks or other appropriate data. It is hoped that the proposed scheme will afford a fairer test of the capacity of applicants, particularly in the case of those who have been engaged in practice for some time, and at the same time make a higher standard of attainment practicable.

The Board is also considering the question of recommending that the examination under Schedule B (Mechanics, Physics, Strength of Materials, etc.) should be set for candidates seeking Junior Membership, instead of reserving the test as a qualification for Associate Membership. While the necessity of a good grounding in these fundamentals will be universally admitted, submission to examination in them becomes, in many cases, more irksome the longer it is deferred, and it is believed that a more satisfactory standard could be maintained by making the change suggested.

Arthur Surveyer, Secretary. — H. M. Mackay, Chairman.

Report of International Electrotechnical Committee

Herdt, Dr. L. A., Chairman.

Gill, L. W.	Barnes, H. T.
Higman, O.	Kynoch, J.
Lambe, A. B.	Roseburgh, T. R.

Murphy, J.

This Committee begs to report that, due to war conditions, the work of the Commission during 1918 has of necessity been very greatly limited. Nevertheless, the central office in London has succeeded in making considerable progress with several subjects, more particularly the question of the Rating of Electrical Machinery. As previously reported, several conferences on this matter have been held in London between English, United States, and Canadian representatives, and it is expected that a report summarizing their deliberations and recommendations will be issued shortly. In the meantime the

French Committee has issued a memorandum on Aluminium Tests, in an effort to formulate standards governing its use in electrical work, and the central office has in hand among other things the questions of Graphical Symbols, Nomenclature for Automatic Telephone Apparatus, and Specifications for Instrument transformers.

The central office has expressed to the Canadian Committee its great thanks for the continued financial support received from Canada, for which your Committee is in turn much indebted to the Dominion Government.

All of which is respectfully submitted.

A. B. LAMBE, Secretary. L. A. HERDT, Chairman.

Report of Roads and Pavements Committee

McLean, W. A., Chairman.

Brereton, W. P.	MacPherson, A. J.
Duchastel, J.	Mercier, P. E.
Griffith, J. E.	Near, W. P.
Henry, G.	Powell, G. G.
James, E. A.	Rust, C. H.
Macallum, A. F.	Doane, F. W. W.

A portion of the work undertaken by the Committee on its formation consisted in the preparation of specifications for road building materials. During 1916, specification for crushed stone, sand and gravel were prepared and tentative specifications for asphaltic road oils were presented.

During the past year the attention of the Committee has been confined to specifications for bituminous materials. Draft specifications were prepared and presented to the members of the Committee for criticism or suggestion. The specifications were revised with consideration for the replies received and are presented herewith. Those for three grades of asphaltic road oils, which were previously presented to *The Institute*, have been revised and specifications for asphalt binder, penetration method, and for three grades of refined coal tar have been added.

Light asphaltic road oil can be used where a dust preventative of more lasting character than the non-asphaltic road oils is desired. It can be applied without heating, in small quantities, and the application repeated if necessary. Medium asphaltic road oil is a heavier grade. It not only acts as a dust palliative but also as a surface preservative. Owing to the heavier body it is more lasting in effect and is adopted for use where the traffic on a macadam road causes a rapid destruction of the binding material. Under favourable circumstances it may be applied cold, but better results are invariably obtained from a hot application. Heavy asphaltic road oil has been extensively used for carpet coats or bituminous mats. Where material of this grade is used it has been found best to apply it in very small quantities with a view to obtaining a penetration of the surface of the macadam and a thin, tough coating of the stone, rather than to securing a thick layer which has a tendency to roll and wave under traffic. Asphalt binder in general, is used where a bituminous surface penetrated to a depth of from two to four inches is desired. While the asphaltic oils can be used on old macadam surfaces, the binder is used where a new surface is constructed. It is applied hot, and under pressure from a tank wagon.

The refined coal tars are used for the same purposes as the asphaltic oils. Light refined coal tar is for cold surface treatment. It acts as a dust preventative and when carefully applied penetrates the surface to some depth. As with the light asphaltic road oil, it is a more or less temporary treatment and the application should be repeated annually or more frequently as occasion may demand. Heavy refined coal tar, if applied in large quantities forms a bituminous mat, which is not desirable where mixed motor and horse-drawn traffic is to be served. If sparingly applied, however, it forms a thin surface dressing which is more lasting in character than the lighter grades of tar or oil. Refined coal tar binder is in general for use in the construction of bituminous surfaces by the penetration method.

The tentative specifications for asphaltic road oils presented to *The Institute* and published in the Annual Report for 1916, have been used by a number of municipal engineers throughout the Dominion. When commencing work the Committee felt the need for such specifications and while these were presented in the nature of a progress report the extent to which they have been used strongly indicates the desire for such specifications on the part of municipal engineers. It is hoped by the Committee that the accompanying specifications will more completely fill this need and that they will be of assistance to engineers throughout the Dominion who are engaged in road and pavement construction. The specifications are presented herewith as an appendix to this report.

W. A. MCLEAN,
Chairman.

APPENDIX

Light Asphaltic Road Oil.

Light oil shall have the following characteristics:—

1. It shall have a specific gravity at 25°C. (77°F.) of not less than 0.92.
2. It shall have an open flash point of not less than 55°C. (130°F.)
3. It shall have a specific viscosity at 25°C. (77°F.) of not more than 70.
4. When fifty grams of the oil are heated in an open vessel at a temperature between 250°C. (480°F.) and 260°C. (500°F.) until the residue has a penetration (100 grams, 5 seconds, 25°C.) of 100° the said residue shall amount to not less than 50 percent nor more than 60 percent by weight of the original oil.
5. Fifty grams of the oil when maintained for five hours at a temperature of 163°C. (325°F) in an open vessel 5.5 millimetres in diameter and 3.5 millimetres deep shall lose not less than 10 percent nor more than 25 percent by weight.
6. It shall be soluble in chemically pure carbon disulphide at room temperature to the extent of not less than 99 percent by weight.
7. It shall contain not less than 6 percent by weight of material insoluble in 76° Baume paraffine petroleum naphtha at room temperature.

8. It shall show not less than 4 percent nor more than 8 percent by weight of fixed carbon on ignition.

Medium Asphaltic Road Oil.

Medium oil shall have the following characteristics:—

1. It shall have a specific gravity at 25°C. (77°F.) of not less than 0.94.

2. It shall have an open flash point of not less than 70°C. (158°F.)

3. It shall have a specific viscosity at 65°C. (150°F.) of not more than 50.

4. When fifty grams of the oil are heated in an open vessel at a temperature between 250°C. (480°F.) and 260°C. (500°F.) until the residue has a penetration (100 grams, 5 seconds, 25°C.) of 100° the said residue shall amount to not less than 60 percent nor more than 70 percent by weight of the original oil.

5. Fifty grams of the oil when heated for five hours at a temperature of 163°C. (325°F.) in an open vessel 5.5 millimetres in diameter and 3.5 millimetres deep shall not lose less than 8 percent nor more than 20 percent by weight.

6. It shall be soluble in chemically pure carbon disulphide at room temperature to the extent of not less than 99 percent by weight.

7. It shall contain not less than 10 percent nor more than 17 percent by weight of material insoluble in 76° Baume paraffine petroleum naphtha at room temperature.

8. It shall show not less than 7 percent nor more than 12 percent by weight of fixed carbon on ignition.

Heavy Asphaltic Road Oil.

Heavy oil shall have the following characteristics:—. .

1. It shall have a specific gravity at 25°C. (77°F.) of not less than 0.96.

2. It shall have an open flash point of not less than 160°C. (320°F.).

3. It shall have a specific viscosity at 100°C. (212°F.) of not more than 50.

4. When fifty grams of the oil are heated in an open vessel at a temperature between 250°C. (480°F.) and 260°C. (500°F.) until the residue has a penetration (100 grams, 5 seconds, 25°C.) of 100°, the said residue shall amount to not less than 80 percent nor more than 90 percent by weight of the original oil.

5. Fifty grams of the oil when heated for five hours at a temperature of 163°C. (325°F.) in an open vessel 5.5 millimetres in diameter and 3.5 millimetres deep shall lost not less than 2 percent nor more than 8 percent by weight.

6. It shall be soluble in chemically pure carbon disulphide at room temperature to the extent of not less than 99 percent by weight.

7. It shall contain not less than 12 percent nor more than 20 percent by weight of material insoluble in 76° Baume paraffine petroleum naphtha at room temperature.

8. It shall show not less than 8 percent nor more than 15 percent by weight of fixed carbon on ignition.

Specification for Asphalt Binder.

Penetration Method.

1. It shall be homogeneous and free from water, and shall not foam when heated to a temperature of 150°C. (302°F.).

2. It shall have a specific gravity at 25°C. (77°F.) of not less than 0.98.

3. It shall have an open flash point of not less than 190°C. (375°F.).

4. It shall have a penetration (No. 2 needle, 100 grams, 5 secs., 25°C.) of not less than 130° nor more than 180°.

5. It shall have a ductility at 25°C. (77°F.) of not less than 75 centimetres.

6. It shall be soluble at room temperature in chemically pure carbon disulphide to the extent of not less than 99.5 percent by weight in the case of oil asphalt, and native asphalts shall show a percentage of the products of the fields from which they come.

7. Of the material soluble in carbon disulphide not less than 14 percent nor more than 30 percent by weight shall be insoluble at room temperature in 76° Baume paraffine petroleum naphtha distilling between 60°C. and 88°C. (140°F. and 190°F.).

8. It shall show not less than 10 percent nor more than 18 percent by weight of fixed carbon on ignition.

9. When fifty grams of the material are heated in a cylindrical vessel 5.5 centimetres in diameter and 3.5 centimetres deep, for 5 hours at a temperature of 163°C. (325°F.) the loss in weight shall not exceed 5 percent, nor shall the penetration of the residue (No. 2 needle, 100 grams, 5 secs., 25°C.) be less than 50 percent of the original penetration.

Specification for Refined and Blended Coal Tar

Cold Application.

1. It shall be homogeneous and free from water.

2. It shall have a specific gravity at 25°C. (77°F.) of not less than 1.14 nor more than 1.18.

3. It shall have a specific viscosity for 50 cubic centimetres at 40° C. (104°F.) of not less than 20 nor more than 30.

4. On distillation the percentages by weight of distillate at the following temperatures shall be:—

To 170°C. (338°F.)	not more than	5	percent.
" 235°C. (455°F.)	" " "	18	"
" 270°C. (518°F.)	" " "	25	"
" 300°C. (572°F.)	" " "	32	"

(a) The residue from the foregoing distillation shall have a melting point of not more than 70°C. (158°F.).

(b) The distillate from the foregoing distillation shall have a specific gravity at 25°C. (77°C.) of not less than 1.01.

5. It shall be insoluble in chemically pure carbon disulphide at room temperature to the extent of not more than 15 percent weight.

Hot Application.

1. It shall be homogeneous and free from water.

2. It shall have a specific gravity at 25°C. (77°F.) of not less than 1.20 nor more than 1.27.

3. It shall show a float test at 50°C. (122°F.) of not less than 65 seconds and not more than 85 seconds.

4. On distillation the percentages by weight of distillate at the following temperatures shall be:—

To 170°C. (338°F.)	not more than	0.0 percent.
" 235°C. (435°F.)	" " "	10 "
" 270°C. (518°F.)	" " "	17 "
" 300°C. (572°F.)	" " "	22 "

(a) The residue from the foregoing distillation shall have a melting point of not more than 75°C. (167°F.).

(b) The distillate from the foregoing distillation shall have a specific gravity at 25°C. (77°F.) of not less than 1.03.

5. It shall be insoluble in chemically pure carbon disulphide at room temperature to the extent of not more than 20 percent.

Binder.

Penetration Method.

1. It shall be homogeneous and free from water.

2. It shall have a specific gravity at 25°C. (77°F.) of not less than 1.20.

3. It shall have a melting point of not less than 28°C. (83°F.) nor more than 35°C. (95°F.).

4. On distillation the percentages by weight of distillate at the following temperatures shall be:—

To 170°C. (338°F.)	not more than	0 percent.
" 235°C. (455°F.)	" " "	3 "
" 270°C. (518°F.)	" " "	11 "
" 300°C. (572°F.)	" " "	15 "

(a) The residue from the foregoing distillation shall have a melting point of not more than 75°C. (167°F.).

(b) The distillate from the foregoing distillation shall have a specific gravity of 25°C. (77°F.) of not less than 1.03.

5. It shall be insoluble in chemically pure carbon disulphide at room temperature to the extent of not more than 22 percent by weight.

Instructions for Taking and Shipping Samples

1. *Sampling.*—Since tests, on a small sample of material, reveal the properties of the material in the sample only, it is necessary that the samples be procured in such a manner that they are representative of the whole shipment. Samples containing material taken from the top or bottom only of a tank car or drum, must be avoided.

2. *Size of Samples.*—In order that sufficient material may be received at the laboratory for all the tests to be made it is necessary that all samples contain at least one imperial pint.

3. *Containers.*—Vessels containing samples should be absolutely clean. Those which have been used to hold oils or greases should not be used. Glass jars should not be used except when there is nothing else available, an they should then be tightly packed with sawdust in stout wooden boxes. Samples which have become contaminated with packing material can not be tested.

For fluid and viscous materials new oil tins with screw caps are suitable and for semi-solid and solid materials new paint tins with tightly fitting pry covers should be used. All containers should be packed in wooden boxes for shipment.

4. *Identification.*—All samples should bear proper identification tags containing the following information:

1. Date that sample was taken.
2. Name of person, corporation, or municipality sending sample.
3. Class of work for which material is to be used.
4. A copy of the specification under which the sample has been submitted.
5. Quantity of material represented by sample.
6. Number of tank or car from which the sample was taken.
7. If the shipment is being held pending the results of the tests.
8. The name of the manufacturer.

Report of Finance Committee

Supplementing the Annual Statement of the Auditors, the Finance Committee submits a table showing receipts and expenditures for the last ten years, upon which the following comments are pertinent:—

1st.—Arrears Collected: There is a large falling off in the arrears collected, due to the fact, that in the three previous years the cream has been extracted.

2nd.—Current Fees Collected: This item now shows that the current fees collected are qual to those of the pre-war period, in spite of the fact that so many members are at the front.

3rd.—Entrance Fees: These have again increased in a satisfactory way.

4th—Salaries and Wages: These have increased, due to expansion of the activities of *The Institute.*

5th.—Branch Societies: There is a large decrease in the amount paid to Branches, under the new by-laws.

6th.—*Journal* Expenses: In Item No. 7, "Miscellaneous Receipts," is included revenue from advertisements in *The Journal,* and List of Members, amounting to $6,008. To offset this in item No. 10, "Printing and Stationery," the cost of *The Journal* is included at $6,032.

7th.—General Results: General results indicate a live Institute rapidly expanding, and going through its most serious period as regards expenses, with the new *Journal* established, a new staff in control, and with 960 members at the front who pay no fees.

R. A. Ross,
Chairman of Finance Committee.

Montreal, January 27th, 1919.

STATEMENT OF ASSETS AND LIABILITIES AS AT 31st DECEMBER, 1918.

Assets.

PROPERTY ACCOUNT		$89,041.64
FURNITURE:		
Balance as at 31st Dec., 1917	$2,504.61	
Less 10% written off for depreciation	250.46	
		2,254.15
		$91,295.79
LIBRARY:		
Estimated Value of Books		6,330.00
INVESTMENTS, including Special Fund:		
Canada Permanent Mortgage Corporation Stock, 18 shares Par Value, $10.00 each	$180.00	
Civic Investment & Industrial Co. Stock, 6 shares Par Value, $100.00 each	120.50	
Canada Victory Loan Bonds of 1927, $500.00 Par Value	500.00	
		800.50
ARREARS OF FEES—Estimated		5,000.00
ACCOUNTS RECEIVABLE:		
Advance in Magazine, etc	$3,558.78	
Advances to Branches	150.00	
		3,708.78
GOLD MEDAL		45.00
PREPAID COMMISSION ON ADVERTISING		75.00
CASH ON HAND AND IN BANK	$3,714.58	
PETTY CASH ON HAND	124.25	
		3,838.83
		$111,093.90

Liabilities.

SPECIAL FUNDS:			
Prize Fund Account		$468.77	
Leonard Medal		500.00	
Plummer Medal		500.00	
Fund in Aid of Members and Families		1,570.86	
			$3,039.63
MORTGAGE ON PROPERTY:			
Royal Institution for the Advancement of Learning.			
Mortgage on Mansfield Street Property at 6½%		$20,000.00	
Interest accrued thereon to date		216.67	
			20,216.67
ACCOUNTS PAYABLE			3,176.74
SUNDRY REBATES DUE TO BRANCHES			466.77
EXAMINATION FEES PREPAID			10.00
SURPLUS ACCOUNT:			
Balance as at 31st December, 1917		$86,519.13	
Expenses for year	$30,644.19		
Revenue for year	28,559.61		
Net Loss for year	$2,084.58		
Depreciation written off Furniture	250.46		
		2,335.04	
			84,184.09
			$111,093.90

Verified, RIDDELL, STEAD, GRAHAM & HUTCHISON, C. A., Auditors.

Montreal, 21st January, 1919.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR ENDED 31st DECEMBER, 1918.

Receipts.

SUBSCRIPTIONS:		
Arrears of Fees collected	$3,243.04	
Current Fees "	15,537.83	
Advance Fees "	165.48	
Entrance Fees "	3,047.00	
		$21,993.35
REVENUE FROM ADVERTISEMENTS IN:		
List of Members, 1918	$2,226.00	
Journal, 1918	3,782.20	
		6,008.20
INTEREST:		
Savings Bank Account	$66.55	
Interest on Overdue Fees collected	249.74	
" on $5,000 Victory Loan Bonds sold	199.77	
		516.06
DIVIDENDS:		
Canada Permanent Mortgage Corporation stock	$18.00	
Civic Investment & Industrial Co. stock	24.00	
		42.00
		$28,559.61
BALANCE being excess of Expenditure over Receipts for the year ending 31st December, 1918		2,084.58
		$30,644.19

Expenditure.

INTEREST ON MORTGAGE		$1,266.67
OFFICE SUPPLIES AND STATIONERY		627.28
BOOKS, MAGAZINES AND LIBRARY EXPENSES		196.38
POSTAGE AND TELEGRAMS		1,045.38
SALARIES OF SECRETARY AND OFFICE STAFF		7,785.77
CARETAKER'S WAGES AND SERVICE		733.05
TAXES		1,202.16
WATER RATES		203.70
REPAIRS AND HOUSE SUPPLIES		138.75
HONOUR ROLL		215.38
AUDITORS' FEES		295.00
STUDENTS' PRIZES		25.00
EXPENSES—Annual Meeting		37.20
EXPENSES—Montreal Branch Meetings		142.96
EXPENSES—Halifax Professional Meeting		58.77
EXPENSES—Toronto Professional Meeting		225.98
EXPENSES—Saskatoon Professional Meeting		98.50
MEMORIAL TO PROFESSOR MCLEOD		81.50
INSURANCE		32.50
ELECTRIC LIGHT AND POWER		87.30
GAS FOR COOKING		28.66
COAL AD WOOD		592.28
TELEPHONE		95.45
BANK CHARGES AND COMMISSION		42.32
MISCELLANEOUS EXPENSES		62.14
LEGAL EXPENSES		922.30
GZOWSKI MEDAL		3.44
PRINTING AND BINDING		5,624.72
EXTRAORDINARY EXPENSE		44.00
TRAVELLING EXPENSE		853.50
"JOURNAL" EXPENSE		6,031.90
LEONARD MEDAL		32.75
ONTARIO PROVINCIAL DIVISION		17.50
ANNUAL DINNER FUND		85.66
EXAMINATION FEES, OVERPAID		1.00
REBATE OF FEES TO BRANCH SOCIETIES:		
Toronto	$353.14	
Quebec	140.60	
Winnipeg	232.75	
Ottawa	349.48	
Vancouver	176.40	
Victoria	84.97	
Edmonton	58.00	
Calgary	74.20	
Saskatchewan	99.60	
St. John	40.60	
Hamilton	29.40	
Halifax	68.20	
		1,707.34
Verified, RIDDELL, STEAD, GRAHAM & HUTCHISON, C. A., Auditors.		$30,644.19

RECEIPTS AND EXPENDITURES—THE ENGINEERING INSTITUTE OF CANADA

		1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
	RECEIPTS.										
(1)	Arrears Collected	$2,023	$4,031	2,092	$2,887	$1,994	$3,298	$6,733	$6,512	$6,215	$3,243
(2)	Current Fees	7,963	9,491	11,893	13,897	15,037	15,616	12,438	13,176	15,359	15,538
(3)	Advance Fees	376	134	288	158	186	270	139	153	220	165
(4)	Entrance Fees	2,190	2,124	2,779	4,077	4,169	2,895	2,233	2,485	3,235	3,047
(5)	TOTAL	$12,552	$15,780	$17,052	$21,019	$21,386	$22,079	$21,543	$22,326	$25,029	$21,993
(6)	Interest Received	211	252	187	1,393	894	315	450	429	556	516
(7)	Miscellaneous Receipts	188	79	174	341	225	172	87	972	113	6,050
(8)	TOTAL	$12,951	$16,111	$17,413	$22,753	$22,505	$22,566	$22,080	$23,727	$25,698	$28,559
	EXPENDITURES.										
(9)	Interest Paid		—	—	$854	$1,695	$1,201	$1,200	$1,200	$1,200	$1,267
(10)	Printing and Stationery	$4,092	$6,268	$3,757	6,865	6,416	10,551	5,970	6,691	6,807	12,480
(11)	Salaries and Wages	4,042	3,845	4,714	5,195	4,906	5,652	4,909	5,180	7,873	8,519
(12)	Taxes and Water	244	244	247	848	1,466	1,448	1,280	1,300	1,025	1,406
(13)	General Expense	2,760	2,670	4,198	4,307	5,257	4,812	4,151	3,260	4,612	5,265
(14)	Branch Societies	374	648	1,118	2,810	2,121	2,296	2,266	2,454	3,693	1,707
(15)	TOTAL	$12,322	$13,675	$14,034	$20,879	$21,861	$25,960	$19,776	$20,085	$25,210	$30,644
(16)	Excess Receipts	629	2,436	3,378	1,874	646	—	2,304	3,642	488	—
(17)	Excess Expenditures	—	—	—	—	—	3,394	—	—	—	2,085

Reports of Branches

Calgary Branch

During the year 1918 there have been held three general meetings and ten Executive Committee Meetings.

The following were the speakers at the general meeting:—

January 30th, A. Ingraham, M.A., Soc. M. E. "Flour Mill Engineering."

March 18th, Mr. Pearce, M.E.I.C. and Mr. Peters, "General Matters."

May 8th, Lewis Stockett, M.E.I.C., "Coal."

May 29th, Mr. G. F. Porter, M.E.I.C., "The Quebec Bridge."

Lecture, illustrated by lantern slides, given in the Public Library Auditorium to which the public were invited, the hall proving much too small to hold the number who wished to attend.

The most important meeting of the year to the Western Branches was the Second Professional Meeting of *The Institute* held at the Saskatchewan University at Saskatoon, August 8, 9 and 10, 1918.

This was attended by about 65 members and was a great success both from the standpoint of the success of the meetings from a professional point of view and from the quality of the entertainment provided.

During the year the new membership joining the Branch is as follows:—

Members	3
Associate Members	4
Associates of Branch	3

And applications received and recommended by Committee on Applications as follows:—

Associate Member	3
Associates of Branch	1

A total of thirteen new members.

Transfers have been made as follows:—

From Associate Member to Member	1
From Student to Associate Member	1
Old members joining or rejoining the Branch:—	
Members	2
Associate Member	1

The present membership of the Branch Totals 72, divided as follows:—

Members	20
Associate Members	34
Junior Members	5
Affiliates	1
Affiliates of the Branch	12
	72

With 3 Associate Members and 1 Associate of Branch to be voted upon to-day makes a total membership at present of 76.

This includes 17 members with the Allied Armies.

As you are all aware, good progress has been made in the matter of proposed Legislation and Committees from the Calgary and Edmonton Branches are preparing to submit an Act to the coming session of the Alberta Legislature.

Financial Statement for the Year Ending, November 30, 1917.

Receipts

Balance in Bank, December 1, 1917	$426.31
Fees from Members	21.75
Rebates from parent *Institute*	135.80
Interest on Bank Account	5.14
Interest on Victory Bond ($300)	16.50
	$605.50

Expenditure

Stationery, Printing and General Expense	$75.09
Books and Magazines	6.35
Balance payment on ($300) Victory Bond	267.33
Miscellaneous	56.10
Balance in Bank, November 30, 1918	200.63
	$605.50

Montreal Branch

To the Members of Council,
The Engineering Institute of Canada,
176 Mansfield Street,
Montreal.

Gentlemen:—

We have the honour to present herewith the first annual report of the Montreal Branch of *The Engineering Institute of Canada.*

On January 23rd, 1918, a petition was presented to Council asking for the formation of a Montreal Branch of the Canadian Society of Civil Engineers. This application was as follows:—

"To the President and Members of the Council of the Canadian Society of Civil Engineers.

We, the undersigned Corporate Members of the Canadian Society of Civil Engineers, resident within twenty-five miles of headquarters, respectfully request that the Council may grant permission to establish "The Montreal Branch of the Canadian Society of Civil Engineers."

Montreal, January 23rd, 1918."

(Signed):

R. M. Hannaford.	Alex. Bertram.
R. S. Lea.	Ls. G. Papineau.
Frederick B. Brown.	J. A. Duchastel.
J. A. Burnett.	W. Chase Thomson.
Geo. K. McDougall.	H. P. Borden.
Onisphore H. Cote.	M. Brodie Atkinson.
A. W. K. Massey.	R. deL. French.
A. J. Matheson.	H. G. Hunter.

To the Members of Council E. I. C.

At a meeting of Council held on the same day this application was presented and permission by Council was granted for the formation of the Branch, and residents of District No. 1 were authorized to proceed with arrangements for organizing into a Montreal Branch.

On February 7th, 1918, the signers of the original petition of January 23rd sent out a circular to all members resident in District No. 1, calling a meeting for the 14th of February to discuss details in connection with the formation of the Branch.

On February 14th a largely attended meeting took place at the headquarters of the Society, 176 Mansfield Street. A committee was named for the purpose of nominating candidates to fill the executive offices of the new Branch and the election by letter ballot was arranged to be declared on March 14th. The Executive of the Branch was discussed and it was decided to have it composed of a Chairman, a Vice-Chairman, a Secretary-Treasurer, these to be elected for one year, and six Committee men, the three receiving the greatest number of votes to serve for two years and the three others for one year, thereafter the Committee men to be elected for two years, three at each election.

A Nominating Committee was selected composed of R. M. Hannaford, Frederick B. Brown, L. G. Papineau, J. A. Duchastel, W. Chase Thomson, M. Brodie Atkinson and H. G. Hunter, and, according to the instructions they received by resolution of the meeting, they were to nominate at least two candidates for each executive office and to add other candidates to the list of nominees provided they had received the certified support of five Corporate Members of the Society.

The Nominating Committee proceeded to carry out their work and on March 14th the following gentlemen were elected to office:

Chairman	Walter J. Francis.
Vice Chairman	Arthur Surveyer.
Secretary-Treasurer	Frederick B. Brown.

Members of the Executive Committe.

F. P. Shearwood, W. Chase Thomson, H. G. Hunter, for two years; and L. G. Papineau, O. O. Lefebvre, K. B. Thornton, for one year.

The first meeting of the newly elected Executive took place at the rooms of the Society on March 21st, 1918, and the organization of the Branch was commenced. A Committee consisting of Messrs. Francis, Safford, Ernest Brown, Surveyer, Lefebvre and Hunter was constituted the Committee on Branch By-Laws to draw up suitable by-laws, working in co-operation with the general By-laws Committee of the Society, namely, Messrs. Francis, Safford and Ernest Brown.

A Papers and Meetings Committee was appointed consisting of R. M. Hannaford, Chairman, together with the Chairmen and Vice-Chairmen of such sections of the Branch as may hereafter be formed. Four suggested Sections of the Branch were named as follows:—

Civil	J. A. Duchastel,	Chairman.
	H. M. Lamb,	Vice-Chairman.
Mechanical	J. A. Burnett,	Chairman.
	J. T. Farmer,	Vice-Chairman.
Electrical	J. A. Shaw,	Chairman.
	A. Frigon,	Vice-Chairman.
Industrial or Manufacturing	S. F. Rutherford	Chairman.
	H. G. Hunter	Vice-Chairman.

Following this meeting the work of organization was continued and the four Sections of the Branch were duly constituted under the leadership of the members of the Papers and Meetings Committee already outlined.

The programme for the balance of the spring season of 1918 being already arranged under the auspices of the Society as a whole, it was decided to continue these as found best from to time until the close of the spring programme, and this arrangement was accordingly carried out.

On May 29th, the Executive of the Branch had the honour of holding the first meeting under the official new name of the Society, the signature of the Governor-General having just been attached to the papers authorizing the change of name to *The Engineering Institute of Canada.*

During the summer considerable progress was made in the drafting of by-laws, discussions on legislation, and suggested formation of a Provincial Division in Quebec. This work was carried on by members of the Committee, and regular meetings of the Committee were resumed early in September. The programme for the fall session was drawn up, and it was decided to hold a discussion on legislation at the first regular meeting of the Branch during the autumn season, commencing on October 10th. The epidemic of influenza, which was at that time commencing to be very severe, caused the Board of Health to issue an order prohibiting all public gatherings in Montreal. This necessitated the postponement of the discussion on legislation until November 28th.

On November 28th the Branch met and commenced the discussion on legislation, about seventy-five members being present. The discussion proved so interesting that it was decided to continue the discussion on legislation, and further meetings were held on December 12th and December 19th. At the meeting on December 19th, following a great deal of discussion, two resolutions were passed by the Branch, one asking Council to appoint a committee to consider the question of legislation throughout Canada, and the other instructing the officers of the Branch to co-operate with the officers of the Quebec Branch in obtaining information regarding legislation from members resident in the Province of Quebec. The text of the two resolutions is as follows:—

Moved by Mr. Tye, Seconded by Mr. Duggan, and carried, that

Whereas it seems advisable that legislation should be sought defining the status of engineers throughout Canada, And

Whereas the widespread activities of the Engineering profession, the great difference in the interests and occupations of the individuals, the necessity of getting satisfactory legislation in the different Provinces, the unsatisfactory result of such legislation as has already been obtained and the dangers and difficulties certain to be encountered by *The Institute* as a whole during the time period of passing of Canadian engineering from an open to a closed or a partially closed profession, make it inadvisable and inexpedient to ask for any further legislation in any Province until the whole question has been thoroughly studied, reported upon and submitted in concrete form to the full corporate membership of *The Institute.*

Be It Resolved:

That the Executive of the Montreal Branch be instructed to ask the Council to arrange for the appointment of a Committee representing all provinces and all branches of the profession to inquire into, study and report upon the whole question of legislation, including a report upon the best method of getting such legislation as will insure a satisfactory and uniform status of engineers throughout Canada, also to draw up such sample legislation as it may deem necessary and advisable in order that the members of *The Institute* in the different provinces may seek legislation on some uniform basis.

That before the final adoption of any proposed act it shall be the duty of the Committee to co-operate as far as possible with similar incorporated technical bodies with a view to harmonizing clauses which might contain points of contention.

That the Secretary of the Montreal Branch be instructed to forward a copy of this Resolution to the Secretary of *The Institute* and to the Secretaries of the Provincial Divisions and the Branches, and to request the Executive of the Provincial Divisions and the Branches to assist the Council in securing the appointment of a strong and representative committee."

Proposed by Mr. Surveyer, seconded by Mr. Brown, and carried,

That the Executive of the Montreal Branch take immediate steps to obtain, in co-operation with the Quebec Branch, and by letter ballot, the views of the members of *The Institute,* residing in the Province of Quebec, on the question of licensing engineers.

And that the following questions for this letter ballot be suggested to the Executives of the Montreal and Quebec Branches for their consideration:

Question 1.—Are you in favour of a closed corporation for engineers having responsible charge of engineering works?

Question 2.—If so, do you favour legislation embracing all engineering works, or only public works?

Question 3.—In the event of the majority of the members of *The Institute* residing in Quebec, declaring in favour of a closed corporation, what are your opinions on the following questions?

(a) Do you consider that the only method of entrance into the engineering profession should be through the engineering colleges?

(b) If not, do you think that candidates who do not follow college engineering courses should be obliged to pass an examination for admission to study somewhat along the lines of the matriculation examination required for university entrance?

(c) Do you think that candidates should be required to pass an examination for admission to practise, similar to the examinations required by the Bar and Medical Associations?

(d) Should candidates be obliged to serve a period of apprenticeship or employment under an engineer, before being allowed to take the final examinations for admission to practise? (The word practise is understood to mean taking responsible charge of engineering works).

(e) If in favour of examination, do you consider that these should be held by the corporation only or by a joint board of the members of the corporation and representatives of the McGill and Laval faculties of applied science?

(f) Do you consider that graduates of engineering schools should be exempted from any or all the examinations?

(g) If so, from what examinations should they be exempted?

(h) Do you think that graduates of engineering schools should be required to prove that they have had experience under some engineer before being admitted to take charge of engineering work?

And that the results of this letter ballot be passed on to the committee appointed under Mr. Tye's motion for their information irrespective of any action the members of *The Institute* in Quebec may wish to take."

The whole subject of legislation is apparently very much alive throughout *The Institute* and the Montreal Branch is taking a keen interest in it.

A programme for the winter and spring season of 1919 has been drawn up by the Branch in accordance with the attached printed list.

Branch Officers, 1918-1919: Walter J. Francis, Chairman; Arthur Surveyer, Vice-Chairman; Frederick B. Brown, Secretary-Treasurer.

Executive Committee: F. P. Shearwood, H. G. Hunter, O. O. Lefebvre, W. Chase Thomson, L. G. Papineau and K. B. Thornton.

Papers and Meetings Committee: R. M. Hannaford, Chairman.

S. F. Rutherford, H. G. Hunter, Industrial Section; J. A. Shaw, A. Frigon, Electrical Section; J. T. Farmer, J. A. Burnett, Mechanical Section; J. Duchastel, H. M. Lamb, Civil Section.

Programme of Meetings, January to April, 1919.

Always at 8.15 p.m. sharp.

Always on Thursday evening, with the exception of February 13th, which is the date of the Annual-Professional Meeting in Ottawa.

Jan. 9—Fire Prevention. Inspection as a Means of Fire Prevention, by George H. Greenfield. *Chairman—Mr. Francis.*

Jan. 16—Design and Construction of Reinforced Concrete Viaducts at Mileages 0.9 and 1.8, North Toronto Sub-division, Canadian Pacific Railway, by B. O. Eriksen, A.M.E.I.C., and S. H. Deubelbeiss, A.M.E.I.C. Some Problems of National Reconstruction, by. W. F. Chipman, K.C. *Chairman—Mr. Surveyer.*

Jan. 23—Coaling Plant for Locomotives, by J. A. Burnett, A.M.E.I.C. Industrial Illumination, by George K. McDougall, A.M.E.I.C. *Chairman—Mr.* Hannaford.

Jan. 30—Modern Boiler Practice, by F. A. Combe, A.M.E.I.C. Coal is King (A motion picture), by R. E. Cleaton Company. *Chairman—Mr. Rutherford.*

Feb. 6—Some Problems in Ocean Transportation, by A. W. Robinson, M.E.I.C. Manufacture of Nitro-Benzol and Aniline Oils, by G. J. Caron, J.E.I.C. *Chairman—Mr. Farmer.*

Feb. 20—Construction of Canadian Northern Railway Tunnel, Montreal, by J. L. Busfield, A.M.E.I.C. *Chairman—Mr. Duchastel.*

Feb. 27—The Effect of Ice on Hydro-Electric Plants, by R. M. Wilson, M.E.I.C. *Chairman—Mr. Francis.*

March 6—Air Drills, by N. M. Campbell, A.M.E.I.C. The Halifax Explosion from a Chemist's and Physicist's Viewpoint, by Dr. Howard Bronson, F. R. S. C. Burroughs Adding Machines (A motion picture), by Burroughs Adding Machine Company. *Chairman—Mr. Hunter.*

March 13—Electrical Welding, by C. V. Holslag. Patents and Engineering, by Hanbury A Budden, A.E.I.C. *Chairman—Mr. Shaw.*

March 20—Ball Bearing Jacks, by W. H. C. Mussen, A.E.I.C. Peat, by Ernest V. Moore, A.M.E.I.C. *Chairman—Mr. Rutherford.*

March 27—Some Notes on the Design and Construction of Reinforced Concrete Covered Reservoirs, by R. deL. French, M.E.I.C. *Chairman—Mr. Surveyer.*

April 3—The Operation of Railways as an Engineering Problem, by V. I. Smart, M.E.I.C. *Chairman—Mr. Frigon.*

April 10—Waterproof Paper Productions and their Industrial Possibilities, by J. A. DeCew, A.M.E.I.C. *Chairman—Mr. Lamb.*

April 17—Quebec Bridge, by Phelps Johnson, M.E.I.C., G. H. Duggan, M.E.I.C., George F. Porter, M.E.I.C. *Chairman—Mr. Francis.*

April 24—Continuation of Paper of April 17th. *Chairman—Mr. Francis.*

The meetings so far held have been very successful and much appreciated by those present.

The Executive Committee of the Montreal Branch feels that a great advance has been made by forming the members resident within twenty-five miles of Headquarters into a separate entity having a Branch standing. In this connection, however, it is felt that certain amendments to the By-laws of *The Institute* are desirable in order to improve certain of the operating conditions of the Montreal Branch and to place the Branch on a footing corresponding to that of the other Branches. At the present time the Montreal Branch members pay much larger fees to *The Institute* than any of the other members of *The Institute*, but the regulations make no provisions for financing the Branch. Being without the funds derived from rebates which constitute the principal revenue of the other Branches, it has been necessary to accept favours of the private members, or to appeal to Headquarters for assistance that does not appear to be provided for in the By-laws of *The Institute*. Up to the present the Council of *The Institute* has kindly undertaken to pay the principal expenses of the Branch, but the Executive Committee of the Branch feels that the Branch should be placed in a position to finance its own expenditures and to make provision for its programme and activities. The Secretary of *The Institute* has also rendered valuable and much appreciated services to the Branch, but the Executive considers that it has no right to thus impose on the Headquarters staff.

The whole question is one of some difficulty and committees are now working in order to prepare amendments to the existing By-laws of *The Institute*, which amendments it is proposed to present at the next annual meeting in order to produce the desired result.

The whole respectfully submitted on behalf of the Montreal Branch.

WALTER J. FRANCIS,
Chairman.

FREDERICK B. BROWN,
Secretary-Treasurer.

Quebec Branch

Quebec, January 12th, 1919.

To the President and Council and Members,
of the Engineering Institute of Canada.

Gentlemen:—

On behalf of the Quebec Branch of *The Engineering Institute of Canada*, we herewith submit our Annual Report for the year 1918.

At the Annual Meeting of the Branch held on the fourteenth of December last, the following officers were elected by ballot for the ensuing year: A. R. Decary, Chairman; J. A. Buteau, Secretary-Treasurer; F. T. Cole, J. E. Gibault, W. Lefebvre, members of Committee.

At this meeting the Secretary-Treasurer's report for the Branch year was read and approved.

The Branch had only five meetings which were fairly well attended. There were no lectures during the season.

During the last Provincial Session, our Legislation Committee took great pains in watching all bills presented to the Legislative Assembly for sanction, so that there would be no infringement on our rights, and have succeeded, together with the influence brought by some of our prominent members, in blocking and having amended certain bills, which formerly had clauses detrimental to the Institute by-laws and regulations.

One of the most important subjects at the meetings was the discussion on ways and means of obtaining Provincial Legislation with clear and well defined charters. Resolution to that effect was sent to the central committee and all the other Branches of *The Institute* for action.

The Branch takes this opportunity of drawing the attention of the central Council to the resolution forwarded to them on the seventh of December last, to the effect that our profession was not having proper representation on various Commissions which have been established to undertake work or problems connected with engineering, earnestly requests that the Executive Council will take immediate action and bring its influence to bear on the Government or Commissions, for the exclusive appointment of corporate members of *The Engineering Institute*, or graduates from recognized engineering universities to fill all engineering positions, thus protecting the public and raising the standing of *The Institute* and the profession.

The financial standing of the Branch is satisfactory, the report showing a balance in bank of $613.93 dollars.

The kindness of the Mayor of Quebec in providing the Branch with free quarters in the City Hall, has largely contributed to this satisfactory financial standing.

The membership of the Branch is as follows:—

Members	18
Associate Members	55
Juniors	17
Students	14
Branch Associate	1

Respectfully submitted,

A. E. DOUCET,
Chairman.

W. LEFEBVRE,
Secretary.

Hamilton Branch

In response to a request from a number of engineers in Hamilton, Fraser S. Keith, Secretary of *The Engineering Institute of Canada*, came to the city on June 14th, 1918, to discuss the question of forming a Branch. Over forty engineers attended the meeting to meet Mr. Keith, and after a discussion it was decided to start a Branch of *The Engineering Institute of Canada* in Hamilton. The necessary application was signed and sent in to Council. The meeting adjourned to an informal dinner.

On July 26th a meeting was held at which Nominating, By-Laws, and Membership Committees were appointed. According to their instructions the Nominating Committee sent out a letter ballot by which the following executive were elected: E. R. Gray, Chairman; H. B. Dwight, Secretary-Treasurer; E. H. Darling and J. A. McFarlane.

The first regular meeting of the Branch was held in the Royal Connaught Hotel on Sept. 21st, 1918, P. M. Lincoln, Past-President of the American Institute of Electrical Engineers, gave a comprehensive and enjoyable lecture on "The Development of Electric Power Transmission." This was followed by a good discussion of the subject by the engineers present.

On Sept. 30th, a meeting was held in the Royal Connaught Hotel. E. R. Gray, the Chairman of the Branch, gave an address on the duties and opportunities of engineers in connection with their professional organization. A set of by-laws for the Branch was then presented by the By-laws Committee, and was amended in some particulars and then forwarded to the Council of *The Engineering Institute of Canada*.

Further meetings for the autumn of 1918 were prevented by the influenza epidemic, although complete arrangements had been made for a joint meeting to be held in Hamilton with the Toronto Section of the American Institute of Electrical Engineers, to be addressed by

G. E. Stoltz of Pittsburgh, on "Steel Mill Electrification." Another lecture which had to be postponed, was the illustrated lecture by Geo. F. Porter on "The Quebec Bridge," which has been given with much success before several other branches.

A meeting of the Branch was held on Jan. 17th, 1919, to discuss the subject of legislation. A Legislation Committee of five members was appointed and it was decided to continue the discussion at a future meeting.

It is planned to hold several meetings this winter, one to be addressed by E. L. Cousins, chief engineer of the Toronto Harbor Commission, on "Harbor Improvements," and one to be addressed by Dr. F. B. Jewett, chief engineer of the Western Electric Co., on "Research."

Since the Hamilton Branch was organized, at least twelve applications have been sent in for corporate membership, and fifteen affiliates have joined the Branch. A financial statement is attached.

H. B. DWIGHT,
Secretary-Treasurer.

1918		*Receipts.*		
Aug.	23	Advance Rebate from *The Engineering Institute of Canada*	$50.00	
Oct.	10	Fees from Affiliates	9.00	
"	17	" " "	9.00	
Nov.	5	" " "	9.00	
"	21	" " "	15.00	
"	26	" " "	3.00	
1919				
Jan.	14	Rebate from *The Engineering Institute of Canada* for 1918	29.40	
		Total		$124.40

1918		*Expenses.*		
Sept.	30	Postage	1.44	
"	30	Typewriting Letter Ballot	3.70	
Oct.	9	Paper and Envelopes	3.50	
"	9	Philip Davis Printing Co	2.50	
"	9	Connaught Hotel Co	10.00	
"	9	Post Cards	3.15	
Nov.	14	Moore Printery	5.10	
"	14	Flowers for Funeral of M. A. Kemp	5.00	
"	14	Post Cards	2.80	
Dec.	17	The Moore Printery	2.50	
"	17	Post Cards	3.00	
1919				
Jan.	3	Expenses of Geo. F. Porter	3.45	
"	14	Total		46.14
"	14	Balance in Bank		78.26
				$124.40

Victoria Branch

To the President and Council, Montreal:—

We have pleasure in submitting the following annual report of this Branch for the year 1918:—

One of the main characteristics of the past year has been the demand for the services of engineers, which has prevented as good attendances at headquarters as possible, but the average has been a considerable improvement on the previous year, and altogether there has been a much greater interest taken in the affairs of both the Branch and *The Institute;* the question of obtaining proper recognition for the profession is occupying chief place at the present time.

Our Legislation Committee deserves special thanks for the time and labour spent in opposing a charter sought from the Provincial House by a number of men (including a few members of our *Institute*) who wished to become certified engineers by Provincial Legislation. They were, however, unable to prove their case or substantiate their claim to legal recognition, and the bill failed to pass through committee. Our thanks are tendered to the parent Council for their advice and financial assistance in connection with this matter.

Ten general meetings were held during the year, the influenza ban preventing all meetings for several weeks in the fall.

Papers were given by D. O. Lewis on the History and Development of Railways, and by A. E. Foreman, on the Dewey Decimal System of Filing; and discussions were held as follows:—

Two on W. F. Tye's paper Canada's Railway Problem and its Solution."

One on Dr. Haanel's paper Fuels of Canada.

One on The Sooke Lake Water supply system.

One on Proposed Saskatchewan Legislation.

One on Reclaiming and Developing Land Areas for Returned Soldiers.

G. F. Porter gave his illustrated lecture on the Quebec Bridge on June 12th.

Several volumes have been donated by members to the Branch library the greater part of the library being loaned by F. C. Gamble, Past President of the Society.

During the year W. K. Gwyer was transferred to the Okanagan and his place on the executive was filled by the election of W. Young.

The membership resident within Branch limits at the close of the year was:—

Members	22
Associate Members	30
Juniors	3
Branch Associates	2
Total	57

The return of those who are overseas is expected to bring increased numbers and greater activity in the near future.

Our Annual Branch meeting was held on December 11th, and the following officers were elected for 1919: W. Young, Chairman; R. A. Bainbridge, Vice-Chairman; E. Davis, Treasurer; J. B. Holdcroft, Secretary; The above with W. Everall and A. Yarrow, Executive; D. O. Lewis and R. W. MacIntyre, Past Chairmen, are ex officio members of the Executive; A. F. Mitchell and W. M. Stokes, Auditors.

The financial statement for 1918 is attached.

Respectfully submitted,

E. G. Marriott, Secretary.
R. W. Macintye, Chairman.

Balance Sheet 1st December, 1917, to 1st December, 1918.

Balance in Bank 1st Dec., 1917	$269.75	
Cash in Hand	18.32	
		$288.07

Receipts.

Fees due prior to 31st Dec., 1917	$32.00	
Fees due for 1918	138.50	
Entrance Fees	4.00	
Rebates from *Engineering Institute*, Montreal	113.40	
Sale of Table	25.00	
Sale of Keys of Room	.75	
Interest on War Bond	5.50	
Stamp on Cheque	.02	
		$319.17

Disbursements.

Rent of Club Room, 1st Dec., 1917, to 30th Nov., 1918		$180.00	
Telephone		33.40	
Telegrams		4.07	
Postage Stamps, Sec. and Treas.		11.36	
Typewriting		12.91	
Stationery		30.50	
Binding Books		5.20	
Technical Papers		14.32	
Quebec Bridge Lecture:			
Car hire	$ 5.00		
Room Hire	3.00		
Advertising	14.28		
		22.28	
Altering Sign on Room Door		1.75	
Keys		1.75	
			$317.54
			$ 1.63

Excess of Receipts over Disbursements	$ 1.63
	$289.70

Liquid Assets.

Victory Bond	$ 99.11
Bank Balance	181.61
Cash Balance	8.98
	$289.70

The books, vouchers and balance sheet have been examined and found correct.

E. Davis, Treasurer.
Clarence Hoard,
F. C. Green,
Auditors.

Saskatchewan Branch

The second Annual Report of the Saskatchewan Branch of *The Engineering Institute of Canada*, is hereby respectfully submitted:—

At the outset we would like to mention the fact, that it is only four years now, that eight members of the Canadian Society of Civil Engineers gathered in the house of one of the local members and decided to request the approval of the Parent *Institute* for the formation of a Regina Branch. At present after four years, we have a membership of ninety-one members, sixteen of whom are overseas. The membership is composed as follows: 9 Members, 67 Associate Members, 3 Juniors, 5 Students, 1 Associate and 6 Affiliates and means an increase of twenty-two over last report.

As there are at present seven applications from our Province in the hands of the Council of the Parent *Institute* we are certain to arrive at a membership of one hundred early during the coming year.

The past year has been one of considerable activity in the Branch. The dividing of the entire membership into two groups, one on "Power," the other one on "Good Roads," with two Main Committees in charge of proceedings and papers, bore good results and all the meetings during last winter were taken up by papers dealing with some of the phases of the two subjects. Especially the question of "Good Roads" has been thoroughly discussed and our Committee hopes shortly to submit a resumé in form of a Progress Report.

Then came our First Western Professional Meeting at Saskatoon under the auspices of our Branch, with its three days deliberations on technical and professional matters. and the first "getting together" on the subject of "legislation," which we hope sincerely will materialize during this year. Another tangible result of our Western Meeting is a permanent "Concrete" and "Good Roads Committee."

We do not want to overlook to mention the visit of G. F. Porter with his interesting paper on the "Quebec Bridge."

After the Professional Meeting all our sessions were devoted nearly exclusively to "legislation," and a fairly good draft of a proposed Act had been prepared. We intended to submit the same at the present session of our Legislative Assembly here, but decided to withold action in deference to a request of the parent Council.

Altogether 6 Executive, 10 regular and 6 special Meetings were held in addition to a considerable number of Committee Meetings.

The following papers have been read:

R. W. E. Loucks, A.M.E.I.C.—" General Principles affecting the Location of Good Roads."

E. W. Murray, A.M.E.I.C. " Construction and Maintenance of Earth Roads."

H. R. Mackenzie, A.M.E.I.C.—" The Necessity of Engineering Supervision on Construction and Maintenance of Earth Roads."

J. D. Peters, Electrical Superintendent, City of Moose Jaw.—" Load Factor and Diversity Factor and their Effect on the Cost of Production of Power."

W. T. Thompson, M.E.I.C.—" Notes on Location and Construction of Trunk and Feeder Roads with Special Reference to their Grades and Width in Relation to Traffic."

A. A. Murphy, A.M.E.I.C.—" Relative Merits of Various Types of Prime Movers Producing Electrical Energy."

E. H. Phillips, A.M.E.I.C.—"A Consideration Affecting the Location of Roads with Respect to Population, Existing Railroads and Road Building Materials."

C. P. Richards, A.M.E.I.C.—" Legal Interpretation of the Quebec Act."

J. N. deStein, M.E.I.C. –" Remarks Regarding Rural Roads.

The financial situation has been rendered rather difficult through the new By-Laws of *The Institute*, cutting the Branch revenue practically in two. A special levy had to be made upon our members, which brought our income of only $132.40 from the parent *Institute* up to $359.97, with an expenditure of $340.07. It will be necessary again to make a special assessment amongst our Branch Members.

At the Annual Meeting of our Branch held on January 9th, the following were elected officers for the ensuing year: H. S. Carpenter, Regina, Chairman; C. J. Yorath, Saskatoon, Vice-Chairman; J. N. deStein, Sec.-Treasurer; H. R. Mackenzie, Regina, W. R. Warren, Regina, J. R. C. Macredie, Moose Jaw, Prof. A. R. Greig, Saskatoon, H. McIvor Weir, Saskatoon, Executive Committee; L. A. Thornton, Regina, G. D. Mackie, Moose Jaw, ex-officio.

For the Saskatchewan Branch, *The Engineering Institute of Canada*,

J. N. deStein, Sec.-Treasurer.

H. S. Carpenter, Acting Chairman.

St. John Branch

Fraser S. Keith, Secretary of *The Engineering Institute of Canada*, addressed a meeting in the Royal Hotel, on March 17th, last, on the advisability of forming a local Branch of *The Institute*. The twelve members present agreed to this proposal, elected A. Gray, temporary chairman, and A. R. Crookshank, temporary secretary, and make formal application to the Council of *The Institute* for permission to establish the St. John Branch of *The Engineering Institute of Canada*.

The Council authorized this on March 19th, and at a meeting of the members of *The Institute*, called by the temporary chairman, on April 4th, the Branch was established, by-laws adopted, officers nominated, and general plans for the ensuing season made.

On May 7th, the officers for the year were elected and the by-laws amended. At a meeting of the Executive on May 13th, A. Gray was appointed Chairman of Membership Committee, with the rest of the Executive as members.

J. A. Grant was appointed chairman of Publicity Committee and was authorized to appoint two Branch members, outside of the Executive, to act with him. G. G. Murdoch, was appointed Chairman of the Proceedings Committee, with J. A. Grant and C. C. Kirby as members of Committee. Lots were drawn by the three elected Committee men, as called for by the by-laws, and the lot fell to J. A. Grant to serve the one year term; the other two men to serve for two years.

During the year, there was one preliminary and five regular meetings, held with an average attendance of ten members and two visitors, one of these was a joint meeting with the Board of Trade, on Oct. 7th, at which Mr. Gray read his paper on St. John Harbor.

A general professional meeting was held in Halifax, Sept. 11, 12 and 13, under the joint auspices of the St. John and Halifax Branches. Attendance of St. John Branch members was ten with seven other New Brunswick visitors. The report of this meeting is contained in the October number of *The Journal*.

One trip was made to points of interest, when on May 18th, eight members and ten visitors visited Grant & Horne's shipyard and saw the " War Fundy " under process of construction.

The Executive Committee met nine times with an average attendance of five and transacted a large amount of business.

The plans for a programme of interesting meetings last fall were upset and the work disorganized by the Influenza epidemic with its consequent ban on public meetings.

Subscriptions were asked for *The Institute's* overseas tobacco fund, and $22.00 was forwarded to the General Secretary on Nov. 1st by the Secretary, as contributions from twenty-two Branch members.

Considerable corresponding has been carried on during the year, as is shown by the attached statement. The financial and membership reports are also attached.

Respectfully submitted,
A. R. Crookshank,
Secretary-treasurer.

Financial Statement.

1918

Receipts.

Advance on account of 20% rebate of 1918 dues of Branch members from *The Engineering Institute of Canada*	$50.00
Tobacco Fund for Members Over-seas	22.00
Affiliates' Fee for Season 1919	4.00
	$76.00

Expenditures.

The Engineering Institute of Canada Overseas Tobacco Fund	$22.00	
Postage on Notices and Correspondence and Exchange	11.18	
Stationery and Printing	6.55	
Stenography	10.00	
One half of Halifax General Professional Meeting—General Expenses	12.50	
Halifax Photo Group	1.00	
Balance in Royal Bank of Canada	12.77	
	$76.00	$76.00

Statement of Membership.

	Resident	Non-Resident	Overseas	Total
Members	10	2	1	13
Associate Members	14	3	4	21
Juniors	3	–	5	8
Students	–	–	–	–
Branch Affiliate	1	–	–	1
Total	28	5	10	43
Membership in Province, outside of Branch				52
Total membership in Province				95

Applications pending election:

Members	Associate Members	Juniors	Affiliates	Total
2	1	1	1	5

Change in Membership during the year 1918.

Decrease—Killed on "Field of Honour." Associate Member, 1.

Increase—	Newly elected	New residents	Non-residents	
Member	–	1	1	2
Associate Member	1	1	3	5
Junior	1	–	–	1
Affiliate	1	–	–	1
Totals	3	2	4	9
Net increase for year				8

Correspondence.

	Received	Sent out	Membership Elections	Total
Non-members	5	3	–	8
Members	18	13	–	31
Halifax Branch	12	11	–	23
Other Branches	5	1	–	6
Headquarters, E.I.C.	43	30	4	77
Letters re forms	3	1	–	4
	86	59	4	149

Notice of meetings (only) 6 sets, about 50 sent out.

Circulars and notices of meetings, including circulars, 11 sets, about 410 sent out.

Ballots, 4 sets, about 110 sent out.

Total, 570 sent out.

Grand total of pieces of mail matter handled, 719.

Meetings.

General Professional	1
Preliminary to Organization	1
Regular	5
Industrial Trip	1
Total	8
Executive Meetings	9
Total Meetings	17

Programme of Ottawa Meetings

Arrangements have been completed for the Annual General Meeting and the General Professional Meeting at the Chateau Laurier in Ottawa on Tuesday, Wednesday and Thursday, February 11th, 12th and 13th. The programme is as follows:

Tuesday.

Morning, 10.00 A.M. **Business Session.**

Luncheon, 1.00 P.M. Followed by,
Short Address, by His Excellency the Governor-General.
Short Address, by C. A. Adams, President, A. I. E. E.
Address—International Affiliation of Engineers, by A. D. Flinn, Secretary of the United Engineering Council.

Afternoon, 4.00 P.M. **Business Session.**
President's Address (invitations).

Evening, 7.30 P.M. **Informal Dinner and Smoker.**

Wednesday.

Morning **Unfinished Business of Annual Meeting.**
Standards in Engineering, by Capt. R. J. Durley, M.E.I.C., Chief of Division of Gauges and Standards, Imperial Ministry of Munitions.
Soldiers' Re-establishment, by Major Anthes, of the Department of Soldiers' Civil Re-establishment.
The Development and Future of Aviation in Canada, by M. R. Riddell, Chief Engineer of Canadian Aeroplanes Ltd.

Luncheon, 1.00 P.M. Followed by,
Short Address, by Dr. Ira Hollis, Dean, Worcester Polytechnic, representing A.S.M.E.

Afternoon 2.15 P.M. **National Highways and Good Roads**, by J. Duchastel, M.E.I.C., Hon. President, Good Roads Association.
Frazil, by R. M. Wilson, M.E.I.C., Chief Engineer, Montreal Light, Heat & Power, Ltd.
Mean Sea Level Datum for Canada, by W. Bell Dawson, M.E.I.C., Supt. of Tidal Survey, Department of Naval Service.
The Montreal Tunnel, by J. L. Busfield, A.M.E.I.C. (Illustrated).

Evening 9.00 P.M. **Formal Gathering.**
Reception by President: Ladies, Music, Refreshments, Dancing.

Thursday.

Morning **Topical Discussion on the Economics of Railway Electrification**, opened by John Murphy, M.E.I.C., Department of Railways and Canals, and Railway Commission; followed by discussions by F. H. Shepard, A.A.I.E.E. New York, Director of Heavy Traction, Westinghouse Electric & Mfg. Co.; and W. G. Gordon, F.A.I.E.E. Toronto, Transportation Engineer, Canadian General Electric Co., Ltd.
Mining and Metallurgy of Cobalt Silver-Ores, by Lt.-Col. R. W. Leonard, M.E.I.C., President, Coniagas Mines.

Luncheon, 1.00 P.M. Followed by,
Short Address, by Hon. F. B. Carvell, Minister of Public Works, to be followed by a visit to the New Parliament Buildings, Ladies.

Afternoon, 4.30 P.M. **Motion Pictures.**

Luncheon—Tuesday, 11.00 to 1.00 p.m., at Chateau Laurier.
Complimentary tickets to visiting members.

Informal Dinner and Smoker—
Tickets $2.50, to be obtained on registering.

Luncheon—Wednesday and Thursday, February 12th and 13th, 1.00 p.m., at Chateau Laurier. Tickets $1.00 to be obtained on registering.

Since the last Annual Meeting many changes have taken place in the organization indicative of progressive development and the new spirit that has been aroused in the affairs of the engineering profession. It is already indicated that this will be one of the most largely attended Annual Meetings ever held. Members of the Ottawa Reception Committee, wearing badges, will meet incoming trains and will furnish information regarding accommodation and registration. The registration will take place on the ground floor in the assembly room at the rear of the rotunda.

Mean Sea Level As A General Datum for Canada*

By W. Bell Dawson, M.A., D.Sc., M.E.I.C., M.Inst.C.E., F.R.S.C.

In regard to a general datum for levels in Canada, there can scarcely be a question that the right datum to adopt is Mean Sea level; since this is used in all civilized countries as the general plane of reference for levels. There are some important purposes however, for which other zero levels are preferred; notably the Low-water datum for navigation and harbour works. Another plane of reference that may have some possible claim for consideration, is the level of High water, which some railway companies and some coast cities have adopted. In some cases also, this is made the reference level for the height of mountains. But apart from these, a great number of independent and discordant datums are in use for reference on railways or in our different cities, which are indefensible in the sense that they do not correctly represent any physical plane of reference.

The object of the present Paper is to outline briefly the situation in Canada at the present time; as it is now possible to aim at the use of one general datum, and gradually to do away with all the undesirable ones. The Railway Commission views favorably the adoption of a general datum of this character, wherever it is practicable to connect with it. The Superintendent of the U. S. Coast and Geodetic Survey, in a Paper entitled "The use of Mean Sea level," published in 1917, gives the opinions of a number of Engineers and others throughout the United States on the datum to which elevations should be referred. All are agreed that Mean Sea level should be chosen, and that it should be adopted without further delay. The *Engineering Institute* should therefore discourage the reprehensible practice of Engineers in beginning almost every new undertaking with a fresh and independent datum, without even inquiring what is already in use in the locality. This practice appears to continue to the present time.

In explaining the advantages of Mean Sea level as a datum, we will avoid technicalities; but the way it is arrived at and its degree of accuracy are matters of interest from an engineering standpoint.

On all shores of the Ocean there is a tide which rises and falls twice a day; and the determination of the mean, or true level of the sea, is necessarily a tidal problem. When this has to be done from the beginning, there are several successive steps required; as a zero level from which heights are to be measured must be established; and also a local Bench-mark for reference, to maintain the levels at a uniform elevation from year to year. The best zero level to adopt, is a Low-water datum, which can be decided upon definitely as soon as the first few months of tidal observations are obtained.

This Low-water datum differs essentially from Mean Sea level in not representing a constant or absolute elevation. It is a plane of reference at half the range of the tide below the mean level of the sea; and the range of the tide varies from 4 feet to 50 feet in different regions. The only justification for the Low-water datum is its great convenience to the mariner, in showing the least amount of water available in bays and channels under the influence of the tide. It is therefore universally used in Hydrographic Surveys as the datum for marine charts; and by using the same datum as the zero level in tide tables, the extra depth due to the rise of the tide is made evident. To this practice, Holland may be mentioned as an exception; for although a Low-water datum is used for their charts, it is not accepted for the tide tables, which are everywhere referred to Mean Sea Level at Amsterdam. This gives all High waters a plus value and all Low waters a minus value; which carries the use of this datum to its theoretical limit.

At a fully equipped tidal station the tide is obtained by a recording instrument, as a continuous curve day and night, summer and winter. The equipment necessary to secure such observations, especially in our climate, need not be detailed; but it is evident that the levels at the tidal station must be maintained accurately from year to year with reference to the Bench-mark; the individual observations being to the nearest hundreth of a foot.

The ordinates of the tide curve above the Low-water datum are then measured at each hour throughout the year, and the average of these is accepted as the best value for Mean Sea level. It is necessary to deal with a complete year at a time, to allow for all the astronomical variations in the tide itself. The resulting value being thus the average of 8,760 individual heights, is already reliable when derived from one year. It is clear that from the tidal point of view, the value of Mean Sea level is the final outcome of the observations.

This method, geometrically speaking, makes Mean Sea level the axis line of the tide curve, which bisects its area horizontally. The only other method is to take "Half tide" as the mean level of the sea; that is, half the difference in height between the average levels of High water and Low water. This is less accurate, chiefly because Mean Sea level may not be truly midway between High water and Low water, unless the tide curve itself is perfectly symmetrical; there being regions in which there is an inequality that interferes seriously with its symmetry.

The value of Mean Sea level from the hourly ordinates of the tide on an open coast, at a point unaffected by river outflow, is reliable to the third decimal of a foot in any one year. There is a slight variation from one year to another of perhaps an inch or two from the mean value; for some reason which is not well understood. For example in a series of 15 years at St. Paul Island the extreme values in individual years are from 0.17 to 0.14 of a foot above or below the average value. The average of the determinations in three or four complete years however, must be regarded as correct in the absolute; because the probable error in about 100 miles of land levelling is greater than the residual error in the determination of Mean Sea level. When a long land line connects two well-situated tidal stations, any outstanding error must therefore be adjusted to correspond with Mean Sea level at its two ends. This is recognized in the extended levelling operations through-

*To be read at the General Professional Meeting, Ottawa, February 12th.

out India and the United States. In Great Britain, special tidal stations on the open coast have been established in recent years, to avoid river influence; as all the more important harbors are in the estuaries of rivers.

In Canada our determinations of Mean Sea level have been kept well ahead of levelling requirements. The Survey of Tides and Currents was organized in 1893; its primary purpose being for the benefit of navigation in obtaining data for tide tables, and in the investigation of marine currents, and it was thus made a branch of the Marine department. It soon became evident that tide levels were valuable for construction purposes or dredging, even if only locally determined in individual harbours; and also that Mean Sea level would be of importance at some future time, as a basis for extended levelling. The extra work necessary to maintain accurate levels was, therefore, undertaken from the outset by the Tidal Survey; as it is obviously a very different matter to keep the levels correct to the nearest 0.01 of a foot, as compared with working to the nearest half or quarter foot as required for chart soundings and navigation generally.

By 1903, reliable results became available; and values for Mean Sea level were given, with other tide levels, in a Paper by the Superintendent, published by the Canadian Society of Civil Engineers. These values were based on 4 to 6 complete years of observation. Similar data for harbors on the Pacific coast were published in 1905. About that time also (in the year 1904) the Academy of Sciences of France offered one of its prizes for the best determinations of Mean Sea level in any country bordering on the North Atlantic ocean; the special object being physical, in establishing a basis for detecting any depression or elevation of the coast relatively to the Ocean level. Somewhat to their surprise, Canada took the first place in the competition; as the Tidal Survey had determinations of Mean Sea level covering eight degrees of latitude from southern Nova Scotia to Labrador, and in longitude from Cape Breton to the lower St. Lawrence. Notwithstanding this recognition from France, it was not until five or six years later that our systems of Geodetic or precise levelling were connected with the Canadian tidal stations, at which the determinations of Mean Sea level available in 1903, had been made known by publication to Engineers.

The first accurate levelling which began in the region of Montreal, along the St. Lawrence, the Richelieu and the Ottawa, was based on Bench-marks on the frontier of the United States, connected with sea level at New York by the United States Coast and Geodetic Survey. The most noteworthy of these Bench-marks is at Rouses Point at the north end of Lake Champlain. It appears to be at the end of a line of secondary importance in the United States system; as its original altitude was diminished in 1900 by 1.08 feet, and its elevation was finally revised in 1903 from 110.06 to 107.95, an alteration of 2.11 feet; with possibly a further small correction in 1907. This shows the disadvantage of having to rely on United States levels; when a line of levels from Montreal to a satisfactory tidal station of our own (at Father Point on the Lower St. Lawrence) is no longer than the line connecting Montreal with New York.

The first precise levelling in the Maritime Provinces, was also started from a frontier Bench-mark in the State of Maine, which is nearly twice as far from New York as from our tidal station at Halifax.

These points are mentioned to show that there is no need to make Canada a mere adjunct of the United States, when our Canadian work may be quite as good; and it would be equally unfortunate at the present juncture to miss the opportunity of correlating all existing levels, to place them on a satisfactory basis.

What has already been accomplished in accurate levelling may be mentioned in the briefest way to indicate the present situation; with the endeavor also to state fairly the amount accomplished by each Survey or Department engaged. There was indeed some excellent levelling along our railways, especially in the early days; no such work being better done than on the old European and North American Railway from St. John to Shediac in 1859. We may also recall the careful instructions on levelling for the Intercolonial Railway given by Sir Sanford Fleming about 1870. But all this is now lost, because unrecorded by Bench-marks; and this often happened on our railways built later, through the hurry during construction. Some early levels have been preserved however, on various canal surveys, though more limited in extent.

The first work done under the name of Geodetic levelling, was in 1883 to 1888, from Quebec to Cornwall and southward to connect with Rouses Point; under the direction of Mr. R. Steckel of the Public Works department; the St. Lawrence section from Quebec to Montreal being published in 1891. In 1904 to 1907 these levels were carried through to Lake Huron by the Georgian Bay Canal Survey. In 1906, precise levelling was begun by the Dominion Observatory, their first results being published in the report of the Chief Astronomer for 1910. The lines run in the first years were in western and southern New Brunswick; and from Sherbrooke to Colborne, Ontario. The whole of the work in these regions was based upon Bench-marks on the frontiers of the United States, and chiefly upon Rouses Point; but most of it had the advantage of the revised elevation of 1903 for that Bench-mark; which was carefully correlated with others in the State of New York by the Georgian Bay Canal Survey before the final reduction of their levels in 1907.

It was not until 1910, that the Geodetic levelling in the Public Works department was continued eastward beyond Father Point, and through New Brunswick and Nova Scotia to Halifax. It thus makes connection with two of the tidal stations at which Mean Sea level is accurately determined; and the final revision, based on both stations, was made in 1914. The precise levelling of the Dominion Observatory was also connected with the Halifax tidal station in 1913. This precise levelling has recently been organized as the Geodetic Survey of Canada, in the Interior Department. This then brings us to the date at which the determinations of Mean Sea level made by the Tidal Survey, were first utilized as a basis for extended levelling. When required for levelling operations, determinations were thus found ready to hand, which had gradually been perfected during a series of previous years. The same advantage was obtained afterwards in the two additional provinces of Prince Edward Island and British Columbia.

At this juncture we may indicate concisely the system of principal stations which were established to command all Canadian waters, as reference stations for tides and currents; but most of which are also well situated for the purpose under consideration. There are eight principal tidal stations in Eastern Canada which are maintained summer and winter; but at two of these the value of Mean Sea level is not satisfactory. At Quebec there is still some river slope, and Mean Sea level, determined locally by the method described, is nearly 1½ feet above the true level in the Ocean. Even at St. John, N.B., the influence of the St. John river appears to be appreciable. The station at St. Paul Island in Cabot Strait, though invaluable for general tidal purposes, is inaccessible for connection with land levels. This leaves five, which are well distributed on our Eastern coasts: namely, Father Point, Halifax, Yarmouth, Charlottetown and a station in Belle Isle Strait at the extreme northeast of the country. At all these stations, the results are now highly accurate; and they are referred to local Bench-marks.

The determination of Mean Sea level at Halifax is derived from nine complete years of tidal observation. The other determinations utilized in levelling are derived from ten complete years at Father Point, five years at Charlottetown, and one year at Yarmouth. The value of Mean Sea level at Charlottetown has been made the basis for levelling over the whole of the Railway system of the island, which was begun in 1915 by the Department of Railways. This will place the levels throughout this Province in a very satisfactory position.

The principal line of Geodetic levelling of the Public Works department runs near to the Eastern coast of New Brunswick, and connects Halifax with Father Point. It thus constitutes a line running north and south for 400 miles across three provinces, which is connected at both ends with sea level. The lines of the Geodetic Survey, running from Halifax to the St. Lawrence, lie further in the interior of New Brunswick; and another line extends from Halifax to Yarmouth, being thus checked at both ends. The two systems of level lines have been laid out with care to avoid duplication, as far as this is practicable. By means of these lines the early levelling along the St. Lawrence and in the Montreal region, and the system of lines in the Maritime Provinces, are well connected and brought to a uniform basis. On all such lines, a series of Bench-marks is established for reference.

It may be possible in localities to which precise levelling has not yet reached, to make a determination of Mean Sea level from a few months of tidal observations, to meet some special requirement. In the Pictou and Sydney coal fields in Nova Scotia, contoured maps by the Geological Survey have been based on local determinations of sea level in those harbours, which afforded fairly good values, sufficiently close for the purpose. A basis for levels required also by this Survey in a mining region on Howe Sound, B.C., was obtained similarly from a special reduction of a few months of tidal observations there.

The region of the Great Lakes is related by its situation to sea level on the New England coast directly opposite; and the determination of Mean Sea level at New York thus affords the natural basis for this region. The lines of the United States Coast and Geodetic Survey form a net work by which the Lake levels are well established; and it would appear that the elevations now arrived at, can be accepted without question of further revision. These have been carried across to the Canadian shores by the Hydrographic Survey.

Passing to the Pacific coast, tidal observations were begun there in 1895 and 1902, which now afford accurate determinations of Mean Sea level at Vancouver and Port Simpson, at the north and south extremes of the coast of the mainland; as well as at Prince Rupert, from observations there since it was founded. The Geodetic Survey had thus a sound basis for levelling, when it was begun in the region of the lower Fraser; and it will be possible to connect the land lines which run through the interior of British Columbia, with Mean Sea level at both Vancouver and Prince Rupert; two points on the coast nearly 500 miles apart in a straight line. This is a further example of the advantage of such a double connection for long land lines, especially in so mountainous a country.

There are also tidal records available from which Mean Sea level can be worked out at the heads of any of the long inlets on the coast, which may possibly become Railway terminals in the future.

On Vancouver Island, there are three determinations of Mean Sea level at well situated points; at Victoria and Hardy Bay at the south and north ends, which are 260 miles apart, and at Clayoquot near the middle of the west side. Land lines throughout the length and breadth of the island can be based on the determinations at these three tidal stations. Already the Geological Survey is utilizing the value of Mean Sea level at Victoria for a contoured map in that region.

The Geodetic Survey has recently completed connections which give a through line of levels across the width of Canada from Halifax to Vancouver. These levels are also checked by United States Bench-marks near the boundary in the middle of the Continent. Towards the western side, a net-work of lines now extends from Vancouver to Regina, and from Edmonton to Lethbridge.

In these central regions, levels are also being carried along the meridians and other boundary lines which are laid out by the Surveyor General's department. This can be done by the same surveying parties, and it helps to extend the levels. This work is correlated with the elevations established by the Geodetic Survey and is kept in harmony with it.

A valuable work of reference, entitled "Altitudes in Canada," has been compiled by Mr. James White, which gives the results obtained by all methods, including precise levelling, re-levelling on railways, and reconnaissances. The earliest edition was published by the Geological Survey in 1901; and the later editions have been largely extended, under the Conservation Commission. The elevations throughout are referred to Mean Sea level, and a description of the primary determinations by the Tidal Survey is given. This work is of great assistance in familiarizing Engineers with the use of a general datum throughout the country.

To sum up the situation, we have at present a network of levelling in Eastern Canada, which has been built up by three systems of levelling operations since 1883, and is now correlated accurately with Mean Sea level. The levelling in the Public Works department, extending from Georgian Bay through the Montreal region, and now connected with the tidal stations on the Lower St. Lawrence and at Halifax, was finally revised in 1914. The lines of the Geodetic Survey in the Maritime Provinces, connected with the tidal station at Halifax since 1913, extend by other routes continuously to the region of the Great Lakes. On the Pacific coast, the lines of levels are also beginning to form a net-work; and the two sides of the country are united by a through line across the Continent finally connected in 1916 and 1917, by the comprehensive work of the Geodetic Survey. There is thus at present a system of Bench-marks throughout all the more inhabited parts of Canada for reference; and the dates mentioned show that this is quite recently accomplished. It is obviously desirable therefore, that all Engineers should now utilize the uniform datum thus established, and that all railway profiles should be referred to it, to eliminate the confusion arising from the adoption of independent datums which is still in vogue.

The only necessary exception to this rule is for marine charts and dredging, for which a Low-water datum must be used; as well as for the height of the tide in tide tables. It may be a question whether it is essential to use Low water or High water as the datum for harbour construction and dry docks; but if so, it should be possible to give a correlation with Mean Sea level. These two datums correspond with the land surface of the country which is out of water, and the harbours and maritime approaches to its shores which are below sea level.

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The Mining and Metallurgy of Cobalt Silver-Ores*

By Lieut-Col. R. W. Leonard, M. E. I. C.

In the Temiskaming & Northern Ontario Railway Commission's Report for 1916 on the Mining Industry in that part of Northern Ontario, served by the T. & N. O. Railway, Mr. Arthur A. Cole, Mining Engineer for the Commission, makes the following remarks:

"Along the Temiskaming & Northern Ontario Railway from Cobalt to Porquis Junction, a distance of 125 miles, it was noticeable this year that there was hardly a station from which some mining operations were not being carried on. New districts were being reported from time to time, and the older districts were looking better as work proceeded.

"Anyone who looked over the unbroken forests of Northern Ontario a dozen years ago and predicted that this district would soon be producing over twenty millions in gold and silver annually would have been put down as a fantastic dreamer; but that figure is surpassed today by three million dollars, and the output is continually increasing.

"And yet only a small portion of the country has been prospected. Running north-east and north-west from Cobalt and extending to the Arctic Ocean is the great pre-Cambrian shield, the basement formation of the Continent. It contains thousands of square miles and offers to prospectors *better chances of locating valuable mineral deposits than can be found in any other country in the world.*"

The principal camps referred to by Mr. Cole are the Cobalt silver and the Porcupine gold areas, and if to this we add the world-famed copper-nickel deposits of the Sudbury district, lying about 160 miles south of Porcupine and 80 miles south-west of Cobalt, we have a very interesting group, of which two are the most wonderful mineral deposits in the world.

In 1918, Sudbury is credited by the Deputy Minister of Mines, Ontario, with a production of Nickel valued, in matte form, at $26,800,000.00, and of Copper, valued in matte form, at $8,500,000.00, making a total of $35,300,000.00. The market value of the refined products would exceed these figures very materially, and in time the refining of these products in Canada will greatly stimulate the production of heavy chemicals, machinery and many other materials required in the process.

In addition to the silver and gold produced in the Northern Ontario district covered by Mr. Cole's Report, we have the metal cobalt, existing in greater concentration than in any other known deposit, enabling Canada to supply for some years past practically the entire world's consumption of refined cobalt products. This metal cobalt, together with nickel and arsenic, are associated with silver in the Cobalt ores, and in this same district served by the T. & N. O. Railway are found copper, molybdenite, barite, fire-clay and pottery-clay, all in notable commercial deposits. For the working of these deposits the district affords an abundance of wood, water-power and large areas of peat which have been favorably reported upon by A. Anrep, peat expert to the Dominion Government, suggesting its use in the form of peat powder, even for locomotive fuel.

Before proceeding to a description of the mining and metallurgy of silver, which is the principal mineral produced in this district up to the present time, just a word in regard to the gold mines of the Porcupine Camp which were discovered in 1907. Since that year to December 31st, 1918, the production of gold has reached a value of $46,000,000.00, and the working mines have paid dividends of $13,312,310.00. Gold has also been discovered in notable deposits in many other parts of this district served by the T. & N. O. Railway, and a number of these occurrences are of a very promising nature.

During the past year the Cobalt Camp produced about 12½% of the total world's output of silver, and this was achieved by a camp about four miles in length and the same in width. The Cobalt silver mines have paid in dividends to December 31st, 1918, over $76,000,000.00, which, added to the dividends paid by the Porcupine gold mines of over $13,000,000.00, gives a grand total of more than $89,000,000.00 paid in dividends by the mines of these two camps since 1904.

Notwithstanding the shortage of labour due to the war, the gold and silver mines of Northern Ontario are employing about 7000 men at present with an annual pay-roll of at least $8,500,000.00; and it is estimated that up to the present time, at least $100,000,000.00 has been spent by the operating mines in labour, equipment and supplies.

The numerous promising discoveries of gold throughout the whole territory served by the railway gives assurance that the gold-mining industry of Northern Ontario is yet in its infancy.

In 1917, there were fifteen dividend-paying silver mines and five dividend-paying gold mines in Northern Ontario, as compared with nine dividend-paying silver mines and three dividend-paying gold mines in 1918.

Notwithstanding that silver was discovered on the north-east side of Lake Temiskaming about a century ago when operations were carried on at the Wright Mine, the history of the Cobalt mining camp began in 1903, when the T. & N. O. Railway was in course of construction, native silver being discovered at that time at both the north and south ends of Cobalt Lake. These spectacular finds of native silver aroused immediate and widespread attention and, as a result of the work done by the large number of miners and prospectors who flocked into the country, a number of mines were rapidly opened up, and these mines paid handsomely from the grass-roots down.

*To be read at the General Professional Meeting, Ottawa, February 12th.

The total output of silver from the Cobalt district from 1904 to the end of 1918, is as follows:—

	Average price, Cents per oz.	Ounces	Value
1904	57.2	206,875	$ 111,887.00
1905	60.4	2,451,356	1,360,503.00
1906	66.8	5,401,766	3,667,551.00
1907	67.5	10,023,311	6,155,391.00
1908	52.9	19,437,875	9,133,378.00
1909	51.5	25,897,825	12,461,576.00
1910	53.5	30,645,181	15,478,047.00
1911	53.3	31,507,791	15,953,847.00
1912	60.8	30,243,859	17,408,935.00
1913	57.8	29,681,975	16,553,981.00
1914	54.8	25,162,841	12,765,461.00
1915	49.69	24,746,534	12,135,816.00
1916	65.661	19,915.090	12,643,175.00
1917	81.418	19,401,893	16,131,013.00
Estimated—1918	96.772	17,500,000	16,935,100.00
		292,224,172	$168,895,661.00

While there is no doubt that the Cobalt Camp is rapidly becoming exhausted, there is every prospect of other workable deposits being discovered of the same geological formation, which covers an enormous area of this Northland, in the vast territory which remains as yet unprospected, and this promise is borne out to a limited extent by notable finds of silver in South Lorraine and Casey Townships, and up the Montreal River.

Geologically, the Cobalt Camp consists of a foundation of Keewatin rocks, upon which a slate conglomerate has been uncomformably deposited, the whole broken in places by eruptions of diabase forming dykes and sills and causing vertical cracks which were afterwards filled with mineral. The most valuable silver deposits are found in these vertical veins cutting through the conglomerate, and the silver almost invariably disappears in depth at the contact with the Keewatin. Some valuable veins have been found in the diabase rocks which have produced a notable amount of silver.

In the opening up of some of the mines in the early days a few hand-drills or a machine-drill, a derrick and a hoisting engine formed the only plant necessary to sacking the rich ore and shipping it in carloads to the smelters, these carloads of ore netting as high as $100,000.00 per car when silver was selling at about 60c. per ounce. This method of mining, however, rapidly gave way to mining from shafts and levels underground with overhand stoping, the rich ore being sorted and sacked in the mine and the remainder sent to concentrating mills before shipment to the smelters. The camp now boasts of some very excellent examples of mining and milling equipment, with resultant up-to-date operating methods, as reflected in the costs of mining and milling at the Coniagas Mine, which mine has produced to date over 26,000,000 ounces of silver and has paid in dividends $9,240,000.00.

The total cost of mining and milling at the Coniagas Mine, including development, head office and administration and all overhead charges, have declined from:

	$19.75	per ton in	1908
to	9.24	" " "	1910
to	6.13	" " "	1915
to	5.67	" " "	1917
and increased to	5.88	" " "	1918

The cost per ounce of fine silver produced, including the above charges, freight, treating and refining at the company's smelter at Thorold, Ont., war taxes and shipment to London, England, have ranged from:

	17.53c.	in 1908
to	11.06	" 1911
to	13.06	" 1913
to	18.26	" 1916
to	25.69	" 1917
to	41.35	" 1918

For the description which follows of the Milling and Hydrometallurgy of Cobalt ores I am indebted to F. D. Reid, Mine Manager, Coniagas Mines, Cobalt; and for that portion which deals with the smelting and refining of these ores, to R. L. Peek, manager, The Coniagas Reduction Co. Ltd., Thorold, Ont.

Ore Treatment.

The outstanding features of the practice of recovery of values from Cobalt ores followed at the various mills are:

1. The utilization of jigs and tables to recover a large percentage of the silver and cobalt content of the ore prior to treatment by flotation or cyanidation
2. The grinding of the table tailing to a slime to obtain a maximum net return from the cyanidation treatment;
3. The necessity of grinding the table tailing to pass a 100-mesh screen to obtain a maximum net return from the flotation process;
4. The use of Sodium Sulphide as a precipitant, and Aluminum in a caustic soda solution as a desulphurizer. (Footnote 1.)
5. The treatment of concentrates by the hypochlorite method. (Footnote 2.)

Since much of the silver now produced comes from low-grade ore, chiefly wall rock, the treatment of this low-grade ore is described more in detail. In this connection cyanidation, flotation and gravity concentration processes are discussed.

The hypochlorite-cyanide process which has been recently introduced for the reduction of high-grade ores is also dealt with somewhat fully.

Brief Historical Review.

For the first three years following discovery only high-grade ore was sought and no attempt was made to extract silver from the low-grade material. Much of the ore was sacked underground and the rest was hand-sorted in washing plants. In this way three products were obtained and shipped to the smelter, viz.: (1) ore carrying from 2000 to 4000 ounces of silver per ton;

(2) ore carrying about 400 ounces; (3) a grizzly product carrying about 125 ounces. The discarded material with a value of from 15 to 30 ounces went to the low-grade dump for future treatment.

In the summer of 1907 the McKinley-Darragh Mining Company erected and put into operation a five-stamp mill equipped with classifiers, a Wilfly table and Frue Vanners, with a view to treating their low-grade ore. Shortly after this the Coniagas Mill was put into operation with a daily capacity of 60 tons. Then followed the Buffalo and others, until to-day there are thirteen mills in operation with a total daily capacity of approximately 3000 tons.

Preliminary Treatment.

The general practice at present is to hand-sort the high-grade ore, either underground or in washing plants and send the low-grade, consisting of country rock containing a portion of the vein matter, to the mill. Here it is crushed in breakers, sized, and given a preliminary treatment on jigs, thereby practically recovering the balance of the vein matter.

The wall-rock, containing finely disseminated mineral and fine leaf silver, passes on to the stamps, ball or Hardinge mills, for further reduction and concentration.

Concentrating by Gravity Machines.

In general it may be said that the silver, when in a gangue of smaltite or niccolite, is readily recoverable by jigging; or, when coarser than 200-mesh and finer than 8-mesh, by concentrating on Wilfly, Deister or James tables. This class of vein matter has a specific gravity of 6 to 6.5, whereas the specific gravity of the wall-rock is 2.7.

Losses occur in concentrating this vein matter when crushed to finer than 200-mesh. Filmy leaf silver, various brittle, complex silver compounds, oxidized vein matter in the form of slime, and silver in a finely disseminated state in the wall rock, are also sources of loss in subsequent treatment. However, from an ore containing 25 ounces of silver to the ton 80% of the values can be recovered by the gravity concentrating methods at a comparatively low cost—the cost depending largely on the capacity of the mill. The cost of crushing the ore to the size required and concentrating on jigs and tables is approximately $1.00 per ton for a mill with a capacity of 200 tons per 24 hours. This does not include overhead charges nor the cost of marketing the concentrates. In general, the cost of concentrating the prepared ore on tables is approximately 20c. per ton. Gravity concentration, therefore, serves its purpose, namely, to reduce the silver content of the ore to approximately 5 ounces, at a low cost.

The introduction of the Cyanide process and later the Flotation process was with a view to recover this elusive five ounces. The cyanide process has the additional advantage of producing silver in the form of bullion.

Note 1.—See "Sodium Sulphite Precipitation of Silver at the Nipissing Mine" (R. B. Watson) Transactions, *Canadian Mining Institute*, 1917.

Note 2.—See "Notes on Metallurgy at Cobalt during 1916." (R. B. Watson), *The Canadian Mining Journal*, March, 1917.

Mechanical Concentration followed by Cyanidation.

Cyanidation as an adjunct to mechanical concentration is employed in three mills, the Cobalt Reduction, O'Brien and Nipissing.

The practice at the Nipissing and Cobalt Reduction Mills, is to concentrate as closely as is economically possible on concentrating tables, and to reconcentrate the rougher concentrates to obtain a product assaying from 2000 to 3000 ounces of silver to the ton. This concentrate is then treated by the hypo-chlorite cyanide process, to be described later. The tailings from the tables after being slimed in tube mills is run to the low-grade cyanide plant for further treatment. The O'Brien practice is similar to that of the Nipissing and Cobalt Reduction, excepting that the concentrate recovered is shipped direct to their smelter at Deloro.

The run of mine ore after receiving a preliminary treatment in the washing plant to recover the vein matter, is crushed in a 0.12% cyanide solution to pass a 4-mesh battery screen. The battery discharge is then concentrated on 12 Wilfly tables, the concentrate going to the hypo-chlorite cyanide plant and the tailings discharging into Dorr classifiers in closed-circuit with tube mills until the product is reduced to a slime. The slime product is re-concentrated on slime tables, the tailing assaying approximately 6 ounces is given a 48 hour treatment in a 0.25% cyanide solution. The pregnant solution is then recovered by filtering in vacuum filters and the residue containing from 2 to 2.5 ounces of silver to the ton, is run to waste. The silver in the pregnant solution is precipitated by the addition of sodium sulphide and the precipitate desulphurized by being brought into contact with aluminum in a caustic soda solution. It is then refined in a reverberatory furnace to 999 parts per thousand fine.

Hypochlorite-Cyanide Process.

The Nipissing Mining Company and the Mining Corporation of Canada, recover approximately 97% of the silver contained in their high-grade ore and concentrates, by the hypo-chlorite cyanide process.

Until recently it was thought that concentrates could not be treated economically by the cyanide process. The method outlined below, however, is now in successful operation, due to the combined efforts of J. J. Denny, research manager of the Nipissing Mining Company and M. F. Fairlie, manager of the Mining Corporation.

Five to seven tons of ore or concentrates is charged into a tube mill along with the required amount of iron balls for grinding and water to give a 1 to 1 dilution. The tube mill is then revolved for 18 hours, as extremely fine grinding is necessary to get maximum results. Calcium-hypo-chlorite is then added at the rate of from 50 to 75 pounds per ton of ore treated, depending on amount of sulphides present, and the grinding continued for an additional six hours. The pulp is then discharged into a tank and fed to a Dorr classifier to separate the coarse metallic silver from the slime pulp. The metallic silver discharged from the Dorr classifier is held over and re-charged into the tube mill, with the next charge of ore, for further grinding. The slime overflow from the Dorr classifier, discharges into a collecting tank and is allowed to settle, the solution is then decanted and the thickened pulp discharged into a vacuum filter to be further de-watered.

The de-watered pulp is then discharged into a cyanide treatment tank and the charge made up to a dilution of 20 to 1 and the cyanide strength maintained at 0.5%. The pulp is then thoroughly agitated and aerated for fourteen hours. The pulp is then allowed to settle and the excess solution decanted. After being again agitated the thickened pulp is pumped to a stock tank for filtering. The discharged residue from the filter, containing from 50 to 75 ounces of silver, with the cobalt, nickel and arsenic content, is sold to the smelters.

The silver is recovered from the pregnant solution by the soldium-sulphide process.

It is possible by this process to recover in the form of fine bullion approximately 97% of the silver content of the ore, in a period of 96 hours.

The Flotation Process

In September, 1916, the Buffalo Mines Limited, put in operation a Callow flotation plant, of 600 tons daily capacity, to treat a arge accummulation of sand tailings and as an adjunct in the treatment of its low-grade ores. Today there are ten mills in the district using the flotation process with a total daily capacity of approximately, 2000 tons.

The flotation machines used are the Callow pneumatic and the Groch centrifugal types. The former depends for its action, entirely on air forced, from below, through a porous medium, at a pressure of 5 pounds; the latter depends on mechanical agitation and air, the air being drawn into the pulp through a hollow shaft by the centrifugal force of impellers.

Oil Mixtures.

Experiments have been carried out with a number of oils and combinations thereof. A mixture of 20% pine oil, 70% coal tar creosote and 10% coal tar, is now in general use, with slight modifications to meet varied conditions.

The amount of oil used ranges from ¾ pound to 1½ pounds per ton, depending upon the dilution of the pulp, the amount of mineral present, the fineness of the product and the skill of the operator.

The oil mixture is usually fed into the tube mills to insure an adequate mixing of the oil with the pulp.

Practice.

The practice in general use, with slight modifications is to concentrate the battery or ball mill discharge on reciprocating tables to recover the coarse free mineral and to reduce the silver content in the slime tailings. The table tailings go direct to the Dorr classifiers and are kept in closed circuit with tube mill, where the oil mixture is added, until ground to pass through a 100-mesh screen.

This product, with a dilution of approximately 4 to 1, is sent to the flotation machines, where it is fed into the rougher cells and agitated or aerated to effect a separation of the mineral from the gangue. The mineral is floated and discharged in the form of a froth, assaying approximately 75 ounces of silver to the ton. The tailing, varying in value from 1 to 3 ounces, is sent to waste.

The rougher concentrate is reconcentrated in cleaner cells to raise the value to, approximately, 250 ounces. The cleaner cells discharge a nine ounce middling product, which is returned to the head of the rougher cells for further treatment. The final concentrate is allowed to settle in Dorr thickeners, filtered, dried and sent to the smelters.

General

The gravity concentration process of Cobalt was developed when the price of silver ranged from 50 to 65 cents an ounce.

Mill operators, employing straight concentrating methods, concluded that an economic limit of extraction had been reached when the silver content of the ore was reduced to 5 ounces. Forty percent of this final tailing was slime, assaying approximately 6 ounces per ton and the balance sand, with a silver content of 4 ounces.

With silver at 55 cents an ounce, it was possible to treat the current slime tailing at a small profit, by the flotation process. It was not, however, until the price of silver advanced to above 65 cents an ounce, that a profit could be made from the 4 ounce sand.

The present activity, in the treatment of these low-grade products cannot be attributed entirely to the flotation process, as, owing to the advance in the price of silver, other attractive processes were available. The cyanide process, which did not look economically attractive when a tailing of only $2.50 was going to waste, was worthy of consideration when this value was raised to $5.00.

It must not be supposed, therefore, that the silver now being recovered by the flotation process would, otherwide, have been lost.

The uncertainty in the price of silver influenced operators, using the gravity concentrating methods, to adopt the flotation process, owing to the comparatively low cost of installation and to the satisfactory results obtained by experiment. On the other hand, the high cost of marketing the flotation concentrates, which is approximately 80 cents per ton of ore, is an objectionable feature to the process. It is possible that research may develop a process to treat this concentrate locally or to raise the value of the concentrate by elimniation of the silica, which is about 65% of the product shipped, and so render this process of more value to the district.

Smelting and Refining.

Up to the early part of 1908 all the ore from the Cobalt camp was shipped to reduction works in the vicinity of New York and Camden, N.J., for treatment. There was previously a natural desire to treat the ores in Canada, coupled with a just appreciation of the complexity of the problem such treatment presented. There was very little useful information bearing on the treatment of these singular ores to be gleaned from the literature available, and it cannot be said that those operating then existing works minimized the difficulties to be met with. That these difficulties—metallurgical, commercial, financial and hygienic—were very real may be inferred from the fact that of eleven works actually built in Ontario for the treatment of Cobalt ores, only three survive as going concerns. To the wastage chargeable against the mining industry as the result of misdirected prospecting, exploitation of unremunerative mineral deposits, and so-called "wildcatting," may be compared the very considerable losses incurred by the backers of the eight defunct plants just referred to.

Leaving out of consideration the methods of treatment that have been used and discontinued, the usual procedure is to first fine-grind and sample the ore or concentrate, and then smelt in a blast furnace. This at once separates the non-metallic or rock materials as a slag; effects a separation of a part of the silver combined with antimony and arsenic—the so-called silver buttons; volatilizes a part of the arsenic as fume, and so leaves the cobalt and nickel combined with arsenic in the blast furnace speiss.

This primary separation having been made by the very simple process of melting the ore with a coke fire, it becomes necessary to consider the four primary products. This consideration leads us far from what has been called "the sweet simplicity of fire," as applied to the the treatment of ores and metals.

The treatment of the slag is summary; it is thrown over the dump or used to ballast the track.

Silver Buttons usually consist of about 80-85% silver, the balance being chiefly antimony. Most of the undesired components may be removed by melting and blowing with air. Silver does not oxidize under the conditions and so remains on the furnace hearth, while the oxides of the impurities either depart as fume or are raked off as skimmings. By appropriate means the silver may be refined on the hearth to the extent desired, or it may be cast as anodes for electrolytic refining.

In the electrolytic refinery the crude silver anodes are treated in an electrolyte of silver and copper nitrates to an electric current. The anode undergoes dissolution and the silver only plates out on the cathodes. The impurities of the anodes remain either in solution or fall as sediment in the anode compartments whence they may be removed and disposed of. The cathode silver is of the highest purity and has only to be washed, melted and cast into bars for shipment.

Arsenical fume from the blast furnace is collected in cloth dust filters called bag houses. As the fume laden gas current from the furnace top is rather hot, it is led through appropriate flues wherein it may partly cool and deposit coarse dust particles before it is filtered. Under proper operating conditions the bag house retains all the solids in the gas stream, and, without it, it may be said that such ores as those of Cobalt could not be safely treated in any even partly settled locality.

After collection in the bag house, the fume is put into refining furnaces from whence white arsenic is volatilized and collected in suitable condensing and filtering arrangements. This white arsenic is sold chiefly to plate glass works and to makers of insecticides. At one time a demand arose from one of the belligerent powers for metallic arsenic. This demand was met by the manufacturers of the metal by the reduction of white arsenic with carbon in large cast iron retorts. This, though but a small matter, is one more item in the record of war time achievement to the credit of this country.

When one takes up the treatment of speiss, he takes upon himself a most grievous task. Essentially an artificial arsenide of a metal or metals of the iron group, it may present a degree of complexity that is quite disconserting. Iron, Cobalt, Nickel, Zinc, Copper, Lead, Silver, Antimony, Sulphur, Arsenic, are the substances practically always present in Cobalt Speiss, and usually small amounts of several other elements are also found.

The practice in one works is to grind and roast the speiss with salt to chloridize the silver and then leach out the silver with a solution of sodium cyanide. The silver is then thrown out with aluminium powder, washed and melted to make bars of great purity. Other practice does not extract the silver at this stage, but recovers it in the smelting of the insoluble residue after separating the greater part of the cobalt and nickel.

All processes separate the cobalt and nickel from the speiss by dissolving them out from the roasted speiss with acids. Sulphuric acid is usually employed on account of its cheapness. The solution of sulphates is next purified until it is technically free from undesirable substances, when the cobalt and nickel are successively precipitated as hydroxides by hypochlorate and alkali respectively. These hydroxides are dehydrated in suitable furnaces and either ground and sold as Cobalt and nickel oxides, or reduced with carbon to produce the metals.

Until the last four or five years practically all the Cobalt produced was utilized in the form of oxide for the manufacture of enamels, ceramic colors and for correcting the color of crockery made from inferior clays. The development of "Stellite," a hard alloy of cobalt, chromium and other metals led to a considerable demand for metallic cobalt. There was also some demand for the metal from the makers of high speed steels, many of whom add small amounts of cobalt to toughen and improve the wearing qualities of their product. Most of the cobalt metal used throughout the world is made in Canadian works by reduction of the oxide with carbon and melting the metal in electric furnaces.

The nickel derived from the cobalt ores is only a trifling part of the Canadian output of that metal, as the very great production from the Sudbury ore entirely overshadows it. Neverthless it is of interest that metallic nickel has been regularly produced in Canadian works from Cobalt ore before any commercial quantity was made in Canada from Sudbury ores.

National Highways and Good Roads*

By Capt. J. A. Duchastel de Montrouge, B.A.Sc. M.E.I.C.,
Hon'y Pres., Canadian Good Roads Association.

It is somewhat embarrassing, addressing a meeting of Engineers on the subject of Good Roads, one would feel more at home in talking to a gathering of the rank and file, men requiring to be taught the gospel of good roads. Every engineer realizes the very great importance of a system of good roads. It will be unnecessary for me to point out the great benefits—material, social and economical—that go with road improvement.

Permit me to bring to your attention some of the conditions we have in Canada today. At the present hour and with increasing rapidity, we will be face to face with the great problem of finding employment for our returned men and munition workers. Many industries will be in the period of reorganization for months to come; railroad construction will practically be at a standstill, and that for many years. Means will have to be taken to create work, and road construction offers in a great measure the opportunity of converting for the good of the country the surplus labor it will have for a long period.

We have to admit to ourselves that, except in a few instances our road construction has been sadly neglected, as compared to European practice. True enough our distances are very large, our population scarcely settled, and our resources limited. Again, nature has in two ways assisted us—first, in providing a wonderful system of navigable streams and chains of lakes, which takes care of the transportation of a great number of our natural products; secondly, the cold weather we experience during several months of the year permits the transformation of many poor country roads into excellent winter roads for sleighing, and in some localities a great deal of our transportation is accomplished during this period.

Railroad companies have expanded in a wonderful manner; we have three transcontinental roads parallelling one another at close range. Many localities depend entirely on the railroad facilities for all their commodities. This condition of affairs is all very well up to a certain point, but there comes a time when feeders, in the way of highways to these railway trunk lines have to be developed. The districts situated twenty miles or more each side of the trunk lines of these railways have to be tapped, and the only way of doing so is to build good roads permitting the settlers and farmers to economically transport their produce to the railroad.

A great deal of talk has recently been indulged about the help the Federal Government should give towards road construction. Several methods of government aid have been advocated. The French system has been advocated by some. There is no question that it is a very wonderful one and its results clearly show its excellence. The roads of France have in a great measure helped to win the great victory of democracy over aristocracy. But unfortunately for us the French road policy is based on a different political organization to ours. In France everything is centralized, the Department of Ponts and Chaussées constructs and maintains all roads—Nationales, Départementales, Vicinales, etc.

Here the situation is quite different; the British North America Act has vested with the different Provinces the obligation of building and maintaining public roads. We know that Provincial rights are sacred and rightly so. Our situation in the road problem is very similar to that of the United States. I would like to study with you an Act passed by Congress in July, 1916, destined to aid the several States of the Union in road construction. I believe that our Federal Government should adopt a measure somewhat on these lines, as in my mind, it is the most practical method to meet our conditions.

These remarks are made with the sole purpose of inviting discussion, and my sincere hope is that it will be extensive and fruitful.

The law in question is entitled "An Act to provide that the United States of America shall aid the States in the construction of Rural Post Roads and for other purposes." It can be summarized as follows:—

1. Congress appropriated a sum of $85,000,000.00 to be apportioned amongst the different States of the Union during a period of five years in the following manner:

$ 5,000,000	to be apportioned during the	fiscal year ending	June 30/1917
10,000,009	do	do	June 30/1918
15,000,000	do	do	June 30/1919
20,000,000	do	do	June 30/1920
25,000,000	do	do	June 30/1921

Also a sum of $1,000,000.00 annually for ten years up to and including the fiscal year ending June 30th, 1926, for the survey, construction and maintenance of roads and trails within or partially within the national forest.

2. The apportionment of the amount available for grants to each State is done in the following manner:

One-third in the ratio which the area of each State bears to the total area of all the States;

One-third in the radio the population of each State bears to the total population of all the States;

One-third in the ratio which the mileage of rural delivery routes and star routes in each State bears to the total mileage of rural delivery routes and star routes in all the States.

*To be read at the General Professional Meeting, Ottawa, February 12th.

3. Any amount apportioned to any State for any fiscal year as remains unexpended at the close there of shall be available for expenditure in that State until the close of the third fiscal succeeding the year for which apportionment was made. Any amount apportioned and unexpended after a period of three years shall be re-apportioned to all the States.

4. The Secretary of Agriculture, who is intrusted with the application of the Law, is authorized to co-operate with the States through their respective *State Highway Department*, in the construction of rural post roads.

5. All roads constructed under the provisions of this Act shall be free from all tolls.

6. The Federal authorities contribute only 50% of the total cost of constructing any portion of road.

7. Any State desiring to avail itself of the benefits of the Act must submit its project to the Federal authorities. Before any grant is made, surveys, plans and specifications must be submitted and approved, as well as the location, character and methods of construction.

8. No payments on account of any work are to be made until the Secretary of Agriculture has assured himself that the work has been constructed according to plans and specifications, and no payment shall be made in excess of $10,000.00 per mile, exclusive of the cost of bridges of more than twenty feet clear span.

9. The construction work and labor in each State shall be done in accordance with its laws and under the direct supervision of the State Highways Department, and subject to inspection and approval of the Secretary of Agriculture.

10. It is the duty of the different States to maintain the roads constructed under the provisions of the Act, and the Secretary of Agriculture shall, if any such road is not being properly maintained, penalize the State by refusing any further grants under the Act.

11. Items including engineering, inspections, and unforseen contingencies, shall not exceed *ten per centum* of the total estimated cost of the work.

12. The cost of administering the provisions of the Act must not exceed *three per centum* of the appropriation of any fiscal year.

13. In the Act:

(a) the term "rural post route" is construed to mean any public road over which the United States mails are now or may hereafter be transported, excluding any street or road in a locality having a population of over 2500 or more, except when on portions of streets or roads along which the distance between the houses average more than 200 feet apart.

(b) the term "construction" is construed to include reconstruction and improvement of roads.

(c) the term "properly maintained" is construed to mean the making of needed repairs and a preservation of reasonably smooth surface, considering the type of the road, but shall not be held to include extraordinary repairs nor reconstruction.

For the purpose of drawing a discussion allow me to present to you my views in the matter of Government aid.

I believe that a Highway Branch of the Public Works Department or Railways and Canals Department should be organized, and that this Branch should be intrusted with the duty of examining and reporting on all projects brought up by the different Provinces, with a view of obtaining Federal aid.

Each province should maintain its sovereignty over the roads constructed within its boundaries, and the Provincial Highway Departments should continue to exercise the same authority and duties they have at the present time.

No project should be considered by the Federal authorities unless presented and vouched for by a Provincial Highway Department.

We should do our best to keep politics out of the administration of a Good Roads Aid Act.

The Federal government should provide but 50% of the funds necessary to build roads of national importance, or international highways. By "roads of national importance," I mean roads connecting centres having a population of at least 20,000 inhabitants.

A sum of $50,000,000. should be voted immediately by the Federal government to aid the construction of roads throughout the different provinces, and this sum should be apportioned to the provinces during a period of five to seven years. Apportionment of this amount should be made only on the basis of population; the areas of our provinces having no relation to their needs or importance. The relation of the mileage of existing roads in each province to the total mileage in the country having, in my mind, little or no importance in our case.

Any amounts unexpended by a province during a given fiscal year should be carried over, for a limited number of years, to the credit of the said province, as in the American Act.

All roads constructed under Federal government aid should be free from tolls.

All road specifications, plans and details should be standardized and adopted by the different Provincial Highway Departments and Federal Department.

A higher limit than $10,000. per mile as the contribution of the Federal Authorities should be fixed. It is the feeling in the United States today that this amount is not always sufficient.

As one of the most important problems in road construction is "maintenance," our bill should go the limit on this score, and compel each province to thoroughly maintain all highways over which the Federal Government has spent money.

No time should be lost in obtaining Federal aid for the construction of roads, because it will take considerable time to organize a Federal Roads Department, and the study of the different problems submitted will also require some time.

Design and Construction of Reinforced Concrete Viaducts

At Mileages 0.9 & 1.8 North Toronto Subdivision, of the Canadian Pacific Railway

By B. O. Eriksen, A.M.E.I.C. and H. S. Deubelbeiss, A.M.E.I.C.

General Description and Design.

The greatly increasing freight traffic and a still greater prospective increase in passenger traffic, due to the agreement between the Canadian Pacific Railway and the Canadian Northern Railway, whereby the latter acquired running rights over the Canadian Pacific Railway, from Leaside Junction to North Toronto Station, necessitated the double-tracking of the line between these two stations.

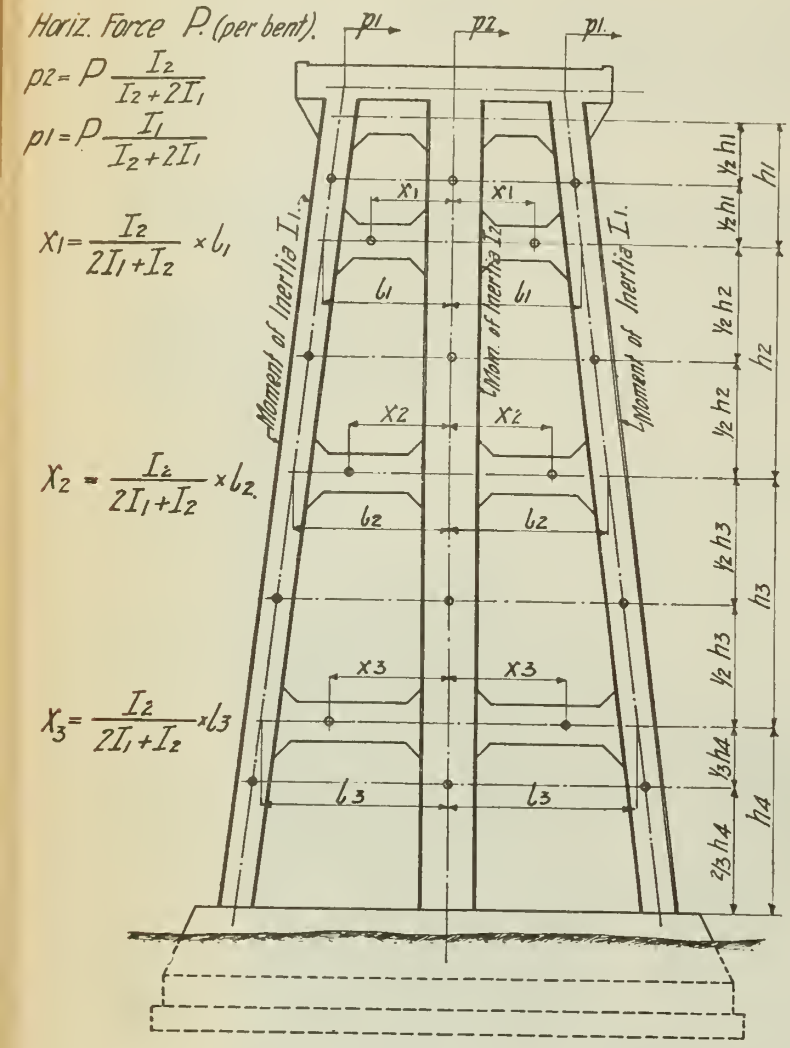
Canadian Pacific Railway Viaduct, Toronto.—Bridge 1.8 Completed.

While this line is only about two miles long, several reinforced concrete culverts required extensions and two important bridges, one at Mileage 0.9 from Leaside Junction and the other at Mileage 1.8 therefrom had to be rebuilt. The existing single track steel viaducts at these two points not being adequate for the present heavy rolling stock, and still less for future requirements, had to be rebuilt, so that these bridges would not limit the use of heavier motive power on this important link. Bridge 1.8, being located at the limit of the North Toronto yard required an extra track for switching purposes, so as not to interfere too much with the main line traffic.

Estimates for both bridges were made for building them in either steel or reinforced concrete. The higher cost of steel viaducts and the uncertainty of the delivery of structural steel were the deciding factors in the choice of Reinforced Concrete Trestles as built and here described.

While no designs were prepared for concrete arches at these points, the possibility of building such was considered. The limited right of way at the bridge sites, however, and the necessity of building temporary trestles within these limits, made the maintenance of traffic in building arch structures a most difficult problem. The designs adopted, where all slabs were pre-moulded and the bulk of the concrete could be cast in forms on the ground, promised a much speedier and safer construction,

*Read at a meeting of Montreal Branch, Thursday, January 16th.



$$p_2 = P\frac{I_2}{I_2+2I_1}$$

$$p_1 = P\frac{I_1}{I_2+2I_1}$$

$$x_1 = \frac{I_2}{2I_1+I_2} \times l_1$$

$$x_2 = \frac{I_2}{2I_1+I_2} \times l_2$$

$$x_3 = \frac{I_2}{2I_1+I_2} \times l_3$$

— FIG. 1.—

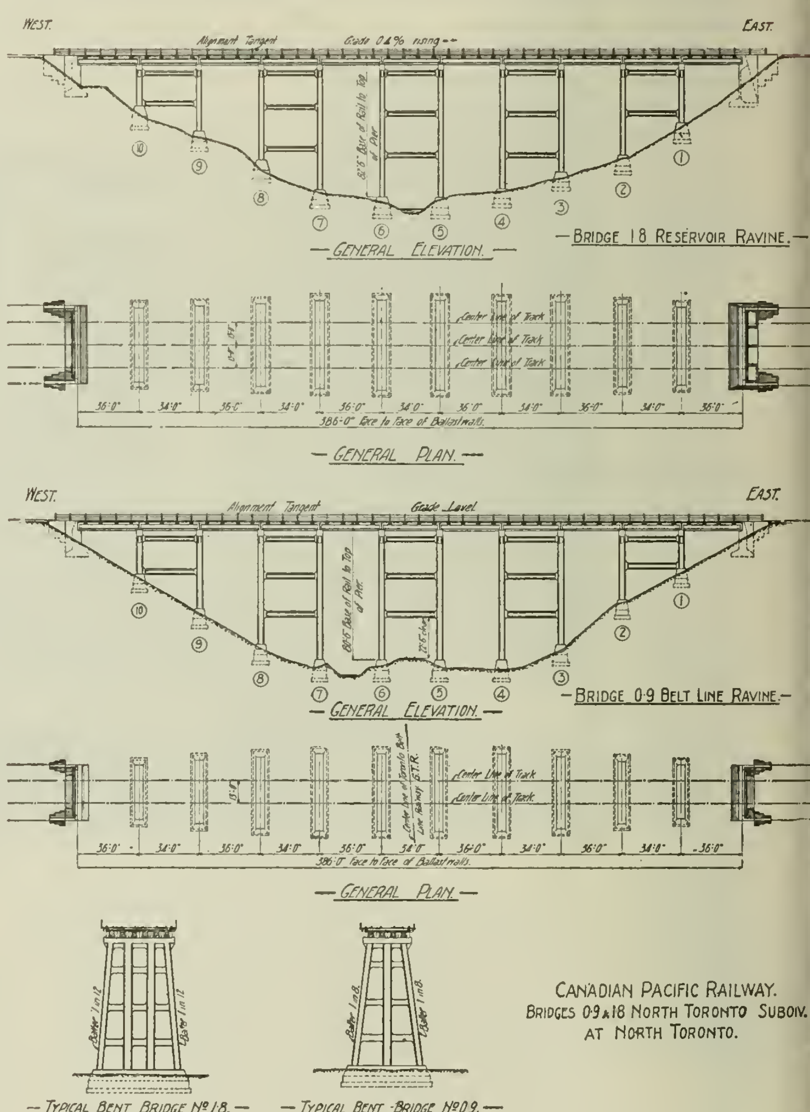
and permitted the carrying of traffic within our right of way without difficulty. These considerations justified the dropping of further studies of reinforced concrete arches, and the adoption of designs of which the principal dimensions are shown on Plate 1.

It will be noted that continuous piers have been used instead of individual pedestals, as is customary for steel viaducts. These, together with the very stiff caps, made each bent act as one unit.

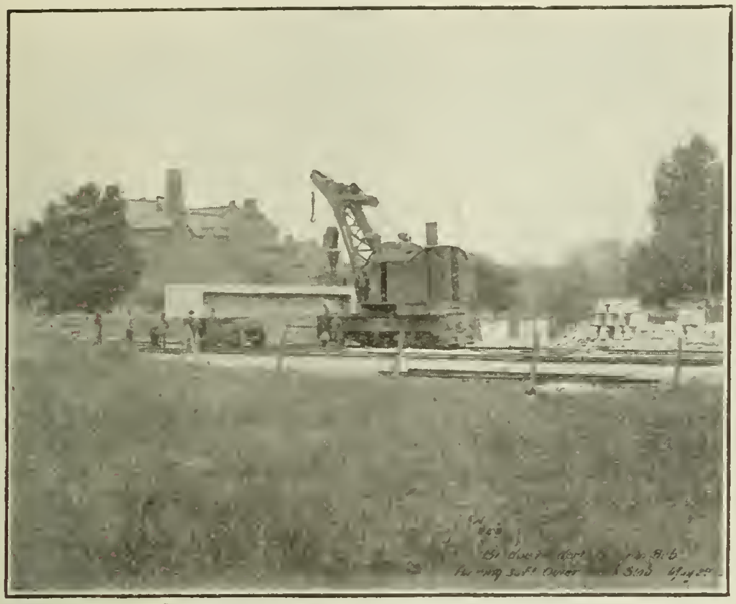
The columns are thoroughly bonded to the piers by the recesses and the rods in tops of same, which correspond to the reinforcing rods in the columns.

In designing the columns, rectangular and octagonal sections were considered; the rectangular section was adopted as the mos suitable to resist the great bending moments that the columns would be subject to. The columns are reinforced with longitudinal rods anchored into the concrete by ⅜″ diameter bands. On account of the unusual size of these columns, these bands were made in sections, so that intermediate bars would be thoroughly anchored into the body of the columns. These bands were not considered to act as hooping owing to their rectangular shape. The tower bracing consists of struts reinforced to resist the bending moments due to their own weight and the various horizontal forces acting on the tower. In order to improve the appearance and reduce the weight, the vertical faces of the longitudinal struts were given a three inch recess. It will be noted that the longitudinal and transverse struts are arranged alternately. At all intermediate points, bending moments, due to transverse forces, will then be practically zero, where the moments caused by the longitudinal forces are maximum. Sliding surfaces for the main slabs are provided by ½″ steel bearing plates on caps of the bents; the plates are held in position by 1½″ dowels. As these plates are continuous over the caps of the bents, they strengthen the caps against stresses produced by longitudinal forces on the bridge.

Each track is supported by two pre-moulded simple T Beams. The end brackets shewn on these slabs do not bear on the caps, but are kept clear by the steel



Bridges 0.9 & 1.8 North Toronto Subdivision at North Toronto.



Canadian Pacific Railway Viaduct, Toronto.—Turning of Slabs.

bearing plates which they overhang; they are intended to strengthen the horizontal flanges and improve the appearance of the structure. The top surfaces of the slabs have a smooth finish and are sloped towards drain pipes, placed along coping blocks and between the tracks.

The ballast is held in position by the coping blocks which were pre-moulded in sections and anchored to the slabs by 1″ dowels. After the erection of the slabs and coping blocks, the surfaces in contact with the ballast were waterproofed with a membrane type of waterproofing. This was laid continuously from abutment to abutment, the gaps between slabs being reinforced by additional layers of felt and mastic.

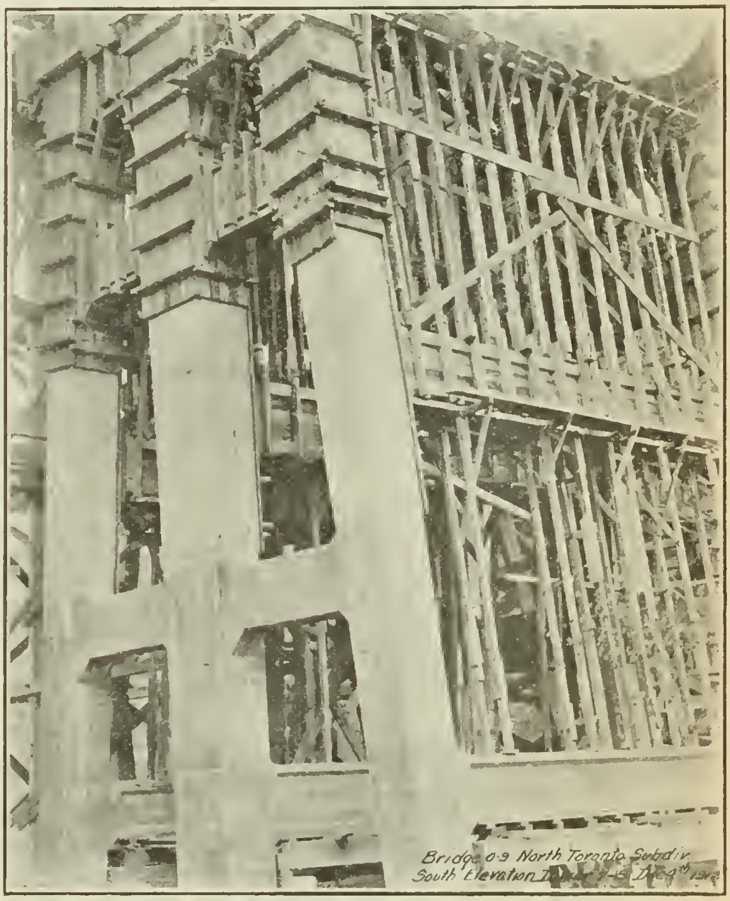
The sidewalks are composed of pre-moulded T shaped slabs, supported on brackets projecting out from the main slabs. The flanges of the sidewalk slabs fit into a horizontal groove in the coping blocks; these coping blocks are heavy enough to counteract any tendency of the T beams to overturn. 1″ dowels hold these slabs in position on the brackets. The hand-railing consists of pre-moulded concrete posts and three rows of 2″ pipe.

The bridges are designed to carry Cooper's E-50 loading, with an impact allowance of $.90\frac{300}{300+l}$ L.L., where L.L. = live load and l = loaded distance in feet. Where stresses are produced by the loading of more than one track l is multiplied by the number of tracks. The design is in accordance with the Specification for Reinforced Concrete of the *Engineering Institute of Canada.*

In addition to dead load, live load and impact, the towers had to be designed to resist stresses due to traction and wind. A traction force equal to 9% of the wheel load was assumed to act at the rail level. This coefficient of traction was derived from diagram in Mr. Blumenthal's paper on " Traction Stresses " (Transaction of the Can. Soc. C. Engrs., vol. xxiv, Part II.).

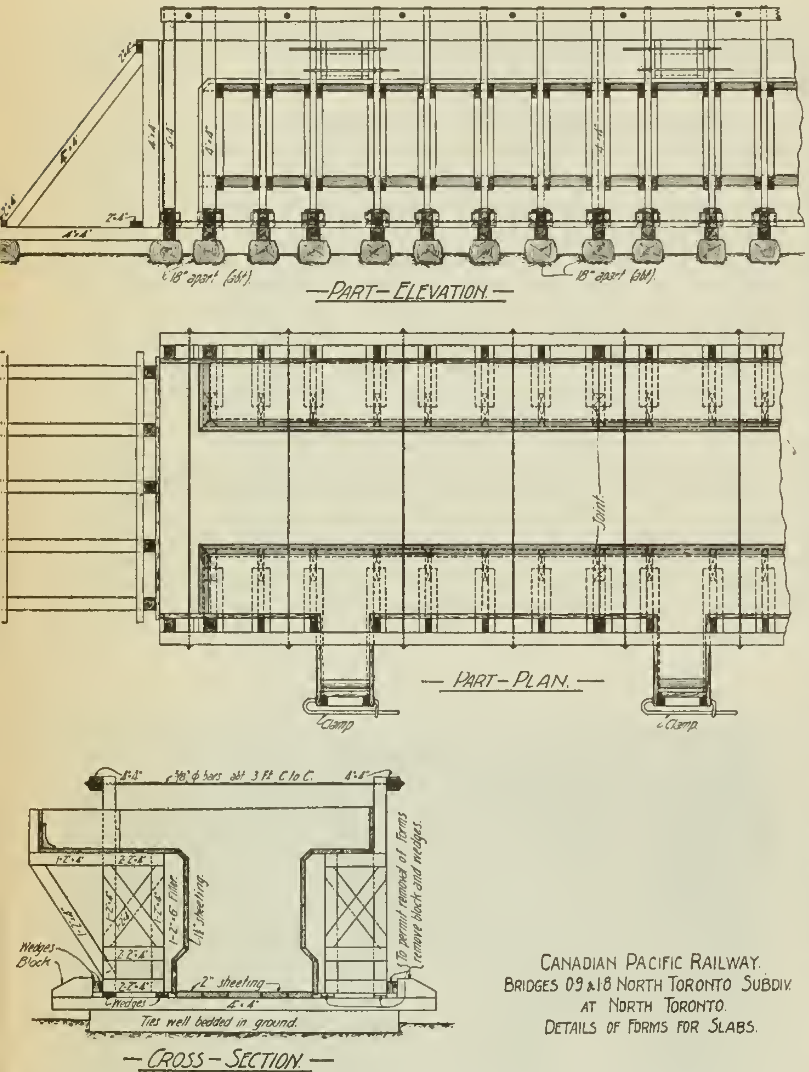
A wind load of 30 pounds per square foot on exposed surfaces of train and slabs, and a similar load on 1½ times the vertical projection of towers was assumed.

Bending moments in columns due to dead load of struts were included in calculations. While this is usually neglected in steel structures, it becomes necessary here, owing to the great weight of the struts. These latter moments, and also the moments due to traction, were calculated by the elastic theory—the equations being solved by the Area Moment Method. Plate X indicates how these equations were developed. The application of this theory, however, for the calculation of moments, due to transverse forces, becomes extremely involved, owing to the shape of the bents. For this reason, points of inflection were assumed as shewn on Fig. 1. Comparison between results obtained by similar assumptions in the case of longitudinal forces with those obtained by the use of the elastic theory shewed that the method adopted would give results sufficiently accurate for the purpose. Stresses in columns including bending moments when one span only was fully loaded were calculated, but found to be below maximum shewn on stress sheet.



Canadian Pacific Railway Viaduct, Toronto.

Bridge 0.9 Tower Partly Stripped.



Bridges 0.9 & 1.8 North Toronto Subdivision at North Toronto. Details of Forms for Slabs.

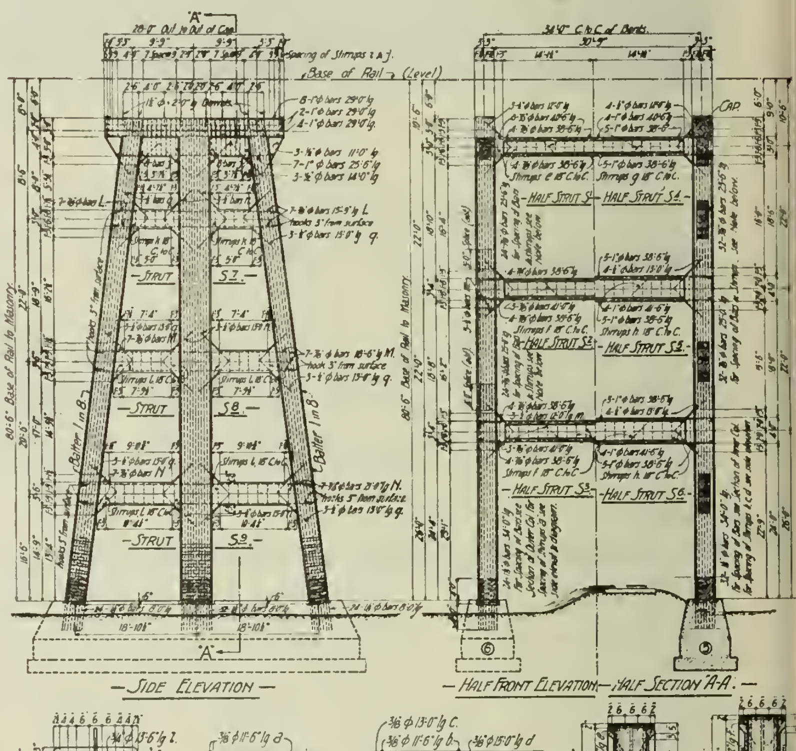
Maintenance of Traffic.

Traffic on both bridges was maintained on temporary wooden trestles, erected on the north side of the old main line track. This was contemplated from the very first for Bridge 1.8, as the spans of the existing bridge were so arranged, that to build a concrete trestle and keep clear of existing steelwork would be impracticable. At Bridge 0.9, however, it was found, that if the new bridge were laid out with 34 ft. tower and 36 ft. intermediate spans, there would be no interference with existing steelwork and traffic could be maintained on the old bridge. This arrangement of spans was, therefore, adopted for both bridges. However, when excavation was started it was found that the condition of existing masonry would not permit excavation for new piers to be carried down to the required depth without endangering the safety of traffic. It was, therefore, considered advisable to build a temporary wooden trestle for this bridge also, rather than attempt to support masonry pedestals on these steep hillsides.

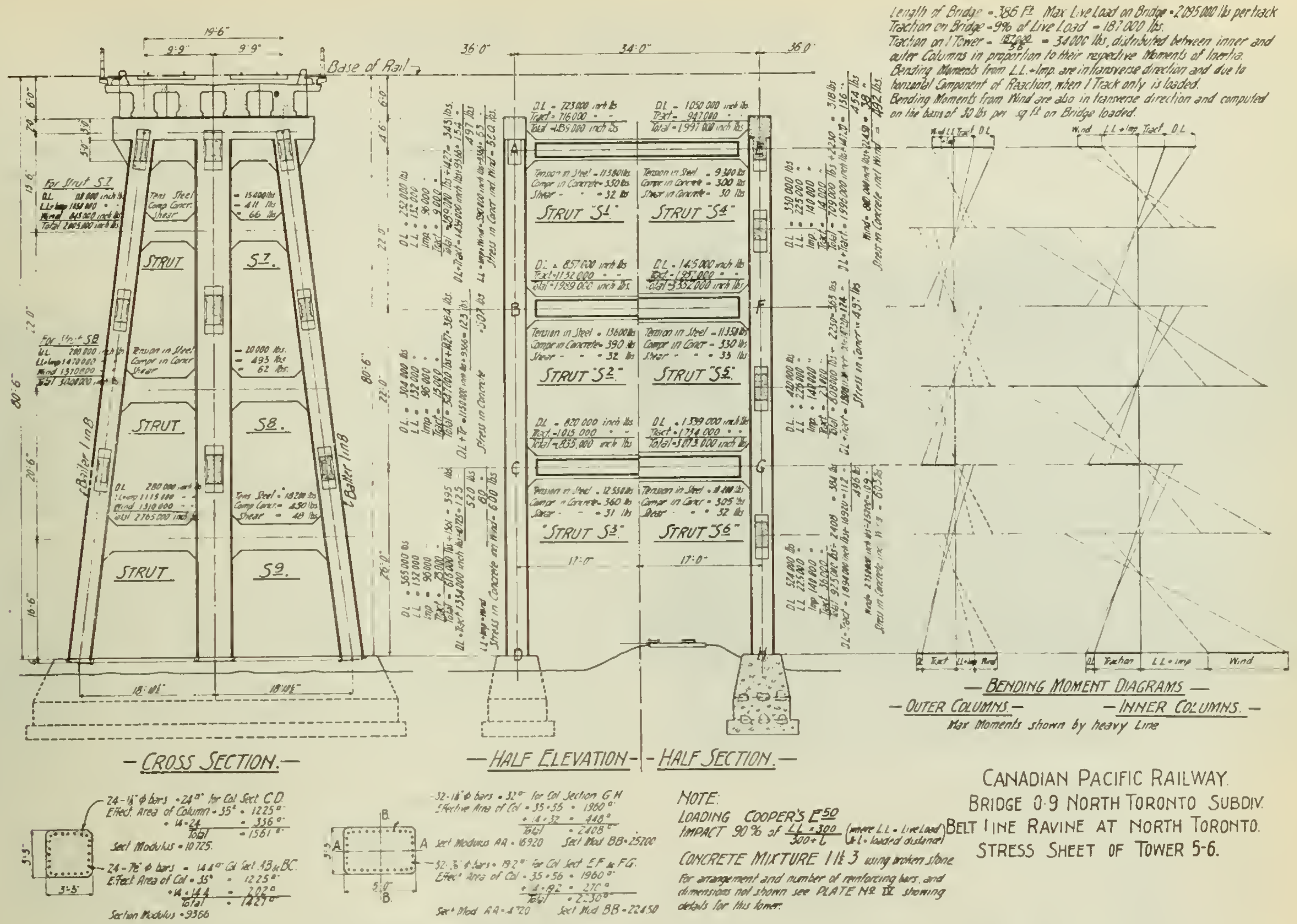
Plant—Bridge 1.8.

A plant for storage and mixing was installed at each end of the bridge, and one at the slab yard about a quarter of a mile east of the bridge. The stone and sand were piled in the open about 25 feet from the mixer. They were stored on plank bottoms to prevent admixture of earth. The cement was stored in three sheds having capacities of five carloads each. They were built of dressed lumber and roofed with ready roofing paper. The floors were kept about 8" clear of the ground in order to make the sheds damp-proof. Each carload was piled separately; there being a space of at least one foot all around each pile.

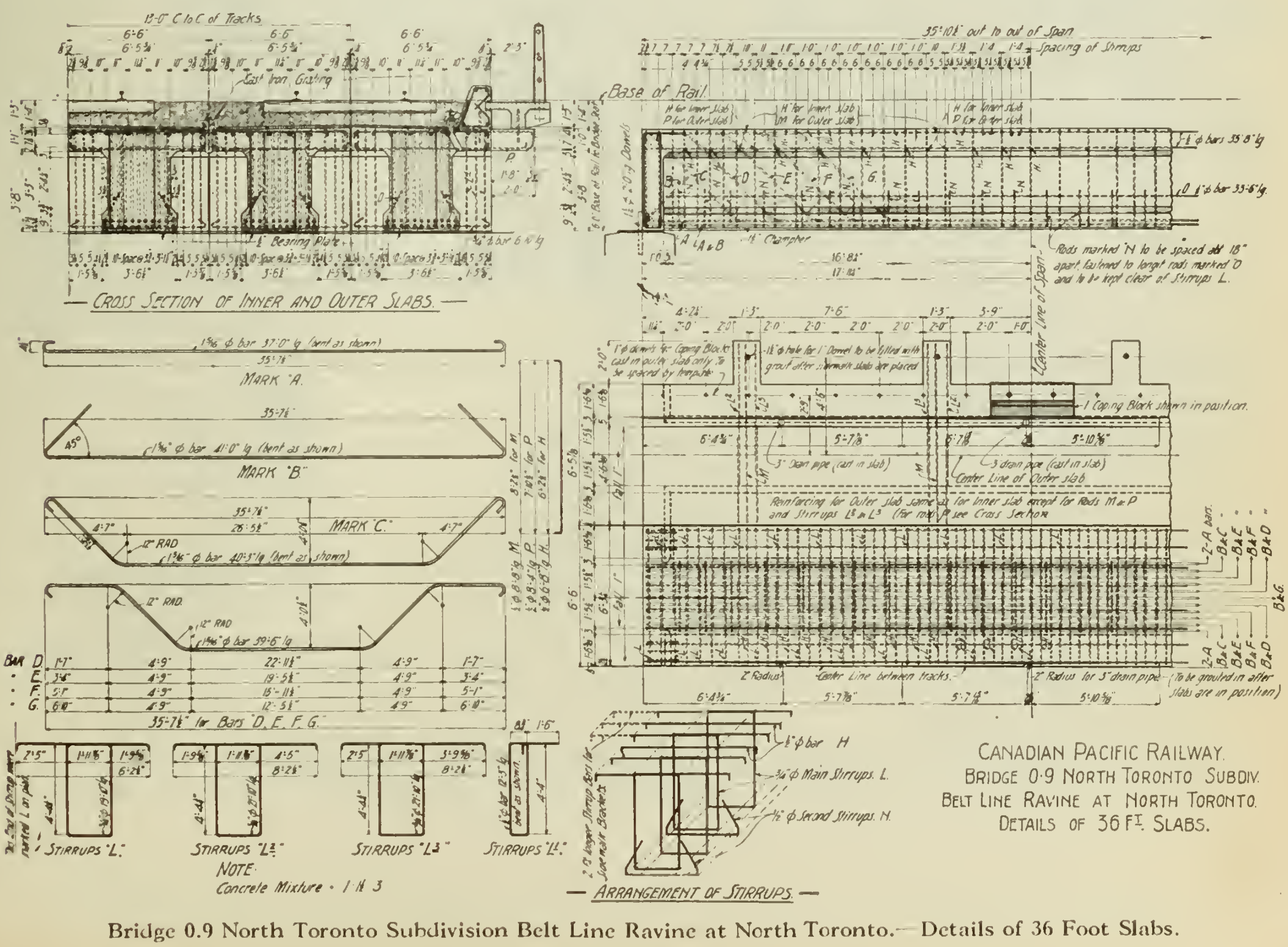
The various materials were wheeled in barrows to the mixers—stone and sand were measured by barrow loads. One bag of packed cement was considered one cubic foot. Water barrels were filled from the City line through 2" pipes, and the water was measured with pails. At each



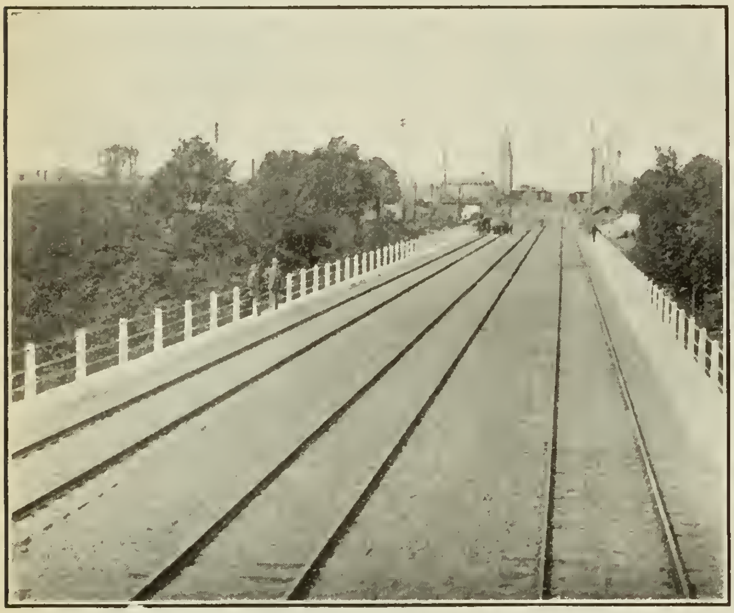
Bridge 0.9. North Toronto Subdivision, Belt Line Ravine at North Toronto. Details of Tower 5–6.



Bridge 0.9 North Toronto Subdivision Belt Line Ravine at North Toronto.—Stress Sheet of Tower 5-6.



Bridge 0.9 North Toronto Subdivision Belt Line Ravine at North Toronto.—Details of 36 Foot Slabs.

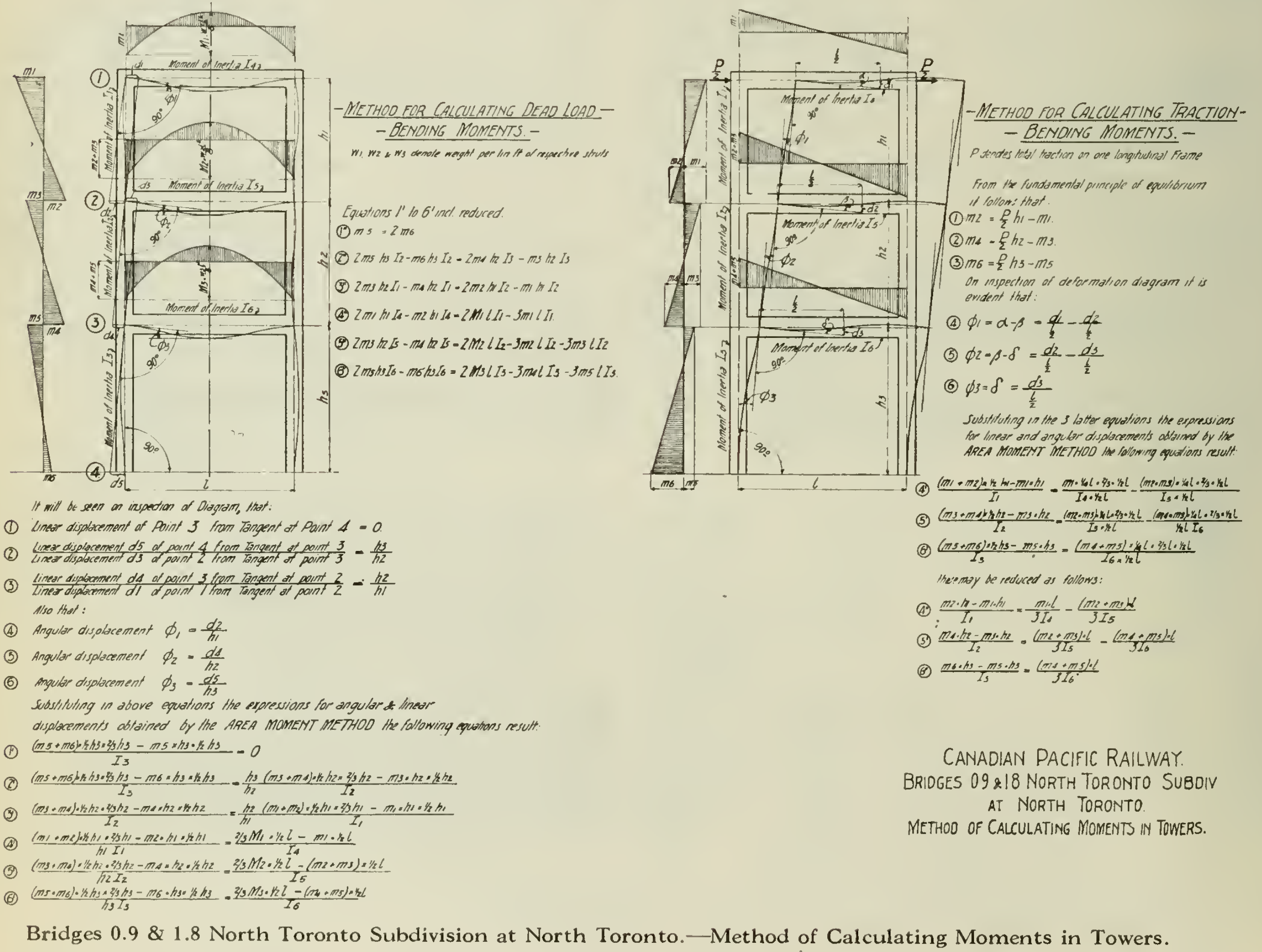


Canadian Pacific Railway Viaduct, Toronto.
Bridge 1.8, Finished Deck.

end of the bridge a 75 ft. hoisting tower was erected from which concrete was conveyed to the various piers and towers by spouting. At the slab yard the concrete was wheeled in buggies along a trestle built on a level with the tops of forms, and dumped directly into the forms.

Plant at Bridge 0.9.

At this bridge only two storage and mixing plants were installed, one at the west end of the bridge and one at the slab yard, half a mile east of the bridge. At the slab yard, materials were stored and handled in the same manner as at Bridge 1.8. The plant at the bridge site, however, was entirely different; the stone received here was too large and had to be crushed and screened to 1″ size. Between the storage pile and the mixer a Gyratory crusher—belt connected to a gasoline engine—was mounted on a platform about 10 ft. high. This crusher was fed from the storage pile by a one yard grab bucket and derrick. The crushed stone dropped through the floor of the platform to an inclined screen, which screened out all particles ¼″ and less. The stone was then delivered from the crusher to an elevated stone bin with an inclined bottom, located directly above the hopper of the mixer,



Bridges 0.9 & 1.8 North Toronto Subdivision at North Toronto.—Method of Calculating Moments in Towers.

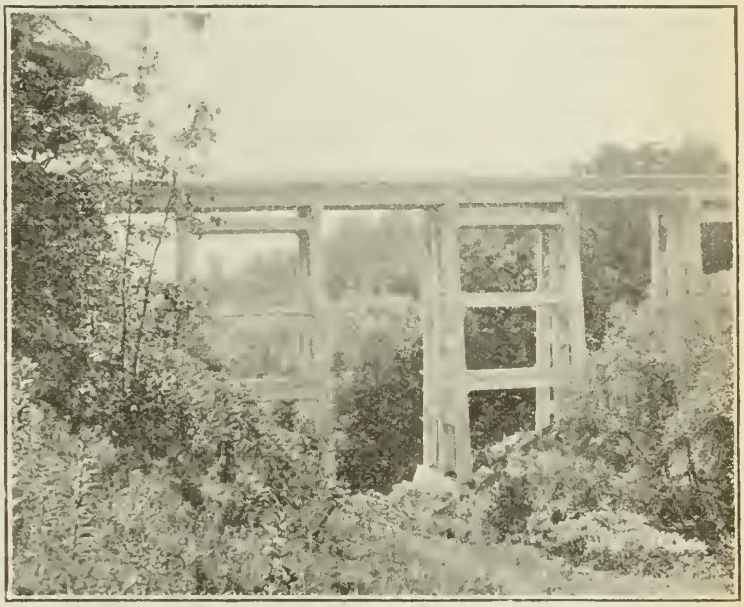
which was set up on a foundation about four feet above the ground. The flow of the stone from stone-bin to hopper was regulated by a steel plate gate, and the hopper was graduated to receive the correct quantities of stone. The screenings from the crusher were used mixed with the sand. The sand was stored on plank bottoms as at Bridge 1.8, and delivered from there to the elevated bin adjacent to the stone bin and handled in same way as the stone. The cement was stored in a shed of similar construction to those at Bridge 1.8 and was delivered to the mixer by the derrick. No hoisting tower was used at this bridge for conveying the concrete. It was wheeled in dump cars running on a narrow gauge track on a trestle constructed at the track level along the bridge. The concrete was dumped into hoppers at various points along the deck of the trestle and delivered from there to piers and towers by metal chutes connected to the hoppers.

Materials.

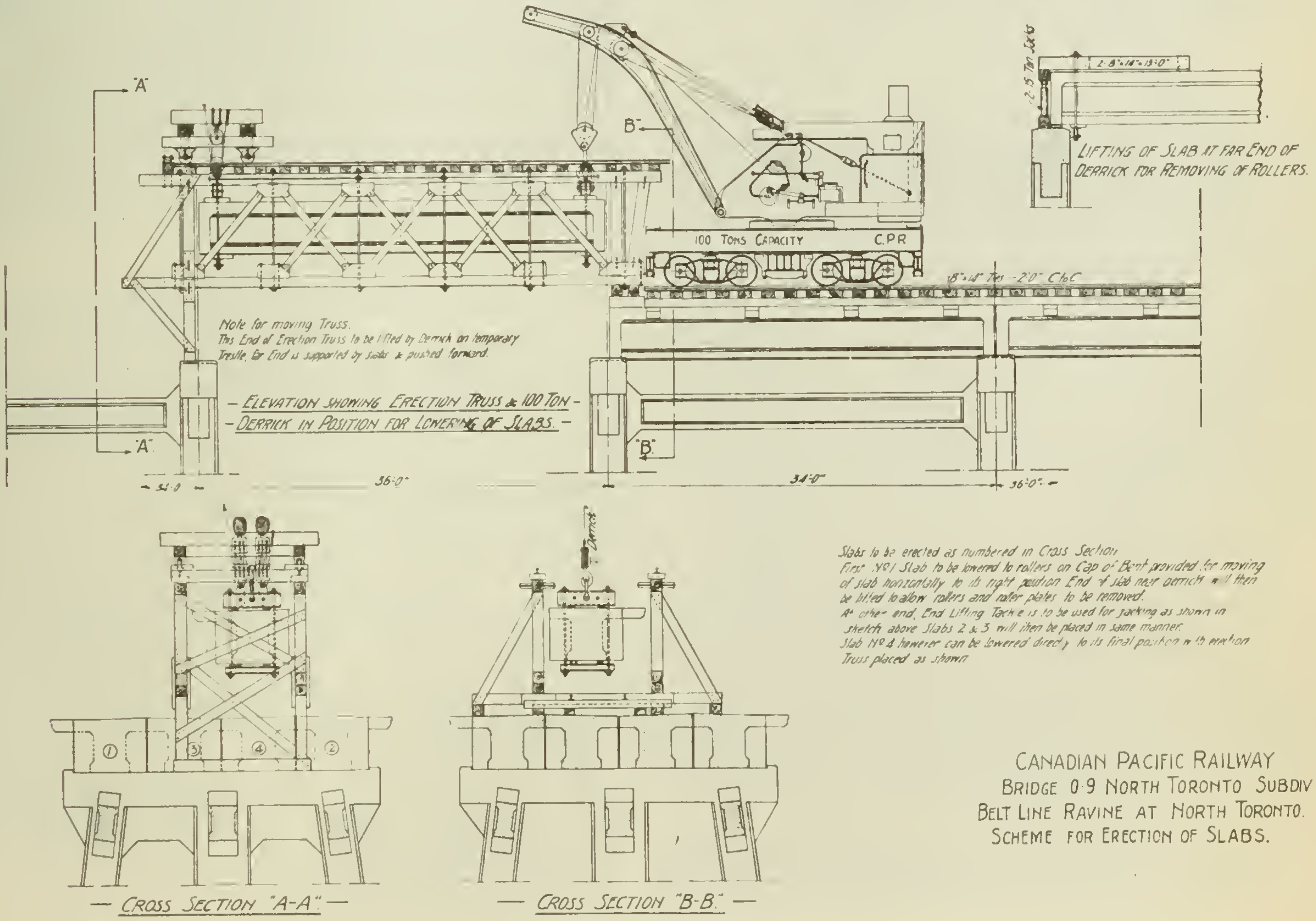
Stone.—The stone used was partly trap rock and partly hard limestone, ranging in size from 1″ down to ¼″.

Sand.—The sand was a natural bank and of a granity composition, well-graded from ¼″ down.

Cement.—Two brands of cement were used. "Pyramid Brand," manufactured by the St. Mary's Cement Company, and "Canada Brand," manufactured by the Canada Cement Company. They were fairly slow setting cements; averaging about 3 hours for initial set, and about 5½ hours for final set.



Canadian Pacific Railway Viaduct, Toronto.
Bridge 0.9 Completed.



Bridge 0.9 North Toronto Subdivision Belt Line Ravine at North Toronto.—Scheme for Erection of Slabs.

While the cement was being unloaded from the cars, one bag in every 50 was opened and a small sample taken from it. These small samples were mixed into one composite sample for each car (one car contained an average of 760 bags). These samples were then forwarded to the testing laboratory in Montreal, shipped in air tight lever top tins which insured that cement did not air slack in transit. Each car load of cement was stored separately in sheds, given a number corresponding to number of sample and held until the inspector was notified that the test had proved satisfactory. All cement used was in conformity with the C. P. R. Cement Specification, 1912.

Treatment of Forms.

The forms were treated with one application of Petrolatum and neutral oil, mixed in the proportion of one of Petrolatum to two of neutral oil, or until a creamy consistency existed. After the forms were fabricated, all holes and large cracks were filled with putty, all knots and putty fillings were then shellacked. The above mixture was then applied on inside of forms with a whitewash brush; the neutral oil penetrated about ¼″ into the wood, leaving a thin waxy film of petrolatum on the surface. The forms, thus treated, did not warp or wind, and moisture did not cause the grain of the wood to rise. A number of the forms were used as often as eight times, and all that was necessary after each stripping was to dust or sweep them off with an old bag or broom.

Heating.

In the month of November, when the temperature dropped to 40°F., heating of the materials was commenced. A live steam jet was introduced into each water barrel, which kept the water nearly to the boiling point while the mixer was running. Sand and stone were heated by perforated steam pipes placed under sand and stone piles. For the very cold weather, the steam was kept on night and day. The temperature of the concrete as it left the mixer was about 55° to 60°F. during the very coldest weather. For the main track slabs, concrete was poured in as low a temperature as 25°F. After pouring of concrete, the tops of slabs were covered with tar paper, kept about 6″ clear of the surface of concrete, a layer of straw was then packed around the entire form and the whole covered with tarpaulins. The sidewalk slabs and coping blocks were protected in a similar manner to the main slabs. The hand-rail posts were cast in a shed heated by a stove.

Bents were housed in from top to bottom with ⅞″ tongued and grooved boards; this housing was built about three feet away from the forms and steam pipes were run into this space. As an auxiliary to the steam heat, a battery of four (4) coke burning salamanders was placed on the ground. With these precautions concrete was poured at a temperature as low as 10° F., and the space around the forms could be kept at a temperature of about 50° F. Heat was maintained for at least three days after pouring was completed.

The longitudinal struts were also housed in and a steam line run along each side near the bottom of the housing. The bottoms of the housings for struts were packed with straw—the tops were covered with tar paper clear of concrete, on this was placed a packing of straw and the whole covered with tarpaulins.

Details of Construction.

Excavation was started during the middle of August, 1917, the soil encountered was generally a hard blue clay, in some cases coarse sand. Before any concrete was placed, each foundation was subjected to a loading test at both ends. An ordinary table having 4-3″ x 3″ legs was used for this purpose; the table was loaded with cement bags filled with sand, the total load corresponding to four (4) tons per square foot.

Piers.—Concrete in the piers was poured in three consecutive runs as follows: The footing course was poured in the open excavation; before this had a chance to set large boulders and stone from the old pedestals, broken up to one man size, were imbedded in the top surface in three rows and about three feet apart; thus a good bond was obtained with the next course. After the footing course had taken its final set, forms were erected for the pier proper and the surface was thoroughly scraped and slushed with water until all signs of laitance had been removed. The concrete was now poured for the vertical portion of pier. After the top surface of same had been treated in the same way as the footing course, concrete was finally poured for the batter course of the pier. For recesses of columns, templets in the shape of a box with proper number of holes spaced to receive the anchor rods were placed and fastened in position to the forms of the batter course. After the last batch of concrete was poured, the anchor rods were inserted in the holes, and driven to the right depth in the wet concrete. The forms of the piers were stripped after two days and the exposed surfaces rubbed with carborundum stones.

Towers.—Details of towers are shewn on Plate IV, and photographs show clearly the details of forms. In erecting the forms great care was taken not to have any parts braced to, or allow any to come in contact with the trestle carrying traffic, so as to avoid disturbance of concrete while it was setting. The concrete was poured from strut to strut, the brackets at the end of each strut forming hoppers to receive concrete. At every construction joint, trap doors had been arranged in the column forms in order to permit removal of all laitance and thoroughly to clean the surface before any new concrete was poured. The concrete in the column forms was spaded by long handled spades, and the outsides of the forms were beaten with wooden mallets to free any air. A good smooth surface with very few air pockets resulted therefrom. The column forms were stripped after four or five days in warm weather, and after a week or ten days in cold weather. The strut sides were stripped after seven days in warm weather and after two weeks in cold weather. The bottoms of the struts were not stripped until absolutely necessary and never before three weeks in warm and four weeks in freezing weather. All surfaces of towers were rubbed down with carborundum stones.

Slabs.—Details of slabs are shown on Plate V and details of forms on Plate VI. Forms were made collapsible, as is clearly shewn in details. A new bottom, however, was made for each slab. After assembling of forms one end was left open until all reinforcing bars were properly placed and wired together. Bars were supported on pre-moulded dove-tailed concrete blocks 1–7/8″ thick; this made suspending wires unnecessary, thus avoiding obstructions to levelling off top surface of slabs. On slabs, only the exposed surfaces of outer slabs were rubbed down with carborundum stones.

Erection of Slabs.—Erection of Main slabs of Bridge 0.9 was started on February 22nd and completed on April 10th, 1918. On Bridge 1.8 erection started on April 11th and the last slab was placed on June 1st, 1918.

The longest slab weighs 56 tons.

As the 100-ton wrecking crane did not have the reach required for placing these heavy slabs, a special scheme of erection had to be devised. This is shewn on Plate VII, and photographs. At the slab yard, one end of the slab was lifted on to a freight car truck, the other end suspended from the crane. The slab was thus pushed ahead by the crane on to the bridge. Two timber trusses specially constructed for the purpose were placed far enough apart to permit the slab to be lowered down to the bents. The end of slab resting on the track was then hitched to a trolley, which was running on rails on top chord of trusses. The derrick was then moved ahead until the slab had reached the position for lowering down to rollers on caps; after the slab was on rollers, it was moved sideways on them to its final position. When all slabs of one span were erected, the erection trusses were moved forward by the crane to the next span and same operation repeated.

The actual cost per cubic yard of concrete in the various parts of the structure at 1.8 North Toronto, was as follows:

Piers.

Forms.—Including labor, o.h. expenses, and contractors' commission	$1.35 per cu. yd.
Concrete.—	
Materials	3.94
Freight for sand, stone and cement	0.87
Labor	1.61
Incidentals, o.h. exp. and comm.	0.98
Steel	1.07
	$9.82 per cu. yd.

Abutments.

Forms.—Including labor, o.h. exp. and commission	$4.38 per cu. yd.
Concrete.—	
Materials	3.70
Freight on sand, stone and cement	0.76
Labor	3.38
Heating	1.28
Drainage and waterproofing	0.16
Incidentals, o.h. exp. and comm.	1.59
Steel	2.54
	$17.79 per cu. yd.

Towers.

Forms.—Material, labor, o.h. exp. and commission	$13.32 per cu. yd.
Concrete.—	
Materials	4.53
Freight on sand, stone and cement	1.00
Labor	5.75
Heating	4.19
Incidentals, o.h. exp. and comm.	2.65
Steel	14.12
	$45.56 per cu. yd.

Slabs.

Forms.—Material, labor, preparing of slab yard, incidentals, o.h. exp. and commission	$9.15 per cu. yd.
Concrete.—	
Materials	5.67
Freight on sand, stone and cement	0.97
Heating	0.20
Labor	3.11
Incidentals, o.h. exp. and com.	1.55
Steel	13.45
	$34.10
Cost of erection of slabs, per cu. yd.	7.18
	$41.28

Regarding the item, Heating of Towers, the average cost of $4.19 is shewn; as, however, only about three fifths of the towers required heating, the actual cost per cu. yd. was approximately $7.00.

The average cost of materials used and the average rates of wages paid were as follows:

Materials.—	
Lumber	$38.50 per M.
Stone	.993 per ton.
Sand	.295 "
Cement (including bags)	2.00 per bbl.
Wages.—	
Carpenters	51 cts. per hour.
Carpenters helpers	40 "
Laborers	37½ "
Engineers on mixers	55 "
Concrete finishers	41 "

The work was carried out under the direction of J. M. R. Fairbairn, chief engineer, P. B. Motley, being Engineer of Bridges — J. H. Barber, with A. H. Munson as assistant, was engineer in charge of construction, while the necessary investigations, calculations and details were worked out by the writers. The contractors for Bridge 1.8 were Wells & Grey Ltd., and for Bridge 0.9 The Dominion Construction Company, both of Toronto.

Can Earth Roads be Made Satisfactory?

By H. S. Carpenter, A.M.E.I.C., Deputy Minister, Department of Highways

Many states south of the International Boundary are known to the road building fraternity as "earth road states." To be thus characterized does not of necessity imply a reflection on the condition of the roads. It may mean that these states like the Province of Saskatchewan have not been supplied by nature with material from which broken stone or other hard road metal can be obtained within their boundaries, and that they are obliged to make the best of the clay, sand and gravel which is found comercially available for road construction purposes. We know that some states have used this inferior road building material to good purpose. If in addition to being known as an "earth road state" a state has earned the right to be called also a "road drag state," it will have gone a long way towards removing any reproach which the former term may imply.

Saskatchewan is an earth road province and although it would be rashness for any one to state that sometime in the future this province may not be served by main roads surfaced with some form of durable road metal we have to face the fact that there is not at present available material from which to obtain broken stone with which to build hard surfaced roads. This material has been shipped into the province for use in paving our city streets. There is also the possibility that it may be obtained from the rock deposits which cover the northern parts of the province. The cost of this material at present makes its use prohibitive for any extensive program of improvement of our country roads. The same may be said of the relatively small amount which can be obtained from field stone.

We sometimes indulge in speculation as to whether or not some process of treatment may not be devised by which our Saskatchewan clays or gumbo soils may be converted into a material which may be used as a substitute for the broken stone, slag, or other hard durable road-building material found in other countries. It is pointed out that it took many years of patient labor and experimenting to demonstrate that the soil of this great northwest would produce crops. Many of us remember not so many years ago when it was said that the Regina plains were barren. Other sections of this country were at one time looked upon as hopeless from an agricultural point of view. Through the hard work, perseverance and intelligence of the earlier settlers all difficulties were overcome and it was demonstrated that Saskatchewan mud could be so treated as to be converted into the very best of farm lands. It is reasoned then that there is reason to hope that the road builder may in a similar manner work out his own salvation, and in time evolve ways and means of converting the prairie soils into serviceable road metal. Certain characteristics of Regina gumbo it must be admitted are such as to lend encouragement to this optimistic outlook. If you will go out onto one of the unpaved streets of this city a few hours after a rain when the surface has dried out sufficiently to have lost its stickiness, but is still plastic, it will be found that portions of the surface which have been rolled out and compressed by heavy motor wheels have been converted into a material which in that state would make a good road surface. It is so hard that it will take a polish, as tough as leather, and so dense that one would expect it to be waterproof, as it dries out under the rolling of traffic these properties increase. If we could devise some means of fixing it in this condition it might be utilized as a serviceable road metal. But we know only too well what happens to it the next time it rains.

Methods of burning clays have been tried in the construction of "burnt clay" roads. This has met with more or less success in districts where fuel is plentiful and cheap, but this treatment does not promise success in this province where fuel is scarce.

We do not wish to dampen the enthusiasm of the optimist or even of the dreamer, on the contrary they should be encouraged, but in the meantime it does not seem wise that we should defer our hopes of providing this province with good roads until some genius has evolved some magical process of transmuting Saskatchewan mud into hard road metal.

It would seem then that we should devote our energies to making the best use of the material commercially available which, generally speaking, is the material which is within scraper haul or at most waggon haul of our roads. This does not imply that we should not make a judicious selection of this material. In fact it is the neglect to exercise judgment in this respect which is responsible for the construction of a great many miles of poor earth roads. Instances of this are noted in the attempt to construct grades across sloughs when advantage is taken of a dry season to build the grade from the soft alkali mud which often forms the bed of the slough regardless of the fact that good material can be obtained from the banks of the slough. Even where it is necessary to cut down these banks to provide a suitable grade at each end of the fill, good material excavated from these banks is sometimes wasted rather than incur the little longer haul that its use involves, as compared with scraping in the material from the bottom of the slough.

Again attempts are made to build a road entirely of light sandy material or even of fine sand, when clay could conveniently be obtained to mix with the sand to construct a sand clay road, or conversely a clay road is built notwithstanding the fact that sand suitable for mixing with the clay can be conveniently obtained.

It may be noted also that we are not making the most of our resources in gravel. In many districts gravel can be obtained convenient to our roads, and although the presence of these gravel deposits is more or less generally known in each locality this is ignored by those in charge of road improvement work. In order that greater advantage may be taken of our gravel supplies it would be well for each rural municipality to undertake a survey of the municipality to ascertain its resources in the way of gravel and sand. This information should be so recorded as to be available in connection with any

*Read before the Annual Meeting of the Saskatchewan Branch, January 9th, 1919.

scheme of road improvement planned by the municipality. Control of many of these deposits could probably be more readily obtained now than later on after the value of the gravel and sand has increased. A start has been made by the Department of Highways to collect information as to location, extent and quality of gravel and sand deposits in the province. It is hoped this information will be very useful both to the department and to the rural municipalities in carrying out, not only road construction, but also in connection with the construction of concrete culverts and bridges.

It cannot be too forcibly insisted on that the question as to whether or not earth roads will prove satisfactory is largely a question of maintenance. The necessity for this should be faced at the inception of any scheme of road improvement. Provision for financing the improvement should also include provision for adequate maintenance.

The satisfactory road to be built in any locality we may assume to be that road which is most suitable to the conditions for which the road is to be used. The conditions to be considered are soil, climate, nature and extent of the traffic, and the materials available, but also unfortunately we cannot overlook the condition that the road must be suitable to our ability to pay for it. This latter condition so dominates the others that it is generally accepted that we are justified in expending on a scheme of highway improvement only so much as will represent a safe sound investment upon which dividends will be paid, not in actual cash disbursements but in actual cash savings to the community to be served and which has to bear the cost. That is, the tax which will have to be borne to finance the improvement must not exceed the tax which is imposed because of the poor condition of the roads.

The suitable class of roads then is the one that can be built, financed, and maintained from the annual savings represented by the difference in cost of hauling over poor roads and the cost of hauling over the improved road. A careful study of the costs of hauling over different classes of roads has been made by the United States Office of Public Roads, and also by officials of some of the highway departments of the different states. The United States Office of Public Roads gives the cost of hauling on unimproved roads throughout several different states as varying from 24 to 37 cents per ton per mile, or an average of 30 cents. From the insuffcient data I have been able to gather it would appear that the cost in Saskatchewan is at least as high as 30 cents.

The cost of hauling on improved roads is given as 10 cents per ton mile on the first class roads in European countries before the war, making allowances for extreme variations in wages between Europe and the United States, the cost in this latter country is given as not to exceed 20 cents on improved earth or sand clay roads, and from 15 to 12 cents on good gravel, macadam or other more expensive pavements. Similar figures for Saskatchewan are for obvious reasons not available.

B. K. Coughlan, Professor of Highway Engineering in the Agricultural and Mechanical College of Texas, gives the following very conservative figures for the saving in the cost of hauling effected by the following classes of improved roads in cents per ton mile: earth or sand clay roads, 7½ cents; gravel roads, 10 cents; bituminous macadam, concrete or other expensive pavements, 15 cents. These figures are made use of in the computations submitted below. It should be noted here that these figures do not take into consideration the saving in wear and tear on vehicles, harness and animals, nor do they include the undoubtedly great benefits to the community from improved social opportunities, greater comforts, and other benefits resulting from improved roads which, however apparent, are difficult to value in dollars and cents.

Having then the annual saving in hauling costs, if we ascertain the annual traffic which the road system slated for improvement will carry reduced to ton miles we can calculate the annual saving to the community which the improvement will produce. We can then capitalize this amount and thus determine the class of road which is economically suitable. Or conversely having the cost of constructing, financing and maintaining a certain class of road it can be ascertained the minimum of traffic which would be necessary to justify the investment.

In this discussion it is assumed the money necessary to cover the improvement will be obtained by the sale of bonds or debentures. This means that included in the cost must be ample provision for annual maintenance sufficient to preserve the investment during the currency of the bond. This provision is a matter that is too frequently overlooked. Bond money should not be spent for road improvement unless the arrangement provides for adequate maintenance.

The annual cost of the improvement then is the interest on the bonds, the annual sum needed to retire the bonds at maturity, and the annual cost of maintenance. The bonds for earth and sand clay roads should not run over 20 years. This may be extended to 30 years for gravel, macadam and the more expensive pavements.

Following then the method of calculation adopted by Professor Coughlan we can determine the amount of traffic which a road will have to carry to justify an issue of bonds to convert it into an improved road of any particular class as follows:

Earth Road.

Cost of construction estimated at $1000 per mile. Annual cost of maintenance at $75 per mile; Interest on bonds at 6%. Interest on sinking fund 3½%. Bonds to run 20 years. The annual cost then equals .09536 x 1000 plus 75 equals $170.36, which at a saving of 7½ cents per ton mile would require a traffic of 2270 tons or about 8 tons for each working day.

Sand Clay Road.

Cost of construction estimated at $1500 per mile. Annual cost of maintenance at $125 per mile. Interest on bonds at 6%. Interest on sinking fund at 3½%. Bonds to run 20 years. The annual cost then equals .09536 x 1500 plus 125 equals 268.04, which at a saving of 7½ cents per ton mile would require a traffic of 3570 tons or about 12 tons for each working day.

Gravel Road.

Cost of construction estimated at $3000 per mile. Annual cost of maintenance at $225 per mile. Interest on bonds at 6%. Interest on sinking fund at 3½%. Bonds to run 30 years. The annual cost then equals 3000 x .07937 plus $225 equals 463.11, which at a saving of 10 cents per ton mile would require a traffic of 4630 tons or about 15 tons for each working day.

Water Bound Macadam Road.

Cost of construction estimated at $9200 per mile. Annual cost of maintenance at $525 per mile. Interest on bonds at 6%. Interest on sinking fund at 3½%. Bonds to run 30 years. The annual cost then equals .07937 x 9200 plus 525 equals 1255.20, which at a saving of 15 cents per ton mile would require a traffic of 8366 tons or about 28 tons for each working day.

Bituminous Bound Macadam Road.

Cost of construction estimated at $10,300 per mile. Annual cost of maintenance at $700 per mile. Interest on bonds at 6%. Interest on sinking fund at 3½%. Bonds to run 30 years. The annual cost then equals .07937 x 10,300 plus 700 equals 1517.50, which at a saving of 15 cents per ton mile would require a traffic of 10,116 tons or about 34 tons for each working day.

The cost of constructing water bound macadam and bituminous bound macadam roads used above at $9200 and $10,300 per mile, respectively, is taken from a report of the United States Office of Public Roads on the average cost of constructing in the years 1908 to 1911 of 137 miles of the former class of road and 85 miles of the latter, the width of the road paved being in both classes 15 feet. I would not venture an estimate of what these two classes of pavement would cost in Saskatchewan.

I have endeavored to give the results of the above calculations a local application, but, unfortunately, traffic census on any of our main roads are not available. Lacking more definite data I have assumed a hypothetical case. Assuming a main market road leading out from a market center in one direction for a distance of twelve miles and considering only the traffic which originates on the farms for which the road is the main market road; neglecting then the traffic in coal, lumber, and other supplies from the market town to the farms, also any traffic which may use the road, but which originates outside the area tributary to the road. I have assumed that each quarter section will annually yield 30 tons of produce or equivalent to 1000 bushels of wheat. The traffic on each mile numbering from the town out would be as follows:

1st mile	7320 tons
2nd "	7200 "
3rd "	6800 "
4th "	6400 "
5th "	5880 "
6th "	5280 "
7th "	4680 "
8th "	4080 "
9th "	3000 "
10th "	2520 "
11th "	900 "
12th "	840 "

Comparing these figures with the results of the computations for each class of road we find that on no part of this road would the traffic warrant the construction of either water bound or bituminous bound macadam surfaces. The theoretically suitable road would be constructed of gravel for the first six miles, sand clay for the next two miles earth for the ninth and tenth miles and the last two miles would not carry sufficient traffic to warrant even an earth road. In actual practice, of course, the total length of the road would be included in the scheme of improvement and the class of road built be that which the average traffic over the whole stretch would justify.

If the road under discussion in addition to being a local market road were also an interurban road or a trunk road there might be added to the local traffic sufficient through traffic to justify more durable and more expensive pavements. We must face the fact, however, that in comparison with our small population we have a very large mileage of roads to construct and maintain; so that when we are confronted with the question as to whether we should use the money available to build one mile of bituminous bound macadam road or ten miles of improved earth road, we are forced to the conclusion that the province will be best served by making the best use of the material commercially available and that for the present at least we should devote our energies to the improvement of our organization for constructing, maintaining and financing our earth roads.

Economy in Ocean Transportation

By A. W. Robinson, M.E.I.C.

The purpose of this paper is to direct attention to a few points connected with ocean transportation which are deserving of special attention now in view of the altered conditions consequent upon the war. In the replacement of lost tonnage we have now an opportunity to make a distinct advance upon previous practice. It is incumbent upon us to make such an advance and to increase the efficiency of everything connected with ocean transportation to the utmost possible extent in view of the new conditions of increased cost of fuel, labor and materials, and the competition of other nations.

*To be read before the Montreal Branch, Thursday, February 6th.

Conservation of fuel whether it be coal or oil is now a national necessity. Economy in the generation and use of propelling power is now highly developed, and the gains that can be made in that direction are comparatively small. It is in the direction of larger units more efficiently employed that we must look in order to obtain a greater output per man and per horse-power.

How can larger and more economical vessels be profitably utilized, what is their relative economy, and what are their limitations? The writer will endeavor to present facts and data that will enable an independent judgment to be formed.

During the four years that have elapsed there would, in ordinary times, have been a natural increase of requirements to be provided for, but this cannot be figured at the normal rate because of the great interruption to trade and commerce. Much of that trade will now have to begin where it left off and the enormously increased transport due to war material having now ceased is no longer a factor.

During the closing months of war a powerful impetus was given to building vessels of any kind that would promise quick delivery, and a large programme was entered upon, the United States alone undertaking to build 25 million tons. All other nations are striving to contribute their quota. It is impossible to foresee the future or to say how far the present building programme will be pushed, but if one may venture on an opinion, there will soon be a superabundant supply of the smaller class of ships now being built. It is now necessary to meet new conditions and build more permanent tonnage. It is most important that the permanent ships now building and to be built, should be in every way suited to carry cargo at the least cost and that all the factors that contribute to this end should be most carefully studied.

The increased cost of construction and of fuel and labor and the likelihood of competition from Japanese and other sources all have to be met. The earlier ships built during the present period will be handicapped by excessive first cost and to some extent also by inferior construction due to haste and inexperience. For reliable service under stress of all weathers and for freedom from repairs and breakdowns nothing but the best and staunchest construction dictated by long sea experience will suffice. In view of the increased cost of fuel and labor it will be necessary to improve the design not only of the ship itself but of every thing connected with ocean transportation, including means for rapid and economical handling of cargo and improved terminal facilities in general.

These questions are receiving close study and attention from both naval architects and ship owners as well as shipping registry societies and port authorities. There is a society of "Terminal Engineers," and a monthly journal called "Freight Handling and Terminal Engineering," now in its fourth volume.

There is also a comprehensive survey of the resources and development of the British Dominions contained in the great report of the Dominions Royal Commission, already referred to. This report being prepared by the most competent authorities and having for its object the economic linking up of the great Dominions of the Empire merits our most careful study and earnest co-operation.

This Commission was appointed by the British Government in April, 1912, and made its final report in March, 1917, so that it covers much of the war period. Its proceedings and evidence are contained in nine volumes and include the most complete and exhaustive study of the relations of the Dominions to the Empire and to each other that has ever been made.

That portion of the report dealing with the question of ocean transportation is so important that I quote a part of it as follows:

"The war has abundantly demonstrated that the life of the Empire depends upon its sea communication. Whatever the existing magnitude of the ocean-borne commerce between the United Kingdom and the Dominions, and whatever the prospect of its development in the future, producer, manufacturer and merchant alike are concerned and vitally concerned with securing cheap, regular and efficient transport for their goods, and consequently with the progressive improvement of the Empire's shipping facilities."

"We emphasize this point for we feel that in discussions as to the best means of fostering trade within the Empire, its importance has been obscured by other factors affecting the exchange of merchandise, and in particular to the prominence given to fiscal legislation. In our view cheap sea transport is not only of importance in relation to other means of fostering exchange of merchandise, but it also confers absolute advantages on the countries which possess it. So long as freights are cheaper and means of communication better between the Mother country and the Dominions overseas, and between the Dominions themselves, than between foreign countries and the Dominions, so long will trade naturally follow Imperial channels. If, therefore, it is possible to devise some means of permanent betterment of sea-routes within the Empire, a powerful impulse will have been given to Imperial trade, while the strength and cohesion of the Empire will be notably increased."

"The development of cheap, regular and efficient transport (and indeed of quick transport) depends in the last resort on increase in the size and draft of sea-going vessels, and consequently on the existence of harbours and waterways of a capacity and particularly of a depth adequate to receive such vessels."

"To some extent these considerations have influenced the minds of ship owners, naval architects and harbour authorities, but the improvement of isolated harbours is of little avail unless all the harbours on a given route are brought up approximately to the same level. Joint co-ordinated action is required. Individual disconnected effort is of little use. It is, therefore obvious that efforts should be made to correlate and develop the existing and future capacity of harbours and waterways on the great trade routes of the Empire, and to suggest a general scheme for improving the ports on these routes."

The report goes on to state that so far as the Dominions are concerned, Canada is most favored by nature with deep and extensive harbours both on the east and west coasts. Full data is given of all trade routes and available depths at present in all principal harbours, and estimated work to be done at various points to bring them up to standard.

A depth of 40 ft. is recommended as being the limit at present available in principal ports, and that can be attained in some other secondary ports within reasonable time. We have, or soon will have this depth at our own ports on the Atlantic and Pacific. The Panama Canal is 40 ft. Hong Kong, Singapore, Sydney, Hobard and Capetown are all 40 ft. Shanghai contemplates 50 ft.

The most efficient size of a vessel fixed upon by this Commission is the largest that can make use of these main ports, and will be a vessel 660 ft. long, 38 ft. draft, and about 25,000 tons deadweight capacity. Vessels of this size are proposed for the main trade routes to Australia, via Capetown, and to Canada. Also a line from a British port to New Zealand, via Halifax, Bermuda, Jamaica and Panama Canal, giving a faster mail route than via Suez. It is not generally realized that the Panama Canal is directly on the shortest sailing line from Britain to New Zealand and that the distance is 560 nautical miles shorter than the mail route via Suez.

Mail services are also an important subject for discussion. Much improvement can be made in the methods that prevailed before the war in our transatlantic mail service. Instead of numerous trans-shipments by methods involving delay, injury and risk of loss, it should be possible to run a mail train alongside the ship and fit portable rubber belt conveyors that would take the mail bags from the railway car and deliver them directly into the mail room of the ship through a door in the ship's side designed for the purpose. A further improvement would be an ample postal station as part of the railway terminal, so that trucking the mail bags through the streets or along station platforms among passengers and baggage would be avoided.

The increased cost of labor and fuel makes it necessary to devise new ways and means to meet this cost. If all countries suffered the same relative increase we would be in much the same position as before. Manual labor must be superseded by mechanical appliances. Where manual labor cannot be dispensed with it should be supplied with such mechanical aids as will render it more effective. In the manufacturing industries it has been shown repeatedly that the most important factor in cheap production is not the rate of wages, but rather the increase of output. We can well afford to pay high wages with efficient plant and large output.

As in railroads economy in haulage has been obtained by increase of train loads, so in marine transport the simplest and most direct way to reduce costs is to increase the capacity of ships so as to carry more tons of freight per unit of labor and fuel. Theoretically the larger the vessel the greater the economy but practically there are limitations. These limitations are not rigid, and do not bind down the ship as do railroad limits of size, but are elastic and depend on commercial considerations of traffic, freight handling and depth of water, and can be expanded to any extent.

The question is, how far can we go efficiently in increasing the size of ships? The discussion which follows will enable us to find the answer.

In November, 1902, the writer read a paper before this Society on "The Economy of Large Ships," in which he stated the principles governing the case and pointed out that when the 30 ft. channel to Montreal was completed, we could employ a vessel 520 ft. long, 61 ft. beam and 30 ft. draft, which would carry 12,000 tons deadweight at 13 knots speed on 5 lbs. of coal per 100 ton miles. He also pointed out the economy that would result in even larger sizes and deeper draft. That limit has been long since reached and passed. A very full discussion was contributed to that paper by the late E. L. Corthell and printed in our transactions, in which he ably reviewed the development of ocean traffic up to that date

The degree to which size can be carried to be profitable is limited, not by any problem of construction but by depth of water and commercial considerations of traffic.

The superior economy of the large vessel is generally recognized. There exists some difference of opinion as to the limits to which great size can be carried to advantage. Economy in railway transport has been attained by heavier train loads and full car loading. The same principle applies to ships except that they are not limited like railways, and hence can derive a greater benefit.

The following table shows the comparative economy of cargo vessels of 2500 to 25,000 tons deadweight capacity:

Deadweight Capacity tons	2500	5000	10,000	15,000	20,000	25,000
Length of vessel....... ft.	215	300	430	510	590	675
Beam " ..... "	36	44	58	68	72	80
Draft of water, loaded. "	22	25	28½	32	34	36
Speed, sea-miles.......	11	11	11	11	11	11
Indicated H. P.........	1460	1900	2800	3750	5000	6000
Coal per hour.........lbs.	2920	3600	5000	6380	7350	7950
Coal consumption lbs. per 100 ton-miles...	10.6	6.5	4.5	3.9	3.3	2.9

In the above table the dimensions may, of course, be varied to suit different designs, as for instance, if deeper draft can be allowed the hulls may have less length and beams, but the comparison is sufficient to illustrate the great saving in coal consumption in the larger sizes. Thus, a vessel of 2500 tons deadweight consumes 10.6 lb. of coal per 100 ton-miles at 11 knots, while a vessel of 25,000 tons only consumes 2.9 lb. per 100 ton-miles at the same speed. In other words: a given amount of cargo is carried in the larger vessel with 27 per cent of the fuel, a saving of 73 per cent, with intermediate sizes in proportion. Not only is there a saving in fuel but in labor also. These savings are cumulative as the space saved by reduced percentage of machinery and fuel goes to increase the paying cargo space. It will be seen that the largest size vessel in the table corresponds closely with that proposed by the Dominions Royal Commission.

The saving in labor in the large vessel is also most important. The question of finding crews for a great number of small vessels is already proving a problem. Inevitably the standard of skill and experience must be lowered and this will result in loss and inefficiency. The number of crew will vary in different services, but roughly speaking a vessel of 5000 tons deadweight may have a crew of 35, while a vessel of 25,000 tons would only require about 68. That is to say twice the crew would carry five times the cargo. For oil-burning vessels the saving would be still more marked.

A further advantage of the large vessel is that less wharf frontage is required for a given tonnage. Thus a berth for one vessel of 25,000 tons deadweight would be about 700 ft. long, whereas berths for two vessels of 12,500 tons would be 1,000 ft. and for four vessels of 6250 tons, about 1500 ft., and so on, in proportion. Consequently the cost of wharfage accommodation is actually less for the large vessels, although the depth of water required is a few feet more. The concentration of so much cargo on a small frontage will, however, make necessary more floor space in the sheds and much better distribution facilities than for the smaller ships. In other words, the harbor accommodation must be designed to suit the vessel and the traffic.

What are the conditions essential to enable us to use successfully these large and efficient vessels?

Unless they can be worked under suitable conditions they will yield no benefit. These are: (1) Sufficient volume of trade on a regular route to furnish full cargoes, or nearly so; (2) Sufficient terminal and warehouse facilities at both ends of the route to collect and hold available a full cargo ready for loading during the time in port; (3) Improved mechanical appliances for rapid loading and unloading so that the time in port can be reduced to a satisfactory minimum; (4) Sufficient depth of water and sufficient space for manoeuvering in port.

Let us consider more specifically the foregoing points. The first condition, that of sufficient traffic, can be determined from statistics of any given trade route, with allowance for future changes. We are not now considering the tramp steamer, which must seek trade where it can find it, and which must necessarily be restricted to the smaller class of vessel. There is no doubt of ample traffic being available on the main trade routes.

The second condition, that of terminal facilities, is one which is now receiving great attention. To utilize the large economical ship, we must assemble 25,000 tons of outgoing cargo at a time in sufficiently close proximity to the ship's side so that it can be rapidly handled, and at the same time provide for incoming cargo. We must also consider the rail and water facilities for assembling this cargo economically. It will require about 15 train loads to fill such a ship.

Improved mechanical appliances for handling cargo are essential to economy. In the case of bulk cargoes as grain, coal or oil, mechanical means can be and are used most efficiently, and the time of loading and unloading is very short. But with miscellaneous freight no means have yet been devised to supersede hoisting by slings or skips which must be loaded by hand in the hold of the ship. The limiting point will be, therefore, the rate at which slings or skips can be loaded. The hoisting apparatus should be so improved that the lifts are made with safety and high speed, and the capacity of the lifts should be in excess of the capacity of the men to load them so that there should be no waiting. The number of hatches should be as many as can be arranged on the vessel, and with as large openings as possible so that two or more lifts can be used at each hatch.

The chief mechanical improvements which can be made are the adoption of electric hoists on shore instead of steam winches on the ship, and electric trucks to receive the load directly from the hoist and carry it away to avoid congestion. In this way manual labor can be reduced and hand trucking done away with. The electric winch should be double drum, and the hoist arranged with two points of suspension, one over the hatch and one over the point of deposit. In this way perfect control at high speed can be obtained, and no swinging booms or derricks are required.

If the 25,000 tons of cargo in the ship proposed by the Dominions Royal Commission can be unloaded at eight hatches with sixteen hoists, each working at 40 tons per hour, the ship can be unloaded in 40 hours. Much depends, of course, on the character of the cargo.

As long as we are obliged to handle miscellaneous freight in packages of every conceivable size and shape so long will the loading process be subject to more or less delay due to hand manipulation. Some improvement might be effected by giving a preferred rate to standardized packages specially adapted to quick loading. Something may also be done to save the ship's time by carrying small freight in large crates or containers that can be quickly lifted and closely stowed.

In repetition work as in unloading a vessel, a time study should be made of each movement to a fraction of a second showing where the losses are and the methods so improved as to eliminate them.

It has been a time-honoured custom for each ship to have a complete outfit of steam winches and derricks to discharge her own cargo. For the tramp steamer and for ports not properly equipped this is, of course, necessary. But why perpetuate it, and why carry a deckload of obsolete winches and derricks cumbering the ship and weighing hundreds of tons when the work can be better done by electrically operated winches on shore? The steam winch as used on shipboard is probably the most wasteful form of power known. With its long steam pipes and general maintenance it costs at least ten times as much to operate as an electric motor on shore. Hatchways could be made larger if the winches were omitted, and the weight of the whole outfit added to paying cargo capacity. Elecricity can also be made available for rapid distribution and stowage of the cargo on shore.

To give effect to this plan requires that all ports of call for this special ship be fully equipped with all the necessary appliances and standardized to suit the ship. A point for discussion is, shall we construct our ships to suit present terminal facilities and channel depths, and thus put a limitation on them, or shall we adopt a size and type of ship that will give the utmost economy for a particular route, and then design the terminals and shore equipment at both ends of the route to suit that ship? The writer believes that the latter should be adopted and that great economies would thereby result.

The most perfect example of the success of this policy is found in the ore-carrying fleet of the Great Lakes. Here, as is well-known, the vessels are standardized, no unloading equipment is carried on them, and the utmost economy and quick despatch is secured. The hatchways are spaced a uniform distance apart so that a vessel of any length and any number of hatchways will fit under a row of fixed loading shoots and also under the unloading equipment. While the Great Lakes type of vessel and unloading equipment would not be suitable for ocean traffic with miscellaneous cargo, the central idea of a standardized vessel with all cargo handling equipment co-ordinated to it and placed on shore finds full vindication. Portable and inexpensive high-speed electric hoists could be spaced along to suit any number and arrangement of hatches, having a double wire-rope tackle carried in snatch-blocks overhead, and requiring no swinging booms or expensive cranes except for special or heavy lifts. They would also be flexible and would suit any spacing of hatches.

The elaborate equipment of travelling and revolving cranes at some foreign ports is often referred to as an example for us to copy. The author thinks that any system of cranes, especially those involving heavy travelling or revolving parts, is much too slow.

It has been customary hitherto to consider the design of a cargo vessel as inseparably connected with the number of hatches and derrick systems that can be arranged along the deck, and to consider the time required to unload the cargo by this means as one of the factors acting adversely to the large vessel. This was brought out by a paper by John Anderson, on "The most suitable sizes and speeds for General Cargo Steamers," read before the Institution of Naval Architects, March, 1918. In this paper the author discusses fully the characteristics of five sizes of cargo vessels with the number and arrangement of winches and derrick systems to each and shows that at the estimated rate of working the time in port would vary from 2.37 days for 1800 tons deadweight to 13 days for 18,000 tons The latter is the largest size he considers and he concludes that at this size the large vessel begins to be less efficient because of the long time required in port. The most efficient cargo liner he places at 450 ft. long and a maximum draft of 28 ft., and in view of this maximum draft he thinks it is an open question whether the proposed deepening of trade routes should be considered prior to other improvements. Mr. Anderson is undoubtedly right in his conclusions, based on the slow unloading rate of ships' winches, but instead of resting content at 28 ft. draft because of inefficient unloading appliances, the writer thinks that the cargo handling arrangements and terminal facilities should be improved so that we can reap the benefit of the large vessel as already pointed out.

The relative advantages and disadvantages of large ships are clearly pointed out by Mr. Anderson in his paper as follows. The principal advantages are: 1st, reduced initial cost in relation to the deadweight; 2nd, reduced horsepower, crew and coal required in relation to the deadweight; and 3rd, greater seaworthiness. These are all indisputable and well recognized.

The disadvantages he states as follows: The increased length of time required to load and discharge; the unsuitability of certain harbors, loading berths and dry docks, and greater loss in case of mishap or disaster. Let us consider these disadvantages specifically. First, as to longer time to load and unload. Undoubtedly it will take longer time to discharge 25,000 tons than a less amount, but this can be greatly reduced by improved and faster methods as already pointed out. Furthermore, the cargo can be discharged from the large ship at a much faster rate than from the small owing to the greater number of hatchways and hoists in use at once, consequently the detention does not increase as the weight of cargo, but in a much smaller ratio.

The second disadvantage is the unsuitability of many harbors, berths and dry docks, etc. My answer is, let these small and unsuitable harbors continue to be served by the smaller vessels and by the tramp steamers, of which we will soon have a superabundance, and let us equip certain harbors on our main trade routes specially for the most economical ship.

The last point is the greater risk of loss in the large vessel. The best answer to this is experience, and statistics show that total losses of large and seaworthy ships are comparatively infrequent. Furthermore, as pointed out in my former paper on "Economy of Large Ships," the risk of accident is in proportion to the number of voyages and these are less in the large ship. Finally the risk of possible loss can hardly be adduced as a valid argument to cause us to forego the undoubted advantages.

The question of draft of water is one of the most important as affecting the use of the large and efficient ship. The 660 ft. ship proposed by the Dominions Royal Commission will have a draft of 38 ft. requiring a 40 ft. channel at least. The ruling depth of ports of the first-class at the present time is 40 ft. The depth of Panama Canal is 40 ft. The present depth of Suez Canal is about 30 ft., but is soon to be 33 ft.

A. D. Swan in his paper on "Deep Water for Harbors and Cargo Handling," read before the American Association of Port Authorities, Sept., 1918, gives a resumé of the question and quotes authorities on the subject. The British authorities "expressed a preference for at least 45 ft. as the minimum depth which harbor engineers should recommend and work for, because although at the present moment 40 ft. might be a satisfactory minimum working depth, the demand for shipping would grow so steadily as to make 45 ft. necessary before even this depth could be achieved."

The same paper also quotes Prof. Biles' calculations showing that the most efficient draft for a ship 1,000 ft. long would be 57 ft. 6 in. and that it was not unreasonable to predict that within 20 or 30 years a depth of harbor of 60 ft. could be profitably employed.

It is clear that deep draft more than any other factor contributes to the economy with which heavy loads can be carried, in fact it is impossible to reap the benefit of cheap transportation without adequate depth of water. Hence the efforts that are now being made to increase the depth in all harbors to a point commensurate with their needs.

Another point in which improvement can be made is in provision for life-saving. By the rules now existing ships are obliged to carry a load of life-boats adequate for the whole population on board. In a passenger liner carrying, say 4000 people this is an onerous and useless requirement. In emergency this fleet of boats cannot be launched, and the history of most disasters is that people are precipitated into the sea and left to cling to a chance oar or piece of wreckage. The writer has long advocated that the life-boat accommodation be reduced and that the supply of automatically floating accommodation be increased in the form of rafts, pontoons or floatable sections of deck-houses. The entire bow and stern superstructure of the ship might be made to float off by disconnecting fastenings. The lifeboat is a survival from early conditions, and while we cannot supersede it entirely we should made a more comfortable and safe means of keeping afloat for the short time now necessary until relief arrives.

In conclusion the writer has endeavored to point out some lines along which progress can be made towards further economy in ocean transportation. The subject is too large and many sided to reach definite conclusions without much further discussion, but it is certain that there is room for great improvement, and that the opportunity is now.

When, as has been shown, the 25,000 ton ship can carry two and a quarter times as much cargo on the same fuel consumption as a 5000 ton ship and do it with two-fifths of the crew and less first cost, it is clear that immense savings can be made that will vitally affect the whole system of ocean transportation. We may not be able to make sweeping changes in the existing order of things, but we can at least endeavor to see that the additions made are in the right direction. It will be an immense step forward if the suggestions of the Dominions Royal Commission can be carried out as to a service of large and efficient cargo liners on our main trade routes.

What we need is co-ordination, co-operation and standardization. By means of these properly applied we can have a merchant marine which will be so efficient as to more than hold its own with any nation, and which will link up the empire with lines of vessels that will be the closest bond of union and that will carry our products to every corner of the globe.

Modern Boiler Practice *

By F. A. Combe, A.M.E.I.C.†

The object of this paper is to give a brief outline of the principles governing boiler and furnace design, with a review of our present knowledge of the laws related thereto, and the trend of modern practice, together with some general notes regarding boiler installation and operation which may be of interest to Canadian engineers and possibly timely in view of the number of new steam plants and extensions to existing plants which it is expected will be undertaken in this country now that war restrictions have been withdrawn.

During the last eight years there has been a considerable advance in the art of generating steam, following a better understanding of the combustion of fuel and heat transmission in boilers, which, while not leading to any radical change in actual construction, has resulted in improved arrangement of boiler heating surface, with more efficient furnaces, boiler settings and plant operation, and engineers and plant owners are beginning to pay more attention to this very important part of power production.

In the past it has been too often thought that anyone could lay out a boiler room, with the result that plants have been put in without proper consideration of their suitability for the particular conditions, or, even when good boilers, stokers and main apparatus were installed, no facilities for economic operation were provided. More money can be saved or lost in the boiler room than in any other part of the plant, yet, while the latest refinements may have been added to the engine room and electrical side, the boiler room has been considered as a necessarily dirty place to be avoided as much as possible. The condition of this same boiler room under operation is, however, usually a direct indication of the ability of the plant designer or management, or both, as a boiler room need not be dirty, and dirt generally means

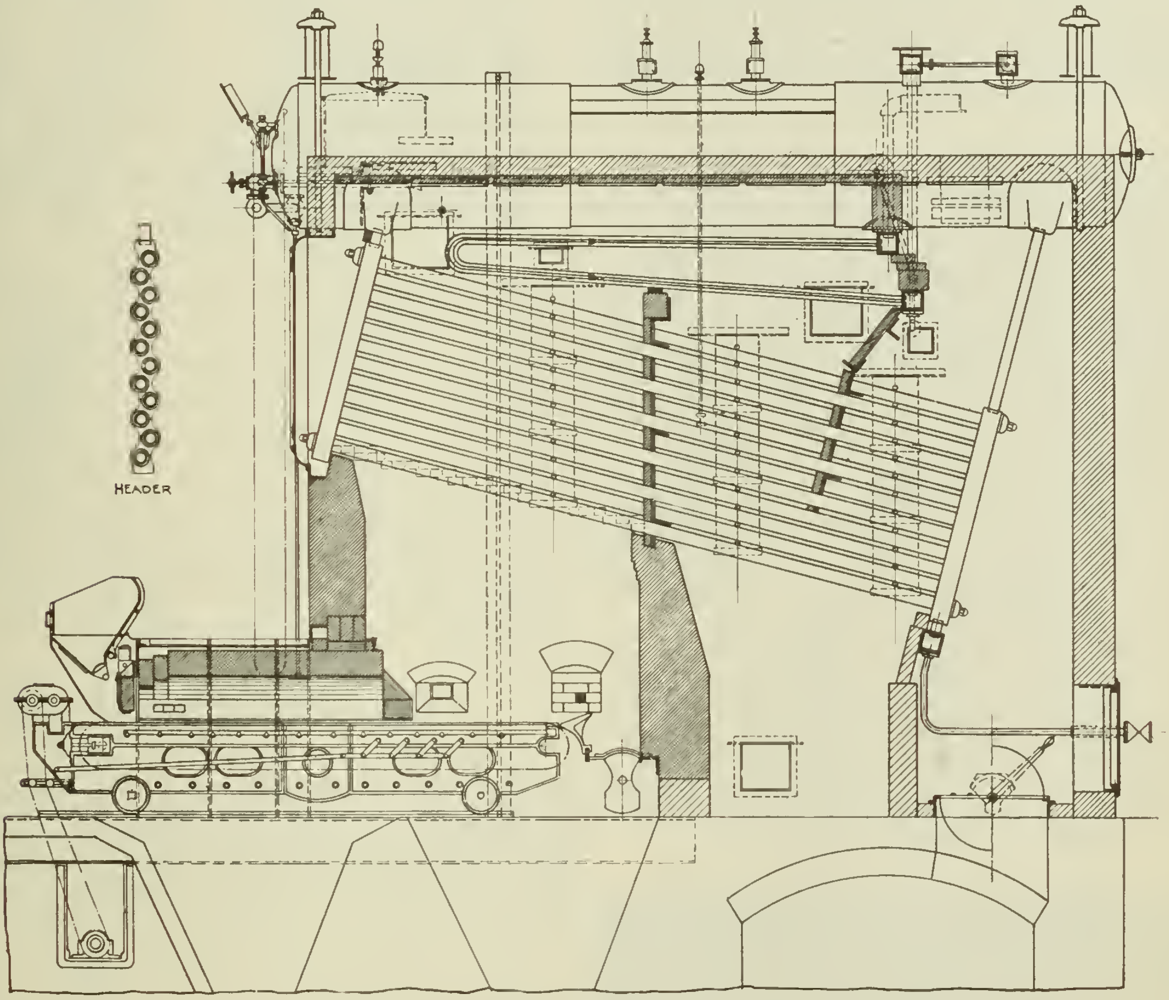


Fig. 1. Standard Longitudinal Drum Sectional Header Boiler.

*Read at Montreal Branch January 30th.

†Engineer for Canada, for Babcock & Wilcox Limited.

inefficiency and bad management somewhere. At the present time when the question of fuel supply is of such importance in Canada, every effort should be made to ensure its efficient use, and steps taken where possible, through education and control, to cut down the enormous waste which occurs annually through inefficient operation, or the false economy or indifference of the plant management.

The operating efficiency of the engine room machinery is largely inherent in the design, that is to say, beyond the control of the attendant, but, although a boiler and furnace must be properly designed, its actual efficiency in service is to a great extent dependent upon intelligent operation and supervision, and for that reason warrants the placing of the most intelligent and highest priced men with every modern appliance in this part of the plant, since an increase of even a fraction of one per cent in efficiency represents the saving of a considerable quantity of coal annually. Such a distribution of labour and superintendence is very seldom the case at the present time.

The present day tendency towards high steam pressures and temperatures, concentration of power and larger unit capacities have led to the practical elimination of the shell boiler for this service and to certain modifications in the setting and rating of water tube boilers. The different water-tube boilers made to-day, suitable for these conditions, resolve themselves into two general classes,—horizontally inclined straight tube boilers and vertically inclined bent tube boilers. Fig. 1 shows a section of a standard longitudinal drum boiler of sectional header construction with vertical baffles, fitted with a superheater and chain grate stoker, having a high furnace setting; and Fig. 2 shows a large double setting vertically inclined tube boiler with superheater and underfeed stokers. For the purpose of illustrating the application of the principles entering into boiler design, the author will confine his attention chiefly to the former type of boiler and its recent development.

The peculiar conditions under which boilers must necessarily work affect their design to a greater extent than with most machines. It is possible to design a boiler which would give a higher efficiency under test conditions than any yet built, but taking into consideration the general class of service, attention, ease of cleaning, first cost and maintenance, a compromise must be made for continued satisfactory and efficient service.

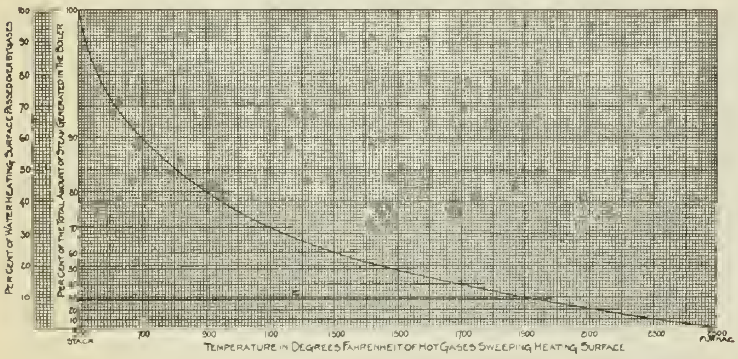


Fig. 3. Heat Absorption by Convection in Standard Boilers.

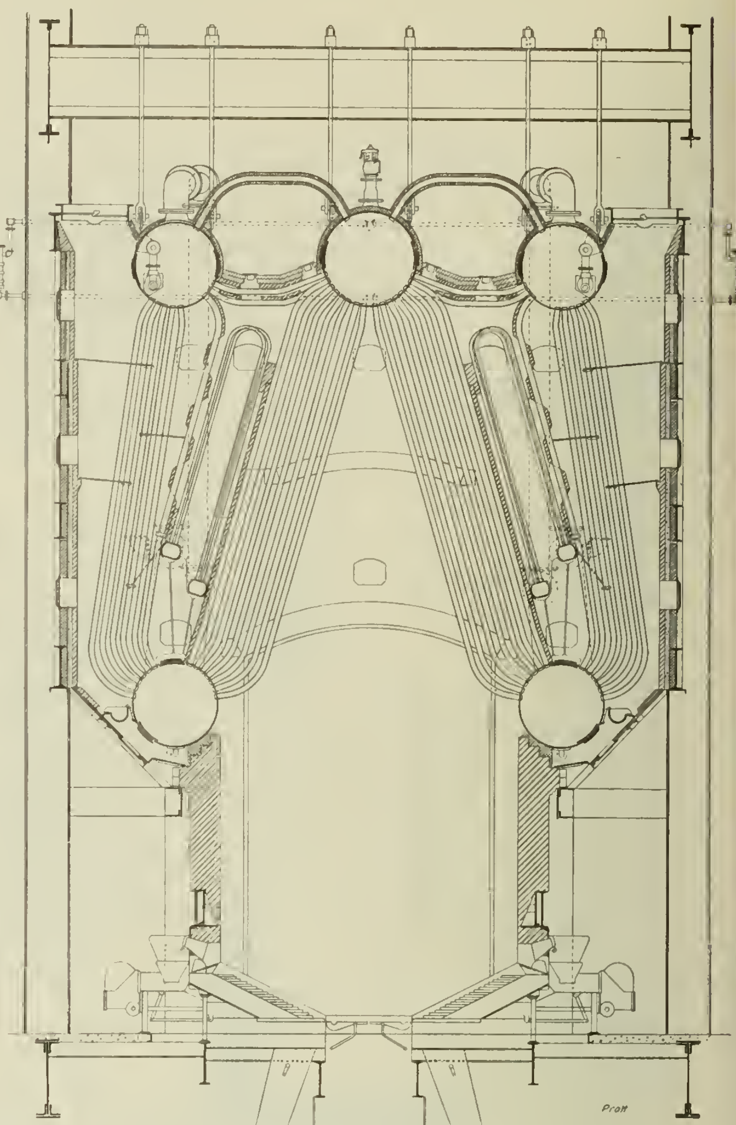


Fig. 2. Double Setting Stirling Boiler.

The more severe demands of modern service and a better realization by engineers of the possible economies to be effected in the boiler room has encouraged the development of boilers for higher efficiency and rating, but it must be understood that, as with any other machine, the higher the rate at which a boiler is operated the more careful attention is needed and the less abuse it will stand. Boilers, engines, or anything else can be, and are, built to stand rough usage, but, if the highest efficiency and rating be desired, they must be treated with respect and for the purpose for which they are designed, for instance:

The function of a boiler is to make steam and it is not at any time the proper place for the treatment and deposit of the impurities in the feed water. Boilers designed for, and operating under, moderate loads will stand a lot of abuse in this way, albeit at a loss in efficiency, and under such conditions the use of chemicals or boiler compounds fed into the boiler with the feed water may be justifiable to lessen adherent scale, but pure soft water

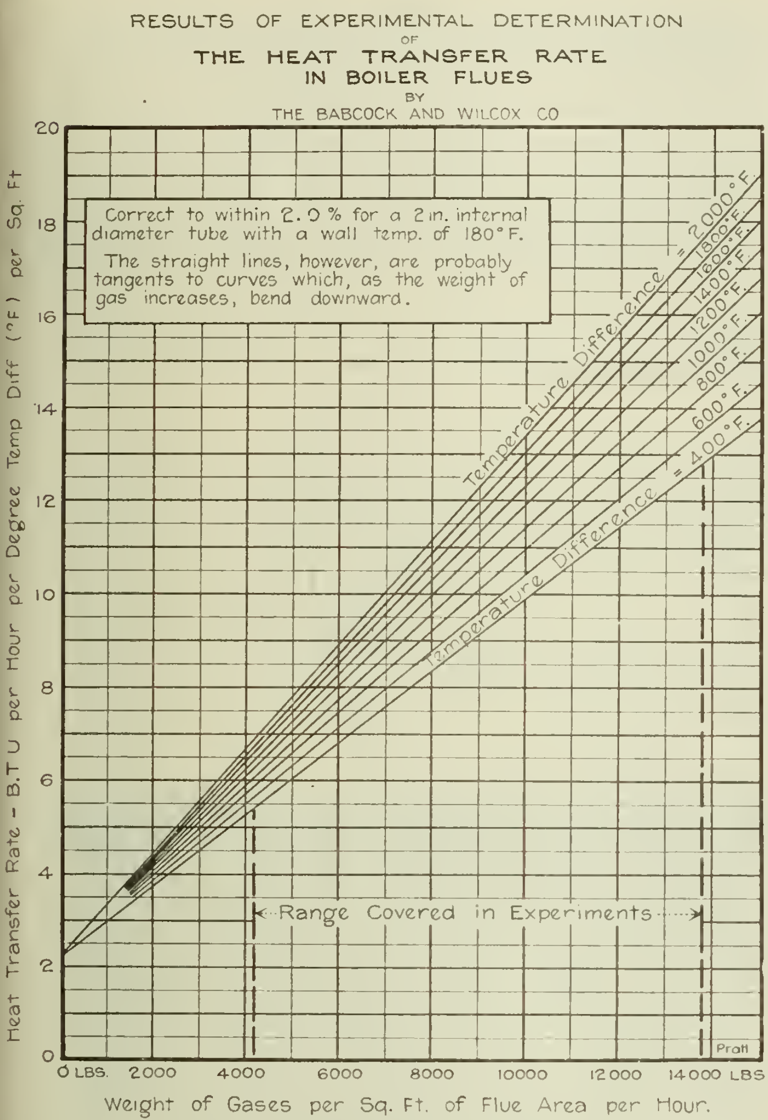


Fig. 4. Heat Transfer in Boiler Tubes.

must be used in any type of boiler which is to be operated at high rates of evaporation in order to get proper benefit from the installation, and to avoid tube troubles, and this usually necessitates the provision of an independent water purifying plant for the raw make up water in the feed supply.

Rating and Capacity.

When speaking of boiler loads or high and low rates of evaporation of boilers, it is necessary to have a clear understanding of the unit on which such evaporations are based, that is, what constitutes a normal full load? In Europe and other countries boilers are usually rated on the quantity of water which they are capable of evaporating per hour under certain conditions with a specified heating surface, but in Canada, following the custom of the United States, boilers are generally rated simply in boiler horsepower, a term often very loosely used.

A boiler horsepower, in its true sense, is solely a unit of evaporation, being equal to 34.5 lbs. of water evaporated per hour from and at 212°F. and equivalent to the standard adopted by the boiler committee of the Centennial Exposition in Philadelphia in 1876. The term has nothing to do, strictly speaking, with the heating surface of the boiler, but at different stages of progress of the art, manufacturers of stationary boilers have adopted as arbitrary standards, certain amounts of boiler heating surface which could be taken as suitable for economically evaporating one boiler horsepower under average conditions of service and with a definite ratio of heating to grate surface. In recent years 10 square feet of heating surface per boiler horsepower or the equivalent of approximately 3½ lbs. evaporation per square foot heating surface has been considered a nominal full load rating for a water tube boiler of standard construction, but considerably higher rates are adopted in modern stationary boilers designed for high duty service, as also in marine boilers where average evaporative rates of 6 lbs. and over per square foot heating surface are usual.

The normal rating, or rate of evaporation, of a boiler, and its point of maximum efficiency is entirely dependent on the design, and while higher rates than 3½ lbs. per square foot heating surface may constitute a so-called overload on a boiler designed for 10 square feet heating surface per boiler horsepower, with a ratio of heating surface to grate area of about 50 to 1, and the efficiency may drop with such overload, it does not follow that the same condition will exist with a boiler and furnace designed for a different rating.

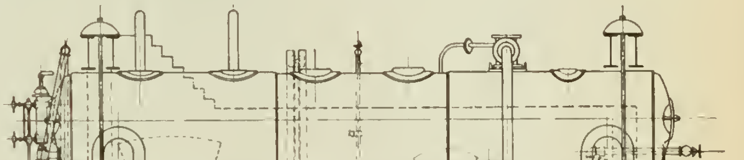


Fig. 5. Modern Waste Heat Boiler.

The rate of conductivity of the metal of the heating surface is sufficiently high to carry away considerably more heat than can possibly be transmitted in boiler service without danger of burning, provided that water be in contact with one side of the metal, so the limit of capacity alone is practically only governed by the positive circulation of the water in the boiler, the cleanliness of the heating surface, inside and out, and the amount of fuel that can be burned, or the gases which can be passed through the boiler.

There is very little difference in temperature of the water throughout any part of a well designed water tube boiler, the circulation being caused by a pumping action set up by the steam bubbles, in a similar manner to an air lift pump, either in the front tubes of a vertically inclined tube boiler, or in the uptake headers of a sectional horizontally inclined tube boiler, and, as with an air lift pump, the rapidity and efficiency of the pumping action is dependent on the avoidance of large chambers in the water passages in which eddies and down currents impede the pumping action. Tests recently carried out on a horizontally inclined tube boiler of the header construction, 28 tubes high, showed that this pumping action amounted to the equivalent of some 18″ of water head when the boiler was operating at rated capacity and that it increased progressively as the load increased. Boilers similar to that shown in Fig. 1, equipped with a duplex furnace are in service operating up to 400% rating during peak load periods or an average evaporative rate of 14 lbs. per square foot heating surface when using purified feed water, so that as far as capacity alone is concerned, a boiler having good circulation can be run at considerably higher rates than has been the usual practice, provided it be kept clean. Cleanliness and positive rapid circulation become of increasing importance as the rate of evaporation is increased.

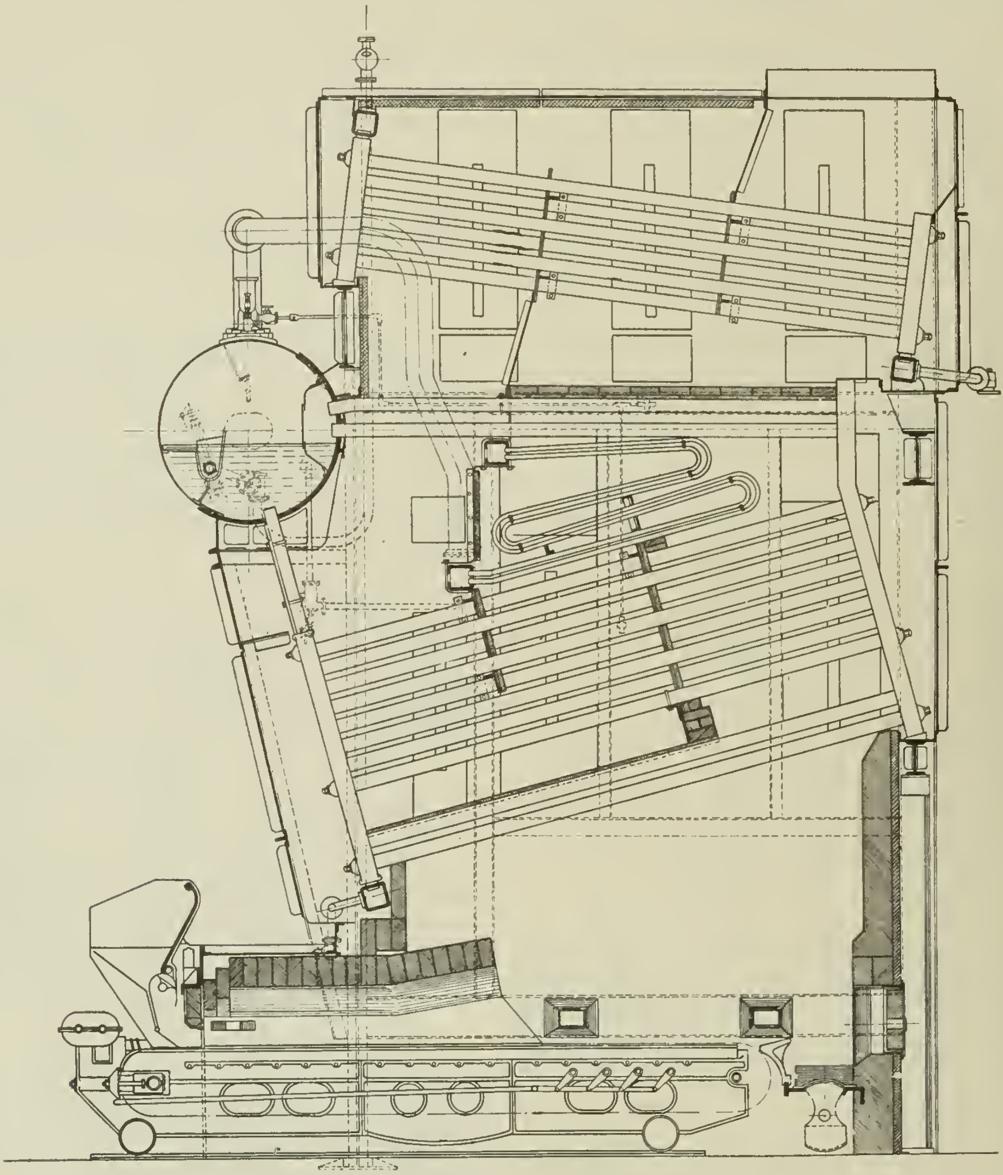


Fig. 6. Cross Drum Boiler with Integral Economizer.

In order to better appreciate the significance of evaporative rates, let us examine the mode of heat transfer in a boiler in the light of our present knowledge, and at the same time see how the general principles are applied in modern boiler design.

Assuming coal to be burned under a water tube boiler at an efficiency equivalent to the production of 12,500 B.T.U. per pound with 18 pounds of gaseous products of combustion; then the temperature above the surface of the fuel bed would theoretically be approximately 2800°. The heat is transmitted to the boiler heating surface, by direct radiation from the surface of the fuel bed and furnace walls and by convection from the hot gases passing over the tubes.

Radiation.

The amount of heat absorbed by the surface of the tubes directly exposed to radiant heat from the furnace is generally proportional to the difference of the fourth powers of the absolute temperatures of the two surfaces, or $= C(T^4-t^4)$ where C is a constant for any unit of surface and time. The laws governing radiant heat or heat rays are analogous to those for light, the heat transfer being extremely rapid, but the great proportion of the heat energy is supplied by the obscure or dark rays, only a very small amount being carried by the actual light or visible rays.

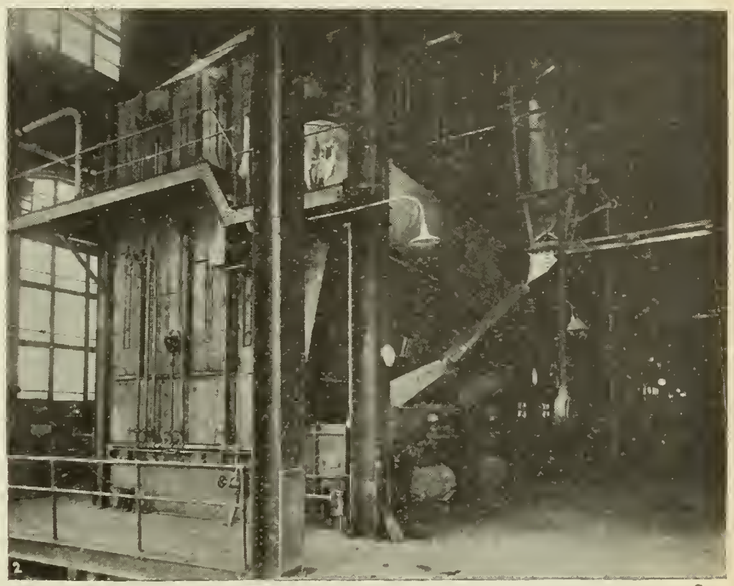


Fig. 8. Boiler Units at Montreal Tramway Company's Plant.

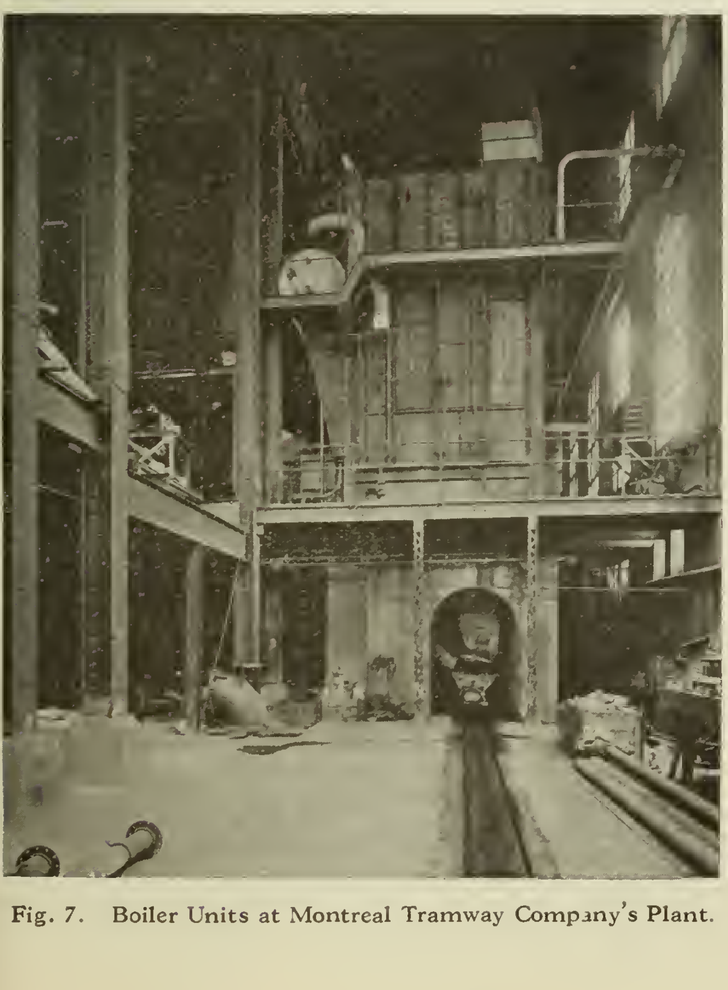


Fig. 7. Boiler Units at Montreal Tramway Company's Plant.

The value of the coefficient in the above radiation formula was determined experimentally for black surfaces by Stefan about 30 years ago, and while this coefficient has been taken as applicable to the partly sooted surfaces in a boiler furnace it is probably far from correct, while the permeability of the gases in the furnace to heat rays, their capability of radiating heat themselves, the reflecting and absorbing power of the fire brick furnace walls and the proper consideration of the exposed areas, are all points on which there is little authoritative data, although investigations are being made into this subject at the present time. Of course a close determination can never be made if the area of the hot surface of the fuel bed is to be a determining factor, as it is obviously impossible to do more than very roughly estimate the average extent of the irregular surface, and there will be, in addition, radiation from the incandescent carbon particles in the gases; but it is questionable if this surface is a necessary factor. With gaseous or oil fuel, we have to deal with

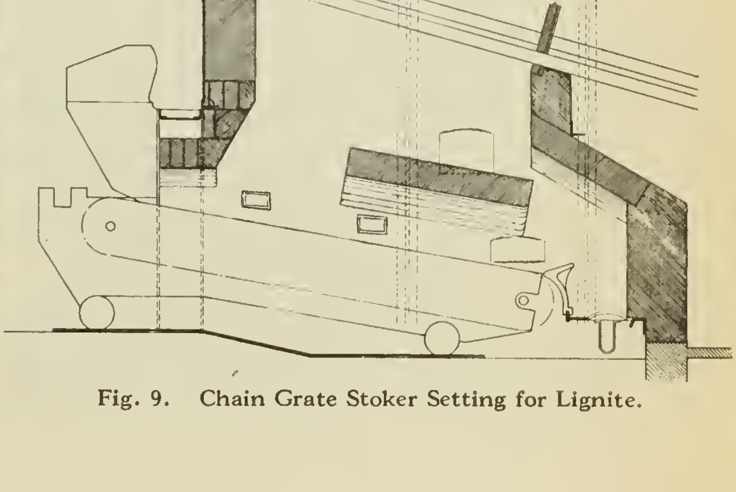


Fig. 9. Chain Grate Stoker Setting for Lignite.

volume radiation which presents a somewhat similar case to that in a gas engine cylinder where the heat from the explosive charge is transmitted to the water jacketed cylinder walls chiefly by radiation, as brought out in investigations undertaken by the explosives committee of the engineering section of the British Association some years ago.

One thing we do know is that in a Babcock and Wilcox boiler, the amount of water evaporated per hour per square foot of surface of the lower rows of tubes exposed to furnace radiation, with a furnace temperature around 2500°F. is at least from 50 to 65 lbs., and as this may represent over one half the total evaporation of the boiler at normal rating, the importance of a full knowledge of the subject of radiation is evident, while it incidentally shows how high the evaporative capacity of a tube is, and that an average evaporation rate of 3½ lbs. per square foot heating surface for the whole boiler gives no indication of the amount of work which any part of the heating surface is doing.

Failure to take into consideration the extent of heat radiation often leads to considerable error in boiler work, both in testing and recording and also in details of the boiler and furnace setting. For instance it is extremely difficult, in fact impossible with the usual type of instruments procurable, to measure exactly the temperature of the gases in a boiler setting owing to radiation from the thermometer bulb or end of pyrometer element to the hot furnace or to the cooler boiler heating surface in close proximity. H. Kreisinger, of the U. S. Bureau of Mines, Washington, presented a paper to the American Society of Mechanical Engineers, in 1917, dealing with this subject, in which he gave the probable error, arrived at by experiment, in temperature measured by a thermocouple placed amongst the tubes of a water tube boiler as from approximately 600° too low at 2000°F. to 40° too low at 500°F. when using a common form of pyrometer with a ½″ diameter element; also showing that the error was proportional to the size or exposed area of the instrument. The author has had some success with a special cap screen surrounding the end of the instrument element, that is, measuring success by the higher temperature recorded, but in any case there will be some correction to make. Even the measurement of the temperature of the flue gases leaving the boiler setting is liable to considerable error unless proper precautions are taken.

Again, the opinion was held until recently that an air space in the walls of a boiler formed a good heat insulator. Actually it is useless and even a disadvantage, as, although still air is a poor conductor of heat, the rate of conduction is proportional only to the actual difference of temperature of the surfaces, whereas radiant heat will pass across the air space at a rate proportional to the difference of the fourth powers of the absolute temperatures of the two surfaces. For low temperatures, as in refrigeration work, air spaces are beneficial, but with a high temperature difference, the heat transfer becomes very great.

To obtain a better insulated wall than that of ordinary red brick for a boiler setting, special insulating material is today often used, either as a middle course between the firebrick lining and the outer wall facing, or on the outside of the brick wall, but it should be realized that if too good an insulation is made, it becomes increasingly difficult with certain types of furnaces to get a firebrick lining to stand the higher temperature attained. Sometimes the entire boiler brick setting is enclosed in a steel casing, but this is rather to give a tight seal preventing the infiltration of air, which occurs through any ordinary brick wall, especially in boilers operated at high ratings with a corresponding greater draft suction in the setting. The cost of these casings is high, but, if properly constructed, are of considerable value and in many cases are undoubtedly a good investment. If they are used, there should always be a course of asbestos or other insulating material between the brickwork and the casing, otherwise the radiation loss may be increased owing to the metal presenting a better radiating surface than the brickwork.

Furnace Duty.

Returning to the furnace and the assumed case, it will be seen that, with the same efficiency of combustion maintained, since heat will be radiated as quickly as generated, the actual apparent temperature will not reach the theoretical figure of 2800° until sufficient coal is being burned to generate the heat necessary to satisfy the radiation equation for 2800° in addition to raising the temperature of the products of combustion to a figure dependent upon their rate of liberation. The stage when this condition is reached will depend on the area of the cool surface exposed to radiation and it does not necessarily mean that apparent high furnace temperature is essential to high efficiency, although they will coincide to an extent dependent upon the constituents of the fuel.

In brick lined extension furnaces or when the lower row of boiler tubes over the fire are encased in brick tiles, as for certain forms of baffling, higher temperatures are attained at a lower rate of combustion on the grate, but this means that the gases also enter the bank of tubes at a higher temperature for the same load, resulting in a corresponding higher exit gas temperature and consequently reduced efficiency, while the higher furnace temperature shortens the life of the furnace brickwork.

With such a horizontal baffling, there will, of course, be radiation from the furnace or hot brickwork to the exposed tubes of the gas passage beyond the tiles, while heat will be conveyed from the furnace to the lower tubes through the encircling tiles by conduction and possibly secondary radiation, but following the fourth power law of temperature difference the amount will be considerably less than for a direct exposure, and it is, therefore, preferable, wherever a high furnace temperature is not necessary for proper combustion, for a lower horizontal baffle to take the form of flat tiles laid on the second row of tubes from the bottom so as to gain the full effect of direct radiation, which is the most active and, therefore, the most economical mode of heat transfer.

If the furnace efficiency could be maintained constant, the temperature of the gases entering and leaving the boiler heating surface would increase with increasing coal consumption, resulting in a continued decrease in overall efficiency as the load increased, but in general practice, the furnace and grate efficiency increases with the load up to a certain point dependent on the proportions of boiler, furnace and grate, so offsetting the drop in efficiency due to the higher flue gas temperature. With a standard setting of boiler designed for 10 square feet of heating surface per boiler horsepower, or an equivalent normal full load evaporation of 3½ lbs. per square foot heating surface, and a ratio of heating surface to grate of about 50 to 1, the maximum efficiency will usually be maintained fairly constant from 90% to 130% rating. Below 90% rating the loss in efficiency is chiefly due to incomplete combustion in the furnace and grate and above 130% rating chiefly due to the increasing exit gas temperatures, the furnace and grate having then reached their highest efficiency. For other proportions and designs of boiler and furnace the point of maximum efficiency will be different; for instance, the very complete tests carried out on the large Stirling boilers at the Detroit Edison Company's plant some years ago showed the highest efficiency of over 80% at 75% rating (based on 3½ lbs. normal evaporation rate) and dropping in a straight line to 76% efficiency at 200% rating. This remarkably high efficiency over such a wide range of load was due to the exceptionally large combustion chamber, promoting almost complete combustion even at low loads; the skilled regulation and operation; and the small proportional radiation loss from the walls with such a large unit. Fig. 2 shows a section of one of these boilers.

The general tendency in modern design is to provide greater and greater furnace volume to ensure more complete combustion before the gases reach the comparatively cool boiler heating surface. Not many years ago the ratio of cubic feet of furnace volume to square foot of grate usually provided was about 3 or 3½ to 1, whereas today we may have 5½ or 6½ to 1 for natural draft stokers and even more for forced draft stokers, particularly when high overloads are demanded. In the Detroit Edison boilers mentioned above the ratio was approximately 9 to 1. For horizontally inclined tube boilers this increased combustion space generally means that the mean height from the floor line to the lower tubes over the fire has been increased from approximately 6 or 7 feet to 9 or 10 feet and over, where conditions permit, and as required by the nature and volatile content of the coal, type of stoker and duty.

Convection.

The best method of passing the gases over the tubes, and the relative advantage of different form of baffling have been discussed at various times, but it seems reasonable that a cross flow over several passes of staggered tubes avoids stratification by ensuring the most thorough breaking up of the gas currents, with the consequently better contact of all particles with the walls of the tubes, while with the first pass at the upper end of the tubes, a contra flow action to the circulation of the water in the boiler is obtained and, at the same time, with a horizontally inclined tube boiler, the circulation will be improved, and the danger of blistering the lower row of tubes lessened by procuring the quick release from the tubes of the steam bubbles formed.

The laws governing heat transfer by convection from the gases passing over the boiler heating surface has been the subject of many investigations, and formulæ have been put forward based on mathematical deduction and laboratory experiment, but the great majority of these formulæ, while holding good within the limits of the experiments, are not applicable without considerable correction for the conditions existing in a full size commercial boiler, especially where the gases pass across a bank of tubes, in which case the area of the gas passage is not constant. In view of the lack of authoritative data on the subject, the Babcock & Wilcox Company, a few years ago, conducted a series of experiments with a specially constructed plant to determine a formulæ with coefficients which could be depended upon, for the rate of heat transfer in boilers.

The relation of the heat absorbed by convection only from the gases to the amount of heating surface passed over in a boiler of standard proportions under coal fired conditions on the basis of 10 square feet heating surface per boiler horsepower is given by the curve, Fig. 3, which shows that the great proportion of the total evaporation takes place in the first pass of the boiler and very little in the last pass; for this reason it does not pay, with these proportions, to increase the heating surface by adding another pass.

A test was published a few years ago of a 4 pass boiler in which the actual drop in temperature through the last pass was only 67° and even this drop was obtained only by reason of the low steam pressure carried (117 lbs. per sq. in.). With a steam pressure of 200 lbs. and a corresponding less difference of temperature between the gases and the water, the flue gas temperature must have been higher and the value of the fourth pass still further reduced.

Waste Heat Boilers.

In direct fired boilers where furnace temperatures are high, and the weight of gas per boiler horsepower comparatively low, there is not a great deal of difference in heat transfer between several different types of standard boilers, fire tube or water tube, when new and clean; but with boilers arranged to utilize the heat from waste gases where larger gas weights are handled, with generally, lower temperature differences, the area, length and arrangement of the gas passages must be very carefully considered in order to obtain transfer rates for an absorption comparable to direct fired practice, and so extract the maximum heat from the gases with an amount of heating surface which will make the installation of a waste heat boiler a commercially economical proposition.

It was principally for such work that the experiments on heat transfer above referred to were undertaken, as with waste gases, the radiation factor being largely negligible, it is possible, with a proper knowledge of the laws governing heat transfer, to calculate very closely the results that will be obtained with a given boiler and vice versa to design a boiler to give the maximum return for the investment.

The results of the investigations are given graphically in Fig. 4, which shows the effect of gas velocity on heat transfer rates. For ease in computation, owing to the variation in density of the gases with the temperature, the velocity is considered in terms of gas weight per unit area.

It will be seen that at low rates of gas flow, as found generally in boiler practice, the transfer rates are affected by the velocity to a much greater extent than by any rate of temperature difference, also that the effect of temperature difference increases as the rate of gas flow increases. The effect of gas velocity on heat absorption had previously been appreciated to a certain extent, but its full importance for waste heat work, as brought out by these experiments, has led to developments in boiler design which has opened up this field to a remarkable extent.

Up to a comparatively few years ago, when boilers were installed to utilize the heat in the waste gases from furnaces, kilns, etc., it was the practice to use boilers of the same general design as for direct coal fired purposes, or even with still larger gas passages in order to interfere as little as possible with the draft at the primary furnace. This meant working on the upper part of the curve, Fig. 3, and necessitated the provision of such an excessive amount of boiler heating surface for the steam produced that the installation became a doubtful investment.

Following the better understanding of the laws governing heat transfer and the possibility of economies from the utilization of a greater proportion of the heat from waste gases, this subject has been receiving particular attention during the last few years and efficient boilers are now in successful operation in connection with all kinds of kilns, furnaces and ovens with temperatures as low as 1000°F.

Fig. 5 shows the side elevation of a typical B. & W. boiler fitted with a superheater, designed for waste heat work.

The high gas velocities necessary for efficiency in waste heat boilers results in greatly increased frictional resistance through the setting, the draft loss running in many cases to over 2″ water pressure and, of course, requiring the use of induced draft fans to handle the gases. The power required to drive the fan is, however, many times offset by the increased efficiency and capacity obtained, while, in many cases, the installation of waste heat boilers has actually resulted in an increased output from the primary furnace owing to the possibility of greater draft at the outlet by the use of a fan in place of the original chimney.

Many factors have to be taken into consideration in waste heat boiler work, peculiar to the particular nature and origin of the gas; for instance the dust held in suspension in many forms of waste gases, especially from cement kilns, has a considerable influence on the weight of gas handled and the draft resistance, and a knowledge of the effect of such factors and the proper way of taking care of them can only be obtained by experience.

Modern Boiler Design.

In modern direct fired boiler design, the principle of higher gas velocities is also adopted where advantage can be gained, and the tendency is to reduce the heating surface, or increase the evaporative rate, of the boiler proper employing it primarily for steam raising, and adding additional independent surface for water heating, in order to get a more efficient total heat transfer by the increase in temperature difference for a portion of the total heating surface. This practically means combining a boiler and economiser in one unit proportioned to give the highest efficiency and resulting in less total heating surface and considerable saving in space and of many of the losses incident to the use of separate economisers.

A cross section of such a boiler is given in Fig. 6., a study of which will show that the maximum effect of direct radiation is obtained while the hot gases, entering the tube bank at the uptake end and passing at right angles across the staggered rows of tubes at high velocity through the long passages of the boilers and economiser fulfil conditions conducive to high efficiency.

In Figs. 7 and 8 are given two views of one of four boilers of this type recently installed at the Montreal Tramway Company's plant at Hochelaga, being the largest boilers in Canada. Each of these boilers contains 5625 square feet heating surface in the boiler proper or steam raising section and 2909 square feet economiser or water heating section, giving a total heating surface for the unit of 8534. These boilers are capable of easily generating over 40,000 lbs. steam per hour at 200 lbs. per square inch steam pressure and 150°F. superheat from a feed water temperature of 120°F. It will be seen that the equivalent evaporative rate for the boiler proper is as high as 8.75 lbs. per square foot heating surface, or 5.75 lbs. for the whole unit, in spite of which, it is possible to reduce the temperature of the gases below what it would be with a standard boiler of 3.5 lbs. normal evaporative rate, that is to say, with considerably more heating surface. Each unit is steel cased, lined with special non-conducting material to minimize air leakage and radiation, and fitted with double chain grate stokers, having a total grate area of 224 square feet.

An interesting feature in connection with these units is the draft apparatus comprising a specially formed stack for each pair of boilers, having a constricted throat into which a high pressure air blast is delivered through a nozzle from a small fan; the action being that of an ejector, inducing a suction in the flue connections to the boilers.

A complete test of these boilers has not been made, but in a paper read before the British Insititute of Civil Engineers about a year ago, details are given of a test made on a boiler of this type, approximately the same capacity, but containing 4963 sq. ft. boiler heating surface and 4086 sq. ft. economiser surface, in which a thermal efficiency of 88.33% for the unit was obtained, the exit gas temperature being 293°F., and the evaporation per sq. ft. boiler heating surface 9.53; while another test made in 1916 at the Hague municipal plant with a slightly smaller unit gave an overall efficiency of 88.41%. It is probably not possible to obtain such efficiencies with the coals usually obtainable here, but it indicates that a very high efficiency in steam generating equipment has been reached.

Boiler Efficiency.

It is to be understood that in a boiler of the usual construction, where the temperature of the water in the boiler is practically at the temperature of the steam, it is obviously impossible to reduce the temperature of gases below that of saturated-steam at the pressure carried, in fact, while it is possible to add heating surface to reduce the gas temperature below 100° above the steam, the very low transfer rate resulting from such a small temperature difference in the last passes of the boiler does not warrant the expense of the additional heating surface.

In a great number of published boiler tests the exit gas temperature is given as near the temperature of the steam, but such temperatures will usually be found to have been incorrectly measured, owing either to air leakage around the boiler damper or to radiation, as pointed out earlier in the paper. The saturated steam temperature referred to in this connection must not be confused with the superheated steam temperature leaving the boiler when a superheater is installed, as the exit gas temperature is often considerably below the superheated steam temperature, the superheater coils being placed in the high temperature gas zone.

For a proper consideration of the efficiency of a boiler, the steam pressure carried must be taken into account. It is not fair to compare the efficiency of a boiler operating at, say 100 lbs. pressure with a boiler operating at 200 lbs. pressure where the temperature of the boiler heating surfaces differs by 50° and the necessarily increased flue gas temperature results in a greater heat loss with a corresponding reduction in the efficiency as usually measured. For this reason it has been proposed that the efficiency of a boiler be measured in terms of its 'true' efficiency, or the ratio of the heat actually absorbed to the heat theoretically available for absorption, which latter value corresponds to a reduction of the temperature of the flue gas to the temperature of the steam. In the same way allowance is made in England and Europe for the burning of the hydrogen in the coal which leaves a boiler in the form of superheated steam, but which in a calorimetric analysis of the coal is condensed and its latent heat added in the heat value obtained. The revised heat value, corrected for the hydrogen content is termed the lower or nett calorific value of the fuel.

Stokers and Fuels.

The greatest factor in the overall efficiency of a boiler unit lies, of course, in the combustion of fuel in the furnace. It is not within the scope of this paper to deal with the theory of combustion, and a great amount of literature has already been published on the subject, but one of the chief causes for inefficient combustion lies in the faulty design of the furnace and the lack of volume provided for the proper mixing and burning of the gases before striking the cool boiler heating surface. With hand firing under small boilers, the skill of the fireman in keeping an even regular fire is also a big factor, but with larger boilers and automatic stokers a great deal of this work is taken care of and, if operated intelligently, with the aid of recording instruments, a high degree of efficiency can be maintained.

The advantage of automatic stokers for plants of over 500 boiler horsepower has now become generally recognized and the only question for the engineer to decide is what stoker to instal. No type is suitable for all coals and conditions of service. Where boilers of a nominal evaporative rate of 3½ lbs. are to be forced to high capacities or where anthracite coal is to be burned, forced draft stokers will probably have to be used and in considering high overloads, allowance should be made for the extra upkeep cost generally entailed and the consequent need for reserve boilers.

Difficulties have frequently occurred through the installation of a chimney of insufficient height to freely take away the products of combustion from the furnace of a forced draft stoker when operating at a high rate, the assumption having been made that as there was an air pressure under the grate, very little chimney draft was necessary. The result has been that a pressure has built up in the furnace, causing excessive burning up of the brick walls by reason of the hot gases being forced into the cracks. A definite suction, say 1/10 inch of water, should always be maintained in a furnace of this type and as with boilers forced considerably above their rating the resistance through the boiler itself becomes considerable, it does not allow of much reduction in the height of chimney to be provided.

For steady running on continuous moderate loads, the natural draft stoker will probably give the best satisfaction; of this type the chain grate is the most common and probably the most logical way of burning high volatile coals, possessing the advantage of simplicity and ease of adjustment to suit the particular grade of coal and load conditions.

In view of the attention now being paid to the utilization of the Western Canadian lignites, it may be of interest to mention that a chain grate stoker was installed in 1913 in the University of Alberta, having a special setting of arches similar to that used in England and Europe and very excellent results have been obtained with the Edmonton lignites on this stoker, so much so, in fact, that several engineers in the Western cities have modified their standard stoker settings as far as possible to conform to it. A similarly set stoker has recently been installed at Moosejaw where the higher moisture Saskatchewan lignites will be burned, and from information received it promises to also prove satisfactory.

Fig. 9 shows the typical setting; the essential feature being the centre and back arch construction, which, by deflecting the gases and reflecting the radiated heat towards the front of the grate, drives off the moisture from the freshly fed coal. A front coking arch of the standard form is of no use for this class of fuel, as the excessive moisture prevents it getting hot and so hinders the ignition. This arrangement of arches is hardly suitable for burning higher grade bituminous coal, as the centre arch would generally not stand up for long against the higher furnace temperatures, but it has been used extensively for low volatile or semi-anthracite coals, which cannot be burned satisfactorily with a natural draft chain grate stoker with the standard arch construction.

Oil and natural gas make excellent fuels in that high combustion efficiency and regulation can be easily attained with low operating cost and with increased cleanliness in the boiler room, but in Canada, oil is generally only economically available on the west coast, while natural gas is confined to but few localities, and the supply limited.

Powdered coal has been receiving considerable attention in recent years. At present the plant required for, and the cost of crushing, pulverizing and drying has generally limited its use to industrial plants where the fuel can be used in heating furnaces in addition to the boilers. For satisfactory operation, the coal must be pulverized to a degree equivalent to 95% through a 100 mesh sieve and should be dried to contain not more than 1% moisture.

A form of extension furnace is commonly used when fired under a boiler, the coal dust being fed through one or more nozzles into the furnace in a fine cloud. Air for combustion is partly carried in with the fuel and partly supplied through annular spaces around the nozzles, either under pressure or simply drawn in by suction. When properly regulated a high efficiency can be obtained and coal utilized which would be difficult to burn in the ordinary way, but care must be taken to avoid unconsumed coal being carried over into the boiler and also in handling the ash which settles in a molten slag condition to the bottom of the furnace, by reason of the high temperature attained, and which, if allowed to solidify, is very difficult to remove. As the finely powdered coal is in a highly combustible state, proper precautions must also be taken in the storing, distribution and firing to prevent explosions. Brickwork troubles, from the high furnace temperature has been one of the difficulties to overcome with the burning of this fuel.

Blast furnace gas and by-product coke oven gas can be used to great advantage under boilers, a considerable advance having been made during the last few years in the efficiency obtained. This has chiefly been brought about through improvements in furnace design and types of burners, while the application of boilers of a similar design to those used for waste heat work now promises a still greater advance in this field.

Selection of Boilers.

The best type of boiler to use in any plant must depend upon the conditions of service. For continuous steady loads such as in manufacturing plants where generally the boiler room does not receive special attention for operation, the standard boiler of 3½ lbs. evaporation per square foot heating surface will usually be found to be the best, with an installation of the regular separate cast iron economizer where conditions show that a saving will be made, and this is usually an easy matter to determine. An automatic stoker should also be chosen with a view to continuous steady service with the minimum cost for upkeep and repairs to stoker and furnace brickwork, and suitable for the particular class of coal which it is intended to burn.

In many manufacturing plants some kind of refuse can be utilized as fuel which usually requires a special form of furnace. Probably saw mills and pulp mills are the chief plants in this country where refuse is burned, being then in the form of hogged bark and edgings; and a straight extension furnace of the Dutch oven type is generally found to be the best, with a large surface of hot brickwork to drive off the moisture when, as is usually the case, the wood is wet. Step grate furnaces are largely used in Europe. To obtain the best results, the areas and proportions of the furnace must be carefully designed; very often the chief consideration appears to be merely to get rid of the refuse without any effort to obtain the maximum efficiency, with the result that a considerable amount of coal is burned as an auxiliary which would not be necessary if the waste were properly utilized.

For large central stations and public service power plants, where floor space is of more value and load conditions special, the selection of boilers and stokers requires more study. In this service the load is usually very variable with short heavy peaks and a more elaborate lay-out and system of operation is justified. The general practice for these plants in the United States has been to get more and more out of the standard boilers of 10 sq.ft. per horsepower normal rating, in conjunction with regular economizers, by forcing them considerably during peaks. Particular attention is paid to good boiler and furnace design, and although the efficiency falls off at the high rates of driving, and the upkeep cost of brickwork and stoker is considerable, owing to the high furnace temperature, the practice has been considered warranted by the advantages gained. In these plants special precautions are taken to supply pure feed water, while expert attention is necessary for successful operation. In England and Europe the practice tends towards the use of boilers of the type shown in Fig. 6.

The proper size of boilers to instal is, of course, governed by the size of the plant and the load conditions and no fixed rules can be laid down. In the United States there are some very large units, considerably larger than any installed in other countries, the Stirling boilers at the Detroit Edison Company's plant, shown in Fig. 2 having a normal rating of 2365 boiler horsepower based on 10 square feet of heating surface per horsepower. In Canadian plants it will probably be a considerable time before units larger than 1000 or 1200 horsepower are warranted. There is a disadvantage in putting "too many eggs in one basket," as the failure of a tube or other cause of shut down means cutting off a big source of power and wasting a lot of coal, but in operation the efficiency is increased through a reduction of radiation and other losses over several smaller units.

Operation.

There are comparatively few plants in Canada where a separate water purifying apparatus is installed; for small plants where moderate loads are carried on the boilers, some form of compound can be fed in with the feed water suitable for the nature of the water used, but as pointed out earlier, the boiler is not the proper place to treat the water and where the highest efficiency is desired or where boilers are to be run at high rates of evaporation, it is essential that the water be treated in a separate apparatus. In the most modern stations, the tendency seems to be towards the use of evaporators to purify the make-up feed water to ensure the absolute removal of all impurities, as in marine practice. It is not sufficient that heavy scale be prevented from actually adhering to the metal of the heating surface, as floating scale, which may temporarily lodge in one place, is apt to cause burning under high rates of evaporation. Oil is one of the most prolific causes for trouble in a boiler, the least sign of it often causing blisters on the boiler heating surface exposed to the furnace heat, even under moderate loads.

A trouble which may arise, unless proper precautions are taken, especially when using as feed water, the condensed steam from a surface condenser, is corrosion in the boiler and economizer from the air entrained in the water. The latest investigations indicate that it is the CO_2, and not the oxygen, present in the air which is the active agent in the corrosion and it is necessary that this be got rid of before feeding the water to the boilers, either by heating and the provision of efficient air escape pipes, or by chemical treatment with calcium hydrate (slaked lime). The use of air pumps which draw off the water and vapour together from surface condensers are particularly undesirable when the condensate is to be used for boiler feed as this water is strongly impregnated with air.

For efficiency and capacity it is also necessary that the outside of the tube heating surface be kept free from soot, and mechanical soot blowers are now being used to a great extent as an easy means of ensuring more regular and effective cleaning than is generally possible with the somewhat arduous task of hand cleaning with a steam lance.

While it is of first importance that good boilers and furnaces be installed, their value is to a great extent lost unless the boilers are kept clean and the plant efficiently run, and it is impossible to expect intelligent operation unless instruments and meters are provided as a guide for the operator. The old idea of the fireman telling by a look at the furnace if coal was being completely burned is obsolete, and, after all, the furnace is only one factor of efficient operation, although the greatest. Some modern boiler rooms are now fitted with regular control boards and instruments by which losses can be immediately detected and located and there is no doubt that the cost of such indicators and the extra supervision entailed is saved many times over in the yearly fuel consumption. Coal scales and water meters are necessary for purposes of record and check on deliveries, yet they do not by themselves ensure efficiency in operation. If thermometers, draft gauges, flue-gas analysers, etc., are used intelligently as a guide for operation, the coal consumption will take care of itself; and with a proper log system, continuous records can be made over extended periods under actual operating conditions which are of real practical value and not subject to the often misleading conclusions resulting from short tests.

Probable Future Development

It does not seem likely that there will be any great departure in the near future from the present general design of boilers, but the probable adoption of steam at higher pressure and temperature in turbines will lead to certain modifications with possibly a more pronounced segregation of the evaporating and water heating surfaces. Several boilers of the type shown in Fig. 6. are already in service in England, and the United States, under a working steam pressure of 350 lbs. per square inch and a steam temperature of 700 to 750°F, and others are under experimentation up to pressures of 500 and 600 lbs. These higher pressures, of course, prohibit the use of any flat stayed surfaces in boiler construction, and the very best material and workmanship must be employed; but from a constructional and operating point of view, higher pressures and temperatures will not be governed by boiler limitations.

With regard to methods of construction, welding of joints in drums does not at present seem likely to replace riveting, although it is receiving some attention and is used in conjunction with riveting on some marine boiler work.

During the last few years, several of the Canadian provinces have put into force very complete regulations to ensure safety in boiler construction and operation and an effort is being made for the adoption of a uniform code of laws for the whole Dominion. The advantage of this, in the protection it would afford to steam users, and the possibility of standardisation for manufacturers would be very great; while if, in addition, a system of control, propaganda and educational work could be carried out by a fuel administration department, it would be of inestimable value to power plant operators and lead to conservation of our fuel resources which form a very large part in the cost of power production.

YOUR ATTENDANCE AT THE ANNUAL MEETING WILL HELP TO MAKE IT WHAT IT IS EXPECTED TO BE---THE LARGEST AND MOST SUCCESSFUL IN THE HISTORY OF ENGINEERING GATHERINGS.

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Summary of Legislation Situation

At the General Professional Meeting held in Saskatoon in August, 1918, the question of Legislation was brought prominently before *The Institute* for the first time, an entire session of the meeting being devoted to this subject. In a paper presented at this session and published in the September issue of *The Journal*, by F. H. Peters, M.E.I.C., of Calgary, a general outline was given of the activity regarding legislation on the part of the western Branches, showing that in the west particularly the subject of Legislation was a live issue and had aroused a great deal of interest.

At the same session of this Professional Meeting a draft act was submitted from the Legislation Committee of the Saskatchewan Branch and after discussion was referred back to the Committee for certain alterations before being forwarded to Council.

On receipt of this Act by Council which was accompanied by a request from the Saskatchewan Branch to be allowed to present it at the fall session of the local Legislature, a special meeting of Council was called and held on October 1st, when the entire session was devoted to the subject. At this meeting a draft act was drawn up based on the Saskatchewan draft, copy of which was forwarded to all branches asking for discussion. This draft was published in the November issue of *The Journal*, page 331, and the Saskatchewan Branch was requested to withhold action until all branches had been given an opportunity of discussing and making recommendations. An editorial on the subject appeared in the November *Journal* on page 335.

As a result of the request of Council to the Branches that legislation be discussed at all branches and the fact Council endorses the principle of legislation to improve the status of Engineers, the question is receiving considerable attention from coast to coast, resulting in a large amount of inter-branch and headquarters correspondence on the subject.

A suggestion of the Manitoba Branch that representatives of each legislation committee of the various branches meet at some central point and agree on a draft act met with general approval in the West, it being felt that this committee should meet and agree so that the question could again come up at the annual meeting. Branch news, pages 409-410 of the December *Journal* contain further reference to the subject. Meanwhile, it became evident to the members of the Saskatchewan Branch that they could secure early legislation and consequently they wired headquarters an urgent request to be permitted to present a draft act immediately. Resulting from this a special meeting was held at headquarters on Tuesday evening, December 3rd, at the call of the President, to consider the request of the Saskatchewan Branch, and to receive the report of a special committee appointed by the President to confer with a special committee of the Mining Institute. At this special meeting of Council it was found that the report of the special committee was unfavorable to any immediate attempt to secure legislation. The draft act submitted was found to differ from the draft submitted by Council. It was considered necessary to advise the Saskatchewan Branch that it was not within the power of Council to approve of the act without a mandate from the membership. Meanwhile the subject has been the foremost topic on the part of the Western Branches, and formed the subject of discussion at two meetings of the Montreal Branch.

A new draft act revised on December 4th has been received from the Alberta Branches where it is believed that immediate Legislation can be secured. This act has not been critically analyzed by the Council. In a letter from Lt.-Col. W. P. Anderson, past President, who was present at the meeting of the Edmonton Branch when Legislation was discussed, he strongly urges that the branches be given authority to secure legislation.

Correspondence from the Prairie Branches shows that there is a strong feeling in favor of early action and that a definite policy be formulated not later than the Annual Meeting.

The Montreal Branch resolved that Council be asked to arrange for the appointment of a committee representing all Provinces and all branches to inquire into, study, and report on the whole question of legislation.

A resolution of the Manitoba Branch held on January 2nd, reads as follows: " That in view of the necessity for prompt action on the question of legislation, the Secretary be instructed to write to all of the other branches requesting that each appoint a representative with full power to act, to attend the coming Annual Meeting to assist in drafting a suitable act for presentation to the various Legislatures."

Victoria and Vancouver Branches have endorsed the action of Council in requesting more mature deliberation. Hamilton, Toronto, Halifax and St. John all favor a general agreement on the question before action is taken to secure legislation.

At the Annual Meeting of the Quebec Branch held on December 21st, it was resolved that it was expedient and urgent to give as soon as possible the member of *The Institute* an opportunity of expressing their views on the necessity of securing legislation similar to that of other professions. That uniform legislation should be enacted for each province in order to enable the engineers of one province to practise civil engineering in another province, consequently the Quebec Branch beg the Council to immediately frame up a legislation project that would meet all the requirements of the situation and then be submitted to the different branches; also to secure through a referendum the opinion of the members of *The Institute* on the opportunity of having such legislation.

The Ottawa Branch has appointed a representative to confer with the representatives of the other branches, and a telegram to the Manitoba Branch included the following: "Your letter of January 6th. Managing Committee in sympathy with your aims to the end that satisfactory legislation should be sought as soon as possible. We believe Council must ultimately direct such action as should be taken after a representative committee has studied and reported on the whole question. We are arranging to have a delegate of the Ottawa Branch meet other representatives here in advance of Annual Meeting which is limited to first day of Convention."

If this meeting is held before February 11th, it will provide an opportunity of having the views of all Branches presented for discussion at the Annual Meeting.

Government Considering Salaries

The Committee of *The Institute* consisting of W. F. Tye, Chairman, H. H. Vaughan, President, and G. Gordon Gale, Chairman of the Ottawa Branch, were pleased with the courteous reception they received from the Honorable Dr. Roche, Chairman of the Civil Service Commission, when they met the Commission to advise regarding the grading of salaries of engineers in the employ of the Government. Not only was consideration promised of the suggestions made, but the committee was requested to make definite recommendations.

P. H. Myers, Acting Chief of Staff Organization Branch, Civil Service Commission, who has charge of drawing up schedules for salary classifications has expressed his appreciation of the advice given, and in thanking the Committee for the information, stated that he would probably have occasion to accept the kind offer of further assistance.

No Railway Rebates

In response to a request to the Eastern Canadian Passenger Association for consideration of rebates on passenger tickets to the Annual Meeting at Ottawa, the following letter was received, showing that no rebates will be available.

Dear Sir:—

The carriers feel that conditions brought about by the war, viz.: shortage of labor and coal, abnormal demands on transportation equipment and power for the handling of returning troops and foodstuffs, do not permit relaxation at the present time of existing restrictions on passenger travel. Reduced fares mean increased travel and, therefore, for reasons stated above, regret to advise you that no reduced fares will be made for special occasions during the year 1919.

Yours truly,
G. H. Webster,
Montreal, Jan. 14th, 1919. Secretary.

Ontario Provincial Division

The Ontario Provincial Division is now established, and it is expected that a meeting of the Executive Committee will take place at an early date for the purpose of electing a chairman and secretary-treasurer or secretary and treasurer. The Executive Committee have suggested Peter Gillespie as chairman pro-tem.

The personnel of the Executive Committee is as follows:—

Councillors:—J. R. W. Ambrose, M.E.I.C., Toronto; Peter Gillespie, M.E.I.C., Toronto; E. D. Lafleur, M.E.I.C., Ottawa; G. A. McCarthy, M.E.I.C., Toronto; John Murphy, M.E.I.C., Ottawa; James White, M.E.I.C., Ottawa; M. H. MacLeod, M.E.I.C., Toronto.

Representing Ottawa Branch:—J. B. Challies, M.E.I.C., Ottawa.

Representing Toronto Branch: — Geo. Hogarth, M.E.I.C., Toronto.

Representing Hamilton Branch: — E. R. Gray, M.E.I.C., Hamilton.

Representing Sault Ste. Marie Branch:—W. S. Wilson, A.M.E.I.C., Sault Ste. Marie.

Non-Resident Members:—Major W. H. Magwood, A.M.E.I.C., Cornwall; G. R. Munroe, A.M.E.I.C., Peterboro; J. L. Morris, M.E.I.C., Pembroke; R. J. McClelland, A.M.E.I.C., Kingston; G. H. Bryson, A.M.E.I.C., Brockville; A. C. D. Blanchard, M.E.I.C., Niagara Falls; T. H. Jones, M.E.I.C., Brantford; J. L. Weller, M.E.I.C., St. Catharines; S. B. Clement, M.E.I.C., North Bay; James A. Bell, M.E.I.C., St. Thomas; R. L. Dobbin, A.M.E.I.C., Peterboro; L. M. Jones, M.E.I.C., Port Arthur; V. A. Belanger, A.M.E.I.C., L'Orignal

Water Resources Conference

A most important Conference of Dominion and Provincial Engineers was held in Ottawa on January 16th and 17th, under the auspices of the Dominion Power Board, of which the Hon. Meighen, Minister of the Interior, is Chairman. A. St. Laurent, the Vice-Chairman of the Board, presided, pointing out as the raison d'être of the meeting that the recent crisis regarding both fuel and power had brought the tremendous importance of both very prominently to the front, and had shown with greater force than ever the necessity among other things of developing and conserving our water powers to the utmost. The first step to this end, seeing that various authorities are handling the problem in different parts of Canada, is to, as far as possible, arrange their methods and organizations along similar lines, viz., the standardization of field and office methods and equipment, uniformity of publications, both in matter and arrangement, period to be covered by each, etc., etc.

The administrative end also had to be considered, with a view to making the requirements and regulations of all the authorities concerned, whether Federal or Provincial, as uniform as possible.

There were present at the Conference:

H. G. Acres.......Chief Hydraulic Engineer, Hydro Power Commission, Ontario.
Arthur Amos......Chief Engineer, Hydraulic Service, Quebec.
R. J. Burley.....Engineer, Reclamation Service, Ottawa.
E. F. Drake......Director, Reclamation Service, Ottawa.
C. O. Foss........Chairman, N. B. Water Power Commission.
T. W. Gibson.....Deputy Minister, Crown Lands, Ontario.
H. W. Grunsky...Legal Adviser, Dominion Water-Power Branch.
J. T. Johnston....Assistant Superintendent, Water-Power Branch.
E. B. Jost........Engineer, Department of Railways and Canals.
R. S. Kelsch......Consulting Engineer, Montreal.
O. Lefebvre.......Chief Engineer, Quebec Streams Commission.
K. H. Smith......Chief Engineer, Nova Scotia Water-Power Commission.
R. G. Swan.......Chief Engineer, British Columbia Hydrometric Survey.
Wm. Young......Comptroller of Water Rights, British Columbia.

together with the following Ottawa Members of the Power Board, viz.:

A. St. Laurent (Vice-Chairman). W. A. Bowden.
D. B. Dowling. B. F. Haanel.
C. N. Monsarrat. John Murphy.
J. B. Challies (Secretary).

As a basis for a uniform system of locating any and all water resources, and analyzing and filing all data of whatever kind concerning them, which is the first requisite to co-ordinated working, there was laid before the meeting a Water Resources Index-Inventory, designed by the Dominion Water Power Branch, and which the Dominion Power Board submitted as one which would suit the needs of any and all authorities concerned with water investigation, whether Federal or Provincial. The basis of the system is the dividing of the country into its main or basic drainage basins, with sub-basins and other divisions, detail maps, a card index system, and a folder equipment, samples of all of which were shown those present, the whole forming an indexing and filing system adaptable to the needs of all the various organizations concerned with any type of water investigation or administration. *The Journal* hopes to publish a full description in an early issue.

After a lengthy discussion as to how various local requirements would be covered by the system, the result of which was to show that it was of such a flexible and comprehensive nature as to cover practically any needs that were likely to arise, and in view of statements by several of those present that they already had the system in use in their offices, in whole or in part, a resolution was passed by the conference recommending its adoption by all Federal and Provincial authorities concerned, and further, to facilitate its adoption, that an explanatory monograph on it, accompanied by maps, diagrams, etc., be prepared for general distribution.

Meteorological data, as a fundamental branch of water survey, was discussed at some length, it being pointed out that continuous and complete meteorological figures were often of inestimable value in deciding as to the water likely to be available for either domestic, irrigation, or power purposes. A Resolution was passed aiming to help the efforts being made to extend the work of the Meteorological Service.

The next matter considered was the co-ordination of the work of investigating water resources, it being pointed out that in view of the fact that several Federal and Provincial organizations were at work on the same matter, in different sections of Canada, it would greatly help if their field and office procedure and their equipment, and finally their publications, could all be largely standardized, both as to form and contents. As a summation of the discussion a resolution was passed recommending the yearly publication of hydrometric data, each report to cover a climatic year, October 1st to September 30th; and to include daily discharge records, but not daily gauge heights, except in those special cases where they are obviously necessary. The Power Board is to prepare and distribute a key map showing the territories covered by the different organizations and surveys. The other details though were thought to be so many and so complex as to require further consideration, and so it was decided to leave them to later conferences, one in the West and one in the East, after which a plenary conference at Ottawa woud make final recommendations on the whole subject.

The final matter before the meeting was that of Water Power Regulations, the question being introduced in the form of a Report prepared by H. W. Grunsky. As the subject is an exceedingly large one, and the report most comprehensive, it was felt that it was impossible to do anything but discuss the main divisions, six in number, viz.: nature of franchise, control of stock and bond issues, rentals, renewal provisions, extent of properties taken over if license terminated, and compensation therefor, in a preliminary way, leaving any decision thereon to a future meeting. The discussion covered such points as sale versus rental, limited versus indefinite franchise, nominal or substantial rentals, uniform regulations, etc., etc., after which the meeting adjourned, first deciding that after the organizations more particularly concerned had gone further into the matter, the Dominion Power Board should call another conference on the subject.

As has been so clearly demonstrated during the last few years, one of the fundamental requisites to the stability and growth of any country is a supply of cheap and dependable power. Canada fortunately possesses the natural sources for this, from coast to coast, in the form of either coal or water, and with a permanently constituted medium like the Dominion Power Board aggressively at work on the problem of co-ordinating the efforts of the various bodies engaged in seeing that these resources are handled to the best advantage, there can be no doubt as to the further progress of the Dominion, as far as water power is concerned. To those who were responsible for the conference, *The Journal* extends heartiest congratulations on the splendid results achieved.

CORRESPONDENCE

The Diving Bell Again

Editor, *Journal:*

I note in the December, 1918, issue of *The Journal,* a letter from Mr. J. J. MacDonald in reply to my letter of October 24th, 1918, with reference to the Caisson used at Halifax Harbor. In his letter Mr. MacDonald assumes that his brief reply clears up the issues raised by me. It would be interesting to know the name of the individual who actually originated the idea of using the outfit of the type employed, and whether the design of the walls was prepared, having in view the use of a caisson of the particular type used.

Mr. MacDonald asserts that the device used by me in Hamilton was lacking in novelty, so far as the regulation of draft is concerned. In making this statement, Mr. MacDonald is either speaking without information as to the actual facts, or deliberately misrepresents them. The device, as used by me here, was capable of being used in depths of water varying between 1 foot 6 inches and 7 feet, and with slight structural modifications, not affecting the principle of the apparatus, this depth could have been increased. The method of obtaining this difference in draft is not in any way fundamentally different from that used in the Halifax outfit. Mr. MacDonald calls the outfit used here, simply a scow with a bottomless central well for working about three feet below the surface, and asserts that any change in draft was impossible. This is not the case. The fact that the Halifax device rested on the bottom when working has nothing whatever to do with the buoyancy and water ballasting principles of the apparatus, except in so far as it aids in maintaining the equilibrium of the apparatus when in operation.

The principle of the bottomless central well is inseparable from diving bells of caissons in any form used in construction work, as a matter of fact, the long air shafts as applied to Mr. MacDonald's device for use in deep water is not at all original as applied to deep water marine work, and the form of the lower part of the caisson is of the general type used on bridge pier foundations. The only parts of the device apparently for which Mr. MacDonald claims originality, are the buoyancy and water ballast chambers. The use of such chambers was made by me on the device used here for floating and moving the outfit when required and for carrying water ballast to increase the dead weight of the apparatus and for regulating the draft of the caisson or bell when in operation.

The matter of the exact name or names which are applied to the device does not alter their functions in any way, and whether Mr. MacDonald calls his device a mobile, pneumatic caisson, or diving bell, or simply a plain floating caisson, as the writer prefers, does not matter and does not affect the fundamental principle in any way. Strictly speaking, the word bell should not be applied to the device, the diving bell proper, so called from its approximate similarity in outline to a bell, has no air lock or shaft, and depends for its ballast on its own dead weight, being suspended in the water from suitable hoisting and lowering apparatus placed above water.

As Mr. MacDonald refers to European practise, it is relevant that I should refer to it also from personal experience in my own particular case. Probably the most extensive recent work carried out by the diving bell type of this device was the construction of the break waters at the Dover Naval Harbor by the contractors, S. Pearson & Son of London. The principles of its operation are too well known to require explanation here. Another device of the type of caisson proper with a shaft and air lock was that used at Plymouth Harbor by the contractors for the removal of a large rocky shoal there for the Admiralty. The writer was at one time a member of the staff of the company carrying out this work, so does not need to generalize or use text book information. In this particular outfit, the air shaft passed through a well in the centre of a large steel scow, which was filled with air compressors, etc., and the air driven rock drills were carried on a track in the working chamber, which was larger than in the Halifax outfit. This particular device, however, was ballasted by the dead weight of the scow When it was desired to float the caisson the ballast connections between the scow and caisson were liberated and the air pressure in the caisson brought it towards the surface. This device was simple and stable in all conditions, and was able to withstand quite a heavy sea, but did not depend for its ballast on excess dead weight or water ballast, there being no buoyancy or water ballast chambers attached. The caissons used in dock wall construction at Antwerp and other ports are of the type which become a part of the permanent structure and are not, strictly speaking, part of the construction machinery or plant.

The writer is quite familiar with the use of ballast and buoyancy chambers as applied to sliding gates for dry docks, etc., but this device is not adapted for construction purposes, and is not generally movable beyond the limits of its berth. The water is simply expelled from a section of the gate, which is built much of the same shape as a ship's hull, in sufficient quantity to permit the gate to lift slightly clear of the sill, and float to one side endwise, not at all an intricate device fundamentally. Mr. MacDonald apparently overlooked the application of ballast and buoyancy chambers to our late friends the "U" Boats.

The writer would be interested in knowing of a case where this principle is applied to scows carrying construction plant in tidal waters as Mr. MacDonald states, and what purpose this is supposed to serve. The writer is aware of a self-dumping deck scow of Norwegian origin, which unloads its deck cargo by alternately flooding and unwatering portions of the subdivided hull, but this has no bottomless central well, and he fails to see where the flooding and emptying of the hull of an ordinary scow, or use of a bottomless central well, presumably for the purpose of turning air in it, serves any purpose.

Mr. MacDonald states that the problem of flotational stability while in a submerged condition was entirely absent, etc. A little superficial examination will correct this statement. Has Mr. MacDonald made any actual calculations in support of this statement, or is this merely an unsupported assertion?

As a matter of fact, the question at issue between the device used at Halifax and that used at Hamilton, is which had priority of design, construction and operation, and whether the principle of attaching compartments to a self-contained movable caisson, or as Mr. MacDonald also calls it, bell, to be used for construction purposes under water, and on which the compartments referred to can be loaded with water to provide additional ballast, or emptied by any suitable means to provide buoyancy or maintain quilibrium in a floating condition is the exclusive monopoly of either apparatus or is common to both. The exact shape of the caisson or the compartments or the position of the latter relative to the working chamber does not affect the principle of the device. Mr. MacDonald says the use of water ballast was not an essential principle of the device used here. Water ballast, as a matter of fact, was a prime necessity, when in operation. A heavier scow, as Mr. MacDonald asserts would not have served the purpose. The *use* of water ballast did not regulate the draft so that it could pass over the piling, as Mr. MacDonald asserts, but rather the *absence* of water ballast permitted this to be done. Mr. MacDonald makes this statement: "In order to float the Halifax caisson when it was required to be moved, the buoyancy chamber was added and this was its only function." Does this mean that the buoyancy chamber shown on figure 5, page 254 of the October issue of *The Journal* of *The Engineering Institute*, is not also used as a ballast chamber by the admission of water into it, and is it not the case that the ballast chamber, as indicated in the same drawing, is also, when required used as a buoyancy chamber, and that this is simply a matter of juggling with names.

The Hamilton apparatus was finally designed in May, 1913, and put in operation in August, 1913, as previously stated, and Mr. MacDonald states he got the idea in 1913, the exact month not being stated, and the design was got out in 1914, rather a remarkable coincidence, to say the least.

In my previous letter in connection with this matter, which was written somewhat hurriedly, I made an error in dictation and got the relative position of the meta centre and centre of gravity in the device used here, misplaced, fortunately these points were misplaced only in my letter and not in the actual apparatus. The theory of the equilibrium of floating bodies to ensure stability, in other words to make sure of them floating right side up, is no doubt more or less generally understood by engineers.

Yours very truly,

John Taylor, A.M.E.I.C.

Hamilton, Jan. 11th.

Institution of Civil Engineers

Dear Sir:

I am in receipt of your letter of the 4th December, and as, owing to the Christmas recess, it will not be practicable to place it before the Council of The Institution until January, I hasten to express on their behalf and on that of the whole body of this Institution, the very cordial appreciation with which the greetings of *The Engineering Institute of Canada* are received here, and to reciprocate the kindly and sympathetic expressions of good will contained in your letter under acknowledgement.

I am,
My dear Sir,
Yours faithfully,
J. H. T. Tudsbery,
Secretary,
The Institution of Civil Engineers,
Great George Street,
Westminster, S.W.,
England.

Overseas Correspondence

Christmas Day, 1918.

Members will be interested to know that a great many replies have been received from our overseas men acknowledging the cigarettes and Xmas greetings sent them. A few of the many are published below.

Dear Mr. Keith:—

I did not answer your last letter in the summer as we were fairly busy, and it did not get any easier in the fall until the 11th of November, when things eased up for most of the Armies, but not for us.

The "hun" has planted a great deal of delay action mines in the railway embankments, yards, stations, bridges, culverts, etc., and in the roads, houses, churches, and large buildings, also in all the ammunition trains, and dumps which he was leaving behind him, and we had to search for them, locate them if we could, and then draw them. The ones in the ammunition were in the form of ordinary looking nose caps set in howitzer shells, and had very very little to distinguish them from the other nose caps in the other shells. These mines were of a chemical mechanical action set at varying periods, and on operating set off the shell in which they were screwed, and that made the train or the dump blow up.

We off-loaded the trains and spread the shells over the fields about ten feet apart so that one going off would not be likely to explode the others. We spread out the dumps in the same manner over large areas, and then anyone who wanted to could start in and unscrew the caps until he found a delay action one. We were in a town that was a big railway junction and there were a large number of dumps and trains on the railways, and as these kept going up at any hour, it was interesting work trying to get them unloaded before they unloaded themselves in a very abrupt manner. Not very many of these nose caps were found at the right time, but I have one which is intact, except that the acid is poured out of it, and if you think the Institute would care to have it, I will give it to you. I enclose a descritpion of a short delay action fuze, the one I have is the long delay action fuze with the red gaine mentioned in the first paragraph.

My fyle of "Mining Notes," "Military Engineering" and "Field Work Notes," is a fairly complete one and would be of interest to the members of our *Institute* as showing some of the works we did and the things we built. They were made up or invented by engineers in the different units and descriptions sent in to G.H.Q., where they were compiled and those of value were issued to all the other units. There was little or no Military engineering that was of use to us at the beginning, and we had to invent things for ourselves. Many of them will appear futile and clumsy, but they were effective as a rule, and handy, and when it is considered that they had to be made in the field with whatever material we could find, mostly under shell fire, a lot can be excused.

In our attack on the Hindenburg line we had a little amusement, and I was awarded the D.S.O. This would not appear in the "Canadian Gazette," as the Imperial authorities had me transferred from the Canadian Army to the "Royal Engineers" of the Imperial Forces, as from January 1st, 1918.

The present of cigarettes was received from *The Institute*, for which I beg to tender my very best thanks, and I will close by wishing all a very happy New Year.

Yours very truly,
Major WILLIAM T. WILSON A.M.E.I.C., D.S.O., M.C.,
"O.C.," Tunnelling Company, R.E.,
B. E. F., France.

The Mount Hospital for Officers,
Parkstone, Dorset,
January 1st, 1919.

Dear Sir:—

I am enclosing the post card found in the box of cigarettes which you were so kind to send me again this Christmas time, and I also wish to add a few words to thank you for your thoughtfulness. It is exceedingly good of the Institute to remember us again in this way, and I appreciate it more than I can say.

As you will see I am in the hospital due to one of the Boche's machine guns locating me and sending me back to Blighty. This happened just before Albert was taken in August last year, and my left hand suffered in consequence, but now it is well on its way and in a few months time, I hope to have complete use of it.

All Canadians, like the rest of the Allied forces, will be rejoicing over the great news of these last two months, and what it means to us all. One certainly has good reason to be thankful whether having taken part or not, and when one sees just what France has suffered these last four years we should be more than thankful that we were victors. Christmas time this year has been a very happy one for those who have not suffered in lost ones, and in the knowledge that it is all over at last.

Great excitement has prevailed over President Wilson's visit and all it means to the Peace Conference. England has given him a most rousing reception and has strengthened the ties that the war has started.

Allow me to wish *The Institute*, through you, a most happy and prosperous New Year, and that nineteen hundred and nineteen will be a real victory year in all ways.

Thanking you again for you Christmas gift, I remain,

Most sincerely yours,
2nd Lieut. J. E. JAFFARY,
34 Redford Place,
Russell Square,
Holborn, London, England.

Just received your very welcome gift of cigarettes for which very many thanks. We are trying to put in our time here preparatory to sailing for England enroute for Canada. The gods be praised its all over but the shouting and the paying.

Sincerely yours,
Sergt. H. P. HEYWOOD,
No. 1039092, 3rd Can. Ry. Tps.,
A. P. O.,
Longon, England.

I desire to acknowledge with many thanks the receipt of the parcel of cigarettes. With best wishes for the future.

Sincerely,
Lieut. THOMAS H. BACON,
Hdqrs., Jura Group,
Can. Forestry Corps,
B.E.F.,
France.

Received cigarettes, also kind wishes from fellow engineers, in Canada. Kindly convey my best thanks, also best wishes for *The Institute* during nineteen hundred and nineteen. I hope to be with you again next year, as soon as my duty towards my country (Canada) is finished.

C. G. READ, Jr., E.I.C.,
"Ravensbourne,"
Victoria Road, Teddington,
Middlesex, England.

Very many thanks for the splendid gift of cigarettes. Best wishes to *The Institute* for nineteen hundred and nineteen.

Yours sincerely,
Lieut. G. E. BELL, M.E.I.C.,
49 Kidbrook Park Rd.,
London, S.E. 3,
England.

Please convey my very best thanks to the members of *The Institute* for the most acceptable Xmas gift and kind wishes.

Yours truly,
Lieut. W. REYNOLDS,
282 Coy. R.E.,
B.E.F.,
France.

Many thanks for kind remembrance. Hope to make a personal call at 176 before very long.

Yours truly,
Captain A. C. REID, A.M.E.I.C.,
R.A.F. Seaplane Base,
(Late R.N.A.S.), Dover, England.

Many thanks for card and smokes, they were both much apreciated.

Yours truly,

Major E. W. Reed-Lewis, A.M.E.I.C.,
6th Batt., Can. Ry. Tps.,
B.E.F.,
France.

May I express my best thanks to *The Engineering Institute of Canada* for the cigarettes, and especially for the kindly thought which prompted so acceptable a gift.

Yours truly,

Captain P. A. Ablett, M.E.I.C.,
Director Board of Administration,
Ministry of Munitions,
32 Nassau Street,
Dublin, Ireland.

I thank the Council and members of *The Institute* for their greetings and good wishes at this time, which I cordially reciprocate. All members overseas will appreciate, I am sure, the kindly spirit which prompted the sending of a remembrance at this season.

Yours truly,

Victor F. Murray, A.M.E.I.C.,
c/o Park Cottage,
N. Union Street,
Cupar Fife,
Scotland.

Your cigarettes have arrived safely and have been greatly appreciated. My best wishes and thanks to *The Institute* for them.

Major G. R. Evans,
55th Field Company,
Royal Engineers,
B.E.F.,
France.

Very many thanks for the kind thoughts expressed by sending the parcel of cigarettes which I have received in good condition.

Yours truly,

Engr. Lieut. Chas. Stephen, A.M.E.I.C.,
24 Handfield Road,
H.M.S. "Glorious,"
Waterloo, Liverpool,
England.

Many thanks for your kind remembrance in the form of cigarettes which we received at a most convenient time. Best regards for the prosperity of *The Institute* in the coming years.

Arthur J. Edwards, S.E.I.C.,

I wish to acknowledge with grateful thanks receipt of cigarettes. Wishing you a very happy New Year.

Yours truly,

Lieut. Philip A. Fetterly, A.M.E.I.C.,
Can. Ry. Tps. Dept,
Witley Camp,
Surrey, England.

The cigarettes arrived safely this morning for which many thanks. It makes us realize that we are not entirely forgotten by our home friends as we sit on the banks of the Rhine here. The wish for a speedy victory expressed on your card has been fulfilled, and it should'nt be long now before we are all back clamouring for positions in the engineering world again. Best of good wishes to the *Institute.*

Yours truly,

Major A. A. Anderson, J.E.I.C.,
2nd Can. Div. Signal Co.,
Bonn, Germany.

Many thanks for your thoughtful gift of cigarettes, which came at a time when they were practically unobtainable in this part of France. Kindest greetings to all your members of the various grades.

Yours truly,

Captain R. McKillop, A.M.E.I.C.,
13th Light Ry. Operating Coy.,
B.E.F.,
France.

The writer has much pleasure in acknowledging receipt of smokes together with the season's greetings from *The Institute*, and wishes you all the compliments of the season.

Yours truly,

Major A. R. Ketterson, A.M.E.I.C.,
No. 1 Canadian Constr. Corps,
Can. Ry. Tps.,
C.E.F.,
France.

Beg to acknowledge with many thanks your thoughtfile remembrance and well wishes.

Sincerely,

Staff-Sergt. W. W. Dynes, J.E.I.C.,
No. 2260308,
Can. Forestry Corps, S. 5,
B.E.F., A.P.O.,
London, England.

In acknowledging the remembrance of cigarettes from *The Engineering Institute of Canada* I wish to add a word of appreciation which I feel is due to those who are bearing the burdens at home while we are away. Many of them are making ends meet on fixed salaries that have not risen with the cost of living, and at the same time they are sending remembrances to us, they are supporting Red Cross and Patriotic Funds and are in many other ways denying themselves.

We, over here, appreciate this, and for this reason value he more highly the remembrances sent us.

Now that our work over here is finished, we await with impatience the time when we may return again to take up the burden alongside you, and to share the economic burdens and problems brought into being by the war.

Yours sincerely,

Floyd K. Beach, A.M.E.I.C.,
8th Batt.,
Can. Ry. Tps.,
B.E.F.,
France.

REPORT OF COUNCIL MEETING

The regular monthly meeting of the Council was held at headquarters on Tuesday, January 21st, at 8.15 p.m.

After confirming the minutes of the previous meeting, the Executive Committee report was presented, the result of one special meeting and three regular meetings held since the last meeting of Council.

The special meeting of the Executive Committee was called to discuss the whole question of *The Institute's* publications and the functions of the committees dealing therewith. In that connection the following recommendations were made, all of which were approved:

Transactions:—That *The Institute* publish the Transactions every year, consisting of papers selected by the Publications Committee. Approved.

Papers Commi tee:—That the Papers Committee shall be responsible for obtaining papers, either through the Branches or from authors direct, and for their allocation to Branch or Profes ional Meetings. Approved.

Journal:—That the Board of Management of *The Journal*, which is the Executive Committee of the Council, shall decide whether papers shall be printed in *The Journal*, either in advance or as a report of a Branch or Professional Meeting, and whether they shall be published in full or in abstract. Approved.

Publications Committee:—That the Publications Committee shall decide what papers shall be printed in the Annual Transactions and will advise regarding their form and editing. Approved.

Technical Press:—That papers read before *The Institute*, either at a Branch or Professional Meeting shall be issued to the technical press on application to the Secretary of the *Institute*, it being a condition of their being given, that the technical press state the meeting at which the paper was read, and give the author's title in *The Institute*, aftr his name. Approved.

Annual Meeting:—That the suggestion of the Professional Meeting Committee that invitations to the Annual Meeting should be sent to His Grace the Duke of Devonshire, the Ministers of the Departments of Public Works, Railways and Canals, Marine, Interior; to the Chairman of the Railway Commission and to the Presidents of the three big railway systems, and the Executive Committee's instructions to the Secretary to send these invitations be approved. Approved.

That the letters from Comfort A. Adams and Ira N. Hollis accepting invitations to Annual Meeting be noted. Noted.

That Council note the cable received from Col. C. H. Mitchell, D.S.O., expressing his inability to be present at the Annual Meeting and approve of its being read at the Annual Meeting. Approved.

Legislation:—That Council approve the instructions to the Secretary to make a summary of the correspondence re legislation and the draft Act received from the Edmonton and Calgary Branches for presentation at the meeting of Council and that he publish an editorial in *The Journal* which would give the membership a general idea of the legislation situation in the different Branches and in view of the activity in the Western Branches, that Council approve of their being asked to send a delegate to the Annual Meeting to constitute a special legislation committee. Approved.

Salaries of Government Engineers:—That Council note the correspondence in connection with the salaries of engineers in the Civil Service and give full approval of the course pursued by the Committee, in meeting the Civil Service Commission and forwarding a letter to the Hon. Dr. Roche recommending a certain standard of salaries and giving specific recommendations regarding positions in the Department of Public Works as an example, this letter being signed by President H. H. Vaughan, J. M. R. Fairbairn, Vice-President, Lieut.-Col. Leonard, President elect, and W. F. Tye, Chairman of the Committee. Noted.

Ontario Provincial Division:—That Council approve the instructions given the Secretary to send a letter to each of the three Ontario Branches, giving the personnel of their executive committees, and suggesting Professor Peter Gillespie as temporary Chairman to elect officers; also to note that the Ontario Provincial Division had thus been established. Approved.

Sault Ste. Marie:—That the application to form a Branch at Sault Ste. Marie be noted and that approval be given to the instructions to the Secretary to visit Sault Ste. Marie in this connection; also approval to the formation of the Branch and their election of Officers, as follows:—Chairman, J. W. LeB. Ross; Secretary-Treasurer, L. R. Brown, Executive Committee, R. S McCormick (two years) B. E. Barnhill (two years), A. G. Tweedie, J. H. Ryckman. Approved.

Windsor and Peterboro Branches:—That the correspondence with reference to the formation of Branches at Windsor and Peterboro, Ont., be noted. Noted.

Resolutions of the Toronto and Quebec Branches:—That the secretary prepare a memorial to the Government, embodying the resolutions of the various Branches, with a view to submitting it at the earliest possible moment. Approved.

Investigation Committee on Cement:—That Council approve the appointment of R. S. Stockton, by the Calgary Branch, on the Committee for Investigation of Disintegration of Cement, to replace H. Sidenius, deceased. Approved.

Joint Committee of Technical Organizations:—That Council approve instructions to the Secretary to write W. G Chace and all the Branches, in view of the letter received from Mr. Chace in answer to the Secretary's letter transmitting Council's decision to withdraw upport from the Joint Committee of Technical Organizations. Approved.

That Council approve the Reports of Committees, the Report of Council for 1918 and the Annual Reports of the Branches for 1918, as follows, also instructions to the Secretary that these be published in the February issue of *The Journal* and that the following Branch officers be approved:—Calgary Branch, Chairman, G. W. Craig; Secretary-Treasurer, C. M. Arnold; Executive

Committee, Wm. Pearce, A. S. Dawson, F. H. Peters, B. L. Thorne, A. S. Chapman; Representatives to Alberta Div sion, F. H. Peters, S. G Porter; Auditors J. S. Tempest, R. C. Gille pie; Quebec Branch, Chairman, A. R. Decary; Secretary-Treasurer, J. A. Buteau; Executive Committee, F. T. Co e, J E Gibault W. Lefebvre, A. E. Doucet, A. Amos S. S. Oliver; Hamilton Branch: Chairman, E. R Gray; Secretary-Treasurer, H. B. Dwight; Executive Committee, E. H. Da ling, J. A. McFarlane; Victoria Branch: Chairman, W. Young; Vice-Chairman, R A. Bainbridge; Treasurer, E. Davis; Secretary, J. B. Holdcroft; Executive Committee, E. Everall, N. A. Yarrow, D. O. Lewis, R. W. Macintyre; Auditors, A. F. Mitchel , W. M. Stokes; Saskatchewan Branch: Chairman, H. S. Carpenter; Vice-Cha rman, C. J. Yorath; Secretary-Treasurer, J. N. deStein; Executive Committee, H. R. Mackenzie, W. R. Warren, J. R. C. Macredie A. R. Greig, H. McIvor Weir, L. A. Thornton, G. D. Mackie St. John Branch: Chairman, C. C. Kirby; Secretary-Treasurer, A. R. Crookshank; Executive Comm ttee, G. G. Murdoch, G. G. Hare, C. O. Foss, A. Gray. Toronto Branch: Chairman, A. H. Harkness; Secretary-Treasurer, W. S. Harvey; Executive Comm ttee, H. G. Acres, Willis Chipman, W. A. Bucke, H. E. T. Haultain, J. R. W. Ambrose, R. O. Wynne-Roberts, Peter Gillespie. Approved.

Programme of the Ottawa Meeting:—That the programme drawn up by the Ottawa Professional Meeting Committee as submitted be approved. Approved.

Memorial to Ontario Government:—That the copy of the Memorial submitted to the Provincial Secretary by the Toronto, Hamilton and Ottawa Branches with the letter by the Secretary of the Toronto Branch, be noted, and the Memorial published in *The Journal.* Noted.

That in view of the desire of the Sault Ste. Marie Branch to have affiliates appointed to their Executive Committee, the Secretary be instructed to write that Council in recommending uniform By-Laws, wishes to have them adopted as uniformly as possible by the various Branches, but is wil ing to recommend a change in the By-Laws to read, that affiliates may hold Branch office. Approved.

Nominating Committee:—That the nominees to the Nominating Committee be approved as follows:—St. John Branch, C. O. Foss· Halifax Branch, J. L. Allan; Vancouver Branch, Newton J. Ker; Quebec Branch, Alex. Fraser; Ottawa Branch, A. A. Dion; Hamilton Branch, H. U. Hart; Toronto Branch, Geo Hogarth; Victoria Branch J. B. Ho dcroft. Approved.

Engineering Index:—The offer made by the American Society of Mechanical Engineers for supplying the index was considered reasonable and its approval recommended. Approved.

Representation on Board of Fire Underwriters:—Alexander Potter, M.E I.C., was nominated as representing *The Institute* on the Board of Fire Underwriters for specifications of Fire Tests. Approved.

That the report of the committee on *The Institute* emblem as submitted by its chairman, Walter J. Francis, be approved, for submission to the Annual General Meeting.

A large number of letters were presented and their contents noted.

Classifications:—Classifications were made for a ballot returnable February 25th.

The following elections and transfers were effected:—

Members.

Albert Johnson Barnes, B.Sc., of Halifax, since 1911, superintendent of Traffic, Maritime Telegraph and Telephone Company, Halifax; Ira Percy MacNab, S.B., of Halifax, since 1915, mechanical superintendent of the Nova Scotia Tramways and Power Company, Halifax; John S. Misene , of Dartmouth, N.S., chief engineer and assistant manager of the Acadia Sugar Refining Company, Halifax.

Associate Members.

John Griffith, of Woolwich, England, assistant superintendent Building Works Department, Royal Arsenal, Woolwich, England; Richard Crosby Harris, with the C. P. R. for twelve years in various capacities, at present time resident engineer at Medicine Hat, Calgary and Edmonton, Alta.; John William Houghton, of Winnipeg, in civil life, with the dept. of City Light and Power, since 1917, Captain in the C.E F.; William Goldsmith Jones, of North Vancouver B.C. since 1916-18, overseas n the C.F.A., at present, representative Imperial Munitions Board at Wallace Shipyard, N. Vancouver, during installing of engines, boilers, etc., in H M.T. War Cayuse and H.M.T. War Atl.n; Alan Thomas Macdonald, of Kentville, N.S., resident engineer with the Halifax Ocean Terminals, since 1917, Major, 1st Batallion, C.R T., France; William Blain MacKay, of Halifax, five years member of firm Farquhar Bros., Ltd., Halifax; Richard Lewis N xon, B.Sc. of Kentville, N.S., since 1916, lecturing in King's College, on mechanics, drawing, surveying and mathematics, in absence of regular professor overseas; Walter Kingston Scott, of Montreal, since 1912, Structural Draftsman with Phoenix Bridge Company; George Leslie Stephens, of Halifax, with the Royal Canadian Navy for seven years, at present, engineer officer of H.M C. Naval Depot, Halifax.

Transferred from *Associate Member* to *Member.*

Cecil Rainsford Crysdale, M.C., of Vancouver, B.C., since 1916, Major Canadian Engineers and Tramway Company, B.E.F., previous to enlistment, asst. div engineer, with the Pacific Great Eastern Ry; Ernest Howard Darling, (graduate of S.P.Sc.), of Hamilton, Ont., in private practice as consulting engineer on bridges, buildings, reinforced concrete, structural steel and industrial engineering.

Transferred from *Junior* to *Associate Member.*

Wilfrid Ernest Hobbs, of East Kildonan, Man., since June, 1918, Captain, 13th Company, Canadian Forestry Corps, B.E.F., on aerodrome construction; David Whittaker, o Pincher Creek, Alta., joined the Canadian Overseas Railway Construction Corps in 1915, 1917, received commission with the Royal Engineers.

BRANCH NEWS

Saskatchewan Branch

J. N. deStein, M.E.I.C. Sec'y.-Treas.

Since the last contribution to *The Journal* from our Branch, the question, which had been uppermost in our minds, namely, legislation, has not advanced one iota. We had an Act ready to submit to the Legislative Assembly of this Province and a delegation appointed to interview the Executive Council of the Government, and it was hoped to get it presented as Government measure. But our Parent Council thought the question should be submitted to the membership at large—and in deference to their wishes we refrained from carrying out our intentions, which, unfortunately meant the postponement of legislation for another year.

Right from the outset (Professional Meeting at Saskatoon), we endeavored to get joint action by at least the Western Branches, and that means the Western members of *The Institute*. But we seemed unable to carry it out, and through no fault of our own. Though we sent copies of the draft of our Act to every Branch of *The Institute* and kept the Western Branches posted as to changes, progress, etc., yet, except a few days ago, we did not receive the copy of a single Act from any of the other Provinces. Recently the Edmonton Branch was courteous enough to send us a copy of the proposed "Alberta Act."

It was the writer's opinion from the very inception of "proposed legislation," that nothing satisfactory could be achieved, except by a meeting of representatives of Branches, who would have to have full authority and would have to be thoroughly posted on the question. And then it would have required a few days of steady "grind" together, preferably with the assistance of an able lawyer. This opinion was voiced by the undersigned at our December meeting, and his motion to that effect carried. We got immediately in touch with all the Western Branches by wire, trying to arrange a meeting of representatives of Western Branches as outlined above.

A satisfactory Act drawn up at that time, could have been submitted to the present sessions of the Legislative Assemblies of the Provinces of Manitoba, Saskatchewan and Alberta and, no doubt, the Parent Council would not have refused their consent to an Act adopted by the Western membership of *The Institute*. The three Prairie Provinces might have had satisfactory Legislation this year.

But the invitation to the meeting was turned down—and now comes the Montreal Branch and practically suggests the same in a resolution passed on December 1918, of which fact the other Branches and Provincial Divisions were not acquainted until January 9th, 1919.

It is nearly six months since the Saskatchewan Branch was instructed at the Western Professional Meeting at Saskatoon to complete the Act and send copies of same to all the Branches of *The Institute*, and we are just now where we started from! Why the delay? I do not think we have maintained the reputation of Western aggressiveness!

And if the Committee, as suggested by the Montreal Branch, should materialize, let it waste not any more valuable time, but get together and "do something!"

As the Duluth Engineers Club in an invitation, dated December 28th, 1918, to form a Union of Engineering Societies, so ably remarks: "The time to do this is now !... We should not lose the momentum we have gained!" Which remark perfectly fits the situation concerning legislation.

Our Annual Meeting, January 9th, at Regina, saw representatives from every city of our Province and was very successful. Several visits had been arranged for the outside members and we hope that our Annual Meeting will be quite an event in the future. H. S. Carpenter, our newly elected Chairman, very ably presented a paper: "Can Earth Roads be made Satisfactory," another important and interesting contribution to our study of the problem of "Good Roads." The Secretary had read a paper at the December meeting on "Remarks concerning Rural Roads," and our February meeting has again the promise of a valuable paper on the road problem in our Province.

The members seem to have taken quite an interest in the exhaustive study of this timely question.

Manitoba Branch

Geo. L. Guy, M.E.I.C. Sec'y.-Treas.

A meeting was held on January 8th at the Engineering Building, Manitoba University, at which consideration of the new by-laws for the section was taken up. A Committee of the local Branch had been working for some time on a revision of these by-laws and a proposed draft had already been submitted to the members for consideration. Subsequent to the issue of this draft the new by-law proposed by Headquarters had appeared in *The Journal*. Professor Brydone-Jack, Chairman of the Committee on By-laws, gave a brief address on the proposed new by-laws pointing out where they differed from the by-laws proposed by the head office. There being no points on which these two drafts essentially differed it was decided to consider the amended draft, clause by clause, and at the same time to consider the points in which they differed from the Headquarters draft. Considerable discussion took place and several minor amendments were proposed. Motion was finally passed that these by-laws be sent back to the Committee with instructions to make the necessary alterations, and that the draft be then submitted to Headquarters for approval.

On January 11th, a luncheon was held at the Fort Garry, at which an address was given by Ex. Controller Puttee on labor and its position with regard to re-organization after the war. Mr. Puttee, who is well known in labor circles in this city, gave an excellent address which was listened to with considerable interest.

At a meeting held in the Engineering Building, Manitoba University, on January 15th, a paper was read by Theo. Kipp, M.E.I.C., on the "Engineer as a Factor in the Development of Agriculture in Western Canada." The paper was of considerable interest to the Members and a good discussion followed.

Among the business transacted at this meeting was the passing of a resolution endorsing the action of the Manitoba Branch of the Mining Institute of Canada in submitting to the Government a protest against the present method of granting mining licenses in Manitoba by Order-in-Council, and requesting that same be altered to Crown grant by Parliament. The Propaganda Committee was instructed to co-operate with the Mining Institute in this matter.

W. M. Scott, M.E.I.C., gave notice of motion that at the next meeting consideration be given as to the best disposition of the railway line of the Greater Winnipeg Water District, which, owing to the completion of the pipe line, is now being considered with reference to whether this line should be disposed of or operated under the Water District management.

Guy C. Dunn and J. M. Leamy were appointed as official representatives of the Branch to represent them at the next general meeting.

Owing to the influenza epidemic no meetings were held during November and December.

On December 21st a luncheon was held at the Fort Garry Hotel at which over sixty members were present. A presentation of a fob with solid gold charm and fastenings, suitably engraved, was made to A. W. Smith, late Secretary of the Branch. The presentation was made by W. P. Brereton, Acting Chairman, who, in a short speech, expressed the appreciation of the Branch for Mr. Smith's valuable service, to which Mr. Smith replied in a happily worded speech.

After luncheon the members visited the tunnel under the Red River, which is being constructed by the Greater Winnipeg Water District.

On January 2nd, the first meeting of the year was held at the Engineering Building, Manitoba University. Con iderable business was put through, including the election of officers for the ensuing year; W. P. Brereton and Geo. L. Guy being elected Chairman and Secretary-Treasurer, respectively, by acclamation, and A. H. O'Rielly and R. W. Moffatt as Auditors. Nominations were also made for the Executive Committee.

A vote of condolence was tendered to the Secretary-Treasurer, Geo. L. Guy, on his recent bereavement in the death of Mrs. Guy.

A resolution was passed instructing the Secretary to write to each Branch of *The Institute* requesting them to appoint a delegate to attend the next annual meeting of *The Institute* in Ottawa, to arrange for proper legislation to be presented to the various Legislatures at an early date, for the registration of Engineers. The motion was made by J. G. Sullivan, Chairman of the Legislative Committee, and was carried unanimously, the Executive being authorized to appoint a representative for this Branch.

An interesting paper was then read by W. J. Dick, M.E.I.C. on "Reconstruction." Considerable discussion took place after the paper, and a Committee was appointed to co-operate with the Winnipeg Board of Trade on forth-coming reconstruction problems.

A full programme has been arranged for the coming season, many interesting papers having been promised. It is hoped by the success of the short season before us to make up for the time lost owing to the recent epidemic.

* * * *

The soft water for Winnipeg, which it was anticipated would be delivered by Christmas, has been delayed owing the late delivery of certain castings, but it is hoped the water will be available early in the year.

Chas. F. Gray, local Associate, was elected Mayor of Winnipeg at the recent elections by an overwhelming majority.

W. A. Duff, Chairman of the Branch, who has been absent from the City for some time, owing to illness, returned for a short time and was welcomed by many of the Members. It is hoped that the will shortly return to Winnipeg permanently.

Grasping an Opportunity.

The action of the Manitoba branch of *The Engineering Institute* in deciding to take a more keen and active interest in matters affecting public welfare calls for commendation. It indicates the trend of the times, that problems vitally affecting the future of the nation are drawing the attention of the right type of men. In other words, the practical as well as the theoretical men are becoming interested. There is little chance of anything "getting past" the engineers save that which will be backed by the best brains in the country on any given subject which has to do with advancement along engineering lines. There will be none of the political element in any of the recommendations which they may make. If a power line is suggested or a waterway advised it will not be recommended until the men best qualified to know its feasibility have pronounced upon it. There will be no wholesale recommendations for roadbuilding in certain constituencies. Neither will there be any moves to spend the public money on bridges which from a utilitarian standpoint give way to the spectacular. It is very easy for a semi-public body to recommend the government to do certain things which, on the surface, appear feasible and are pleasing to the ear. It is, however, another thing for the promoters of such an idea to be able to show the government how the fundamentals of such a plan are possible in conformity with the need of the greatest possible economy in the use of public money. From this standpoint the engineers are at a great advantage. They will not recommend any plan until they find it is feasible and reasonably economical.

But the best sign of all is that these men have been induced to come out publicly and offer their valuable services in advising federal, provincial and municipal authorities on important matters. The value of this cannot be overestimated.—*Winnipeg Free Press*, Jan. 17.

St. John Branch

A. R. Crookshank, M.E.I.C. Secy.-Treas.

The Annual Meeting of the St. John Branch was held in the old Post Office Building, January 14th, at 8 p.m.

The members present were the Chairman and Secretary, and Messrs. Archibald, Baxter, Cameron, Dufresne, Hare, Hatfied, Kirby, and Macdonald; also the following visitors: B. Allen of Dept. Ry. & Canals, Cape

Tormentine; G. B. Ballantyne, F. M. Barnes, J. L. Heans, H. D. Macaulay, T. W. Russell and K. Vavasour, a total of seventeen.

The minutes of the meeting of May 7th, at which the present officers were elected, were read by the Secretary, who also read the minutes of the meetings of October 7th and November 21st, which were then approved.

The Chairman then appointed Messrs. Archibald and Cameron to act as scrutineers.

The Secretary then read his report, which was adopted on motion.

On motion of Mr. Kirby, seconded by Mr. Hare, D. L. Hutchinson's application was received, and he was elected an Affiliate of the Branch.

The Chairman then introduced G. S. Baxter, and called upon him to read his paper, entitled "A Contractor in a Clyde Shipyard." The paper had been carefully prepared, was interesting and well illustrated by photographs and diagrams. It dealt with the work of remodelling, bringing up to date and enlarging the existing facilities of the shipyard to allow of the construction of the largest steamer built up to that time, 1911. This comprised (1) the construction of several ways, with the use of concrete keel blocks, each served by two sets of guyed stiff leg full circle cranes; (2) the equipping of the material yard with railway tracks served by overhead travelling cranes, straddling a track with storage space on each side and a radial gantry 136 feet long, pivoted near the centre and swinging an angle of 180 degrees at the rear of one of the raised traveller crane rails; (3) the lengthening of two fitting out berths so that the new vessel would not stick out into the river and interfere with navigation. This necessitated the sinking at head of a slip within three fee of a railway track and near a heavy building of three curved caissons, with steel cutting edges and working chamber, brick superstructure with a horizontal concrete arch forming the core and tie; (4) the building of a steel sheet pile retaining wall and timber pile wharf, after the removal of the old existing structure. A hearty vote of thanks was tendered to Mr. Baxter by the Chairman for the presentation of his paper.

The report of the scrutineers was then read, and they stated that twenty-three ballots had been received, one was rejected, as improperly marked, that C. C. Kirby had received the plurality of votes for Chairman, A. R. Crookshank for Secretary-Treasurer and G. G. Hare and C. O. Foss for Executive Committee members. The Chairman then declared these gentlemen elected, and welcomed Mr. Kirby to the chair. Mr. Kirby in reply, thanked the members for honouring him and then referred to the General Professional Meeting that is planned for this fall, and asked hat each member begin to think seriously about the matter, to make plans for preparation of papers, entertainment, etc., and to impart all suggestions to the Executive, so that this meeting should be worth while. He then called for a vote of thanks, which was unanimously given to Mr. Gray for all the effective hard work he had done for the Branch during the past year.

Mr. Gray stated he appreciated the kindness of the Meeting and referred to the conscientious work done by the other officers of the Branch. He then strongly emphasized the necessity of each and every member turning out to the meetings, and to give their active assistance and support to the officers in this work, " For the Branch can only be a success, if each member works." The New Brunswick turnout and the part St. John men played in the Halifax General Professional Meeting showed what St. John men can do when they try, so if we all work together the meeting this fall should be equally successful as the Halifax one. Mr. Gray then had to leave to catch his train for home.

The new Chairman then asked the Secretary to read the communications. A number of letters were then read by the Secretary.

Under new business it was decided to have the present and the proposed revised by-laws mimeographed and distributed to members of the Branch. Moved by Mr. Baxter, seconded by Mr. Archibald, that the Executive Committee draw up a set of by-laws based on those recommended by the Council and that would be applicable to our Branch. Carried. Notice of motion of change in by-laws was given by the secretary, seconded by Mr. Macdonald, as follows: " That the fee paid by Affiliates be $5.00, the same to include the subscription to *The Journal* for the concurrent year."

On motion the meeting then adjourned at 11.20 p.m.

Sault Ste. Marie Branch

L. R. Brown, A.M.E.I.C. Secy.-Treas.

The first meeting of the Branch was held in the Y.M.C.A. on the evening of January 9th with about thirty engineers in attendance. Fraser S Keith, Secretary of *The Institute* gave a brief outline about the aims and objects of *The Institute* and of its history and present organization for the benefit of prospective members.

The following Executive was elected for 1919:—Chairman, J. W. LeB Ross; Secretary-Treasurer, L. R. Brown; Executive Committee R. S. McCormick, B. E. Barnhill, A. G. Tweedie, J. H. Ryckman.

It was resolves that a meeting be held on the last Thursday of each month. A membership committee was appointed from the various industries. W. S. Wilson was elected representative on the Ontario Provincial Division. F. F. Griffin read a paper entitled Efficiency Acceptance Tests on a 3200 H.P. Water Turbine.

The next meeting was called for January 30th.

Quebec Branch

J. A. Buteau, A.M.E.I.C. Secy.-Treas.

At the Annual Meeting of the Quebec Branch the following officers were elected: Chairman, A. R. Decary; Secretary-Treasurer, J. A. Buteau; Executive, F. T. Cole, J. E. Gibault, W. Lefebvre.

The past Chairmen of the Branch are A. E. Doucet, A. Amos and S. S. Oliver. Alex. Fraser, 16 Aberdeen Street, has been appointed a member to represent the Quebec Branch on the Nominating Committee.

Vancouver Branch

A. G. Dalzell, A.M.E.I.C., Sec'y.-Treas.

A meeting of the Vancouver Branch was held on December 13th, 1918, at which a paper, illustrated by lantern slides, on The Detroit Tunnel, was read by C. T. Hamilton, A.M.E.I.C., and an interesting discussion took place.

A resolution was passed approving the action of the Council at Montreal regarding proposed legislation.

At an Executive meeting of the Branch it was decided to prepare a memorandum to be presented to the Local Members of Parliament regarding the rating of engineers by the Civil Service Commission. A copy of this memorandum has been sent to all Branches of *The Institute.* A delegation waited upon H. H. Stevens and S. J. Crowe, M.P's. for the Vancouver District and presented the memorandum, and favourable consideration was promised.

A general meeting was held on January 17th, and the communications from the Montreal and Manitoba Branches regarding legislation considered. After discussion it was decided to endorse the attitude of the Montreal Branch with the addition of the word " promptly " in the sentence of their resolution—" to inquire into, study and report (*promptly*) upon the whole question of legislation, etc."

It was decided to send a delegation to interview the Premier of the Province to suggest that the proposed Public Utilities Commission of the Province should consist of: one lawyer, one accountant, one qualified engineer.

A discussion took place regarding a local civic issue:—the control of the watershed area of the waterworks system of Vancouver and adjoining municipalities, and it was decided to submit a resolution to the City Council, suggesting that a commission of three engineers be appointed, to consider the whole question of the watershed area, its development and future control, and to report to the Council so that prompt action could be taken to preserve the rights of the citizens.

The Secretary of the Branch was appointed to represent *The Institute* on the Civic Re-construction League.

A vote of condolence was passed to be sent to the relatives of the late Colonel Bodwell, and express the sympathy of the Branch in the loss of an esteemed colleague, and a true representative of the Canadian Engineers who have served the Empire.

From the last statement of membership the strength of the Branch is as follows: Members 47; Associate Members, 72; Juniors, 7, Students, 4; Total, 130; and out of this number the following have served or are still serving the country, in Army or Navy: Members, 14; Associates, 23; Juniors, 3; Students, 3; Total, 43.

Montreal Branch

Frederick B. Brown, M.E.I.C., Sec'y.-Treas.

The Montreal Branch programme for the session, January to April, 1919, has been issued showing that a meeting will be held every Thursday evening at 8.15, this being the catchword used on the programme and also on the announcements of weekly meetings, the only exception being February 13th, when the Professional Meeting in Ottawa will be held.

On January 9th an interesting paper on Fire Prevention was read by George H. Greenfield. On January 16th, B. O. Eriksen, A.M.E.I.C., read a paper, prepared by himself and S. H. Deubelbeiss, A.M.E.I.C., which was completely illustrated by slides, on The Design and Construction of Reinforced Concrete Viaducts at Mileages 0.9 and 1.8 North Toronto Sub-Division, Canadian Pacific Railway. Following this paper, W. F. Chipman, K. C., chairman of the National Reconstruction Committee, gave an eloquent address on the problems facing Canada, in which he pointed out the necessity for not only a broader policy but for immediate action.

On January 23rd the meeting of the Branch was held at the headquarters of *The Institute*, with R. M. Hannaford in the chair, when J. A. Burnett, A.M.E.I.C., read a paper on Coaling Plant for Locomotives, followed by a treatise on Industrial Illumination, by George K. McDougall.

The programme for the remainder of the session, as at present outlined, is:—

Jan. 30—Coal Briquetting, by Paul Seurot, M.E.I.C. Coal is King (a motion picture), by R. E. Cleaton Company.

Feb. 6—Some Problems in Ocean Transportation, by A. W. Robinson, M.E.I.C. Manufacture of Nitro-Benzol and Aniline Oils, by G. J. Caron, J.E.I.C.

Feb. 20—Construction of Canadian Northern Railway Tunnel, Montreal, by J. L. Busfield, A.M.E.I C.

Feb. 27—The Effect of Ice on Hydro-Electric Plants, by R. M. Wilson, A.M.E.I.C.

March 6—Air Drills, by N. M. Campbell, A.M.E.I.C. The Halifax Explosion from a Chemist's and Physicist's Viewpoint, by Dr. Howard Bronson, F.R.S.C. Burroughs Adding Machines (a motion picture), by Burroughs Adding Machine Company.

March 13—Electrical Welding, by C. V. Holslag. Patents and Engineering by Hanbury A. Budden, A.E.I.C.

March 20—Ball Bearing Jacks, by W. H. C. Mussen. A.E.I.C. Peat, by Ernest V. Moore, A.M.E.I.C.

March 27—Some Notes on the Design and Construction of Reinforced Concrete Covered Reservoirs, by R. deL. French, M.E.I.C.

April 3—The Operation of Railways as an Engineering Problem, by V. I. Smart, M.E.I.C.

April 10—Waterproof Paper Productions and their Industrial Possibilities, by J. A. DeCew, A.M.E.I.C.

April 17—Quebec Bridge, by Phelps Johnston, M.E.I.C., G. H. Duggan, M.E.I.C., George F. Porter, M.E.I.C.

April 24—Continuation of Paper of April 17th.

Calgary Branch

C. M. Arnold, M.E.I.C., Sec.-Treasurer.

The Annual General Meeting of the Branch was held in the Board of Trade rooms on the afternoon of Saturday, December 7th, 1918.

The meeting was preceded by a luncheon, at which twenty-five members were present. During the interval between the luncheon and the meeting, the candidates for Mayor gave short addresses, touching on matters particularly of interest to the engineer.

A. S. Dawson was elected to act as Chairman in the absence of Mr. Pearce, and owing to the indisposition of the Secretary, the position was filled by the Assistant Secretary, M. H. Marshall.

The Chairman called the meeting to order and called for the minutes of the last general meeting to be read. These were adopted and signed by the Chairman.

Communications were read from the Secretary of the Parent Institute, dealing with badges and new certificates, and also canvassing for Associates.

Accounts.—Septimus Burnand, $1.50.
Campbell Floral Co., $10.00.

Moved by P. Turner-Bone, seconded by G. N. Houston, that these be approved.

Applications to join the Branch were received from four candidates with results of elections as noted:—

George S. Deslandes.......Elected Associate of Branch.

James F. McCall.........
Charles Howarth.........
George Phillip Frederick Boese...............
}Elected with status of Associate of Branch, with recommentation for election to *The Institute* as Associate Members.

Reports. — A. S. Dawson, Chairman of the Concrete Committee, stated that he had not as yet prepared a written report, but would do so. He gave a short resumé of the work that had been done to date. He wished to nominate R. S. Stockton as a member of this Committee to fill the vacancy caused by the death of Mr. Sidenius. Moved by Mr. Peters, seconded by Mr. Marshall, that Stockton be elected. Carried.

Mr. Peters, Chairman of the Legislation Committee, stated that he had not prepared a report as the matter was fully discussed at the recent general meeting of the Branch.

In the absence of Mr. Arnold, Secretary-Treasurer, his Annual Report was read by the Assistant Secretary, and is appended as part of these minutes.

A financial statement was submitted showing that the Branch was in a good financial position.

On the motion of the Chairman, seconded by Mr. Houston, the report was adopted, and the financial report was approved subject to auditor's certificate being given.

Elections.—The ballots for Officers for the ensuing year were counted by Scrutineers Gillespie and Chapman, who reported the following officers elected:—

Chairman	G. W. Craig	Member.
Sec.-Treasurer	C. M. Arnold	"
Executive	Wm. Pearce	Member.
	A. S. Dawson	Past Chairman.
	F. H. Peters	Member.
	B. L. Thorne	"
	A. S. Chapman	Assoc. Member.
Executive Alberta Division	F. H. Peters	Member.
	S. G. Porter	"
Auditors	J. S. Tempest	Assoc. Member.
	R. C. Gillespie	"

Mr. Craig was given a hearty reception upon assuming his new duties and made a short address, dealing with the desirability of publicity on engineering matters. This branch News seems to be crowded up more than the others.

General Business.—Mr. Marshall drew attention to the fact that one of the most important matters to come before the new City Council was that of Sewage Disposal, and suggested that this was a question that could very well engage the attention of the Branch this session. After some discussion, Mr. Craig promised to present a paper on the subject, and it was arranged after the matter had been fully discussed to give one or two public lectures, presented in a manner intelligible to the ordinary citizen.

The Branch will also take an active interest in any town planning or housing scheme the city may undertake.

It was announced that W. J. Gale, Associate Member, offered a mounted beaver to the Branch, and suggested that it be placed in a prominent public place as "The First Engineer." The Secretary was instructed to thank Mr. Gale for his offer, which was accepted, and a suitable inscription would be arranged for. The matter would be dealt with by the Executive.

On the motion of Mr. Dawson, it was decided to send a Greeting to members of the Branch on Active Service. It was decided to leave the matter in the hands of the Chairman and Secretary to do what was considered best.

The meeting adjourned at 4 p.m.

AT THE SASKATOON MEETING THE PRESENCE OF LADIES, WIVES AND FRIENDS OF MEMBERS WAS APPRECIATED. A SPECIAL PROGRAMME OF ENTERTAINMENT HAS BEEN ARRANGED FOR VISITING LADIES BY WIVES OF OTTAWA MEMBERS, OTTAWA, FEB. 11th, 12th and 13th.

PERSONALS

O. W. Smith, M.E.I C. (a member of the Sask. Branch) is spending the winter at Victoria, B.C.

E. W. Murray, A.M.E.I.C. (a member of the Sask. Branch) has gone to Montreal for the winter.

W. A Mather, A.M.E.I.C , has been appointed general superintendent, C. P. Ry., at Moose Jaw, Sask.

C. H. Fox, A.M.E I.C., who has recently returned from overseas, has been appointed to Mr. McKenzie's position as resident engineer C. P. Ry., Regina.

A. V. Redmond, A.M.E.I.C., has been moved from Cochrane to Winnipeg, as district engineer of the Canadian National Railways, his district extending from O'Brien, Que., to Brandon, Man.

Murdoch McKenzie, A.M.E.I.C., until recently resident engineer, C. P. Ry. at Regina, has been appointed engineer in charge of a locating party from Swift Current, Sask., eastward.

A. W. Haddow, A.M.E.I.C., city engineer of Edmonton, has been appointed professor of Civil and Municipal Engineering at the University of Alberta, succeeding the late Professor Wm. Muir Edwards. Professor Haddow is a member of the Executive of the Edmonton Branch, and was Branch Secretary for 1917. He will still devote part of his time to the city's engineering department.

Stewart F. Rutherford, A.M.E.I.C., one of the most active members of the Montreal Branch, in which he has taken a prominent part from the start, being Chairman of the Industrial Section, has been elected on the new Council of the City of Westmount at the head of the poll. Those who know Mr. Rutherford predict that he will do credit to his new position.

W. S. Harvey, A.M.E.I.C., has received an appointment with the Toronto Harbour Commission as engineer of sewers and will prepare plans for the drainage of the Ashbridge's Bay Industrial Area and extensions to the city's main sewer outlets beyond the fill along the waterfront. This work will be done under the direction of George T. Clark, A.M.E.I.C., designing engineer to the Harbour Commission. Mr. Harvey has just been elected Secretary of the Toronto Branch of *The Institute* for 1919.

Dr. J. A. L. Waddell, M.E.I.C., Consulting Engineer of Kansas City, U.S A., and a member of this *Institute* since 1903, has been elected a corresponding member of the Academy of Science of France. Only nineteen corresponding members, including Dr. Waddell, have been elected from the United States since the founding of the Academy in 1795, and of these there are living at the present time Drs. Pickering and Hale, astronomers and Dr. Davis, geographer.

W. F. Drysdale, B.Sc. (McGill), A.M.E.I.C., reached New York on the Lorraine on December 6th, from France, and after a conference on business matters arrived in Montreal where he renewed former acquaintances. Mr. Drysdale is a Canadian who is occupying one of the big positions in industrial affairs in Europe, being the European representative of the American Locomotive Sales Corporation, and the Montreal Locomotive Works, Ltd., with headquarters at Paris, his territory being Continental Europe. He proposes sailing for France on February 10th.

Major William Geo. Swan, B.A.Sc. (Univ. Tor.), A.M.E.I.C., has recently added further laurels to his already distinguished military career. He has been twice mentioned in despatches, was decorated with the Croix de Guerre last year, and has just been invested with the Distinguished Service Order. Major Swan, previous to going overseas, was on the engineering department of the Canadian Northern Ry. at Vancouver, with which Company he was for the past fifteen years, his latest position before enlistment being divisional engineer in charge of construction C. N. Ry., from Steveston to Hope, B.C. He is a graduate of the Toronto University, and was a lecturer in the School of Science for two years. He enlisted with the 131st Battalion, and upon arrival overseas was transferred to the Railway Troops. For 20 months he was with the Imperial Army, and later transferred to the Canadians.

G. H. DUGGAN, M.E.I.C.

Newly elected President of the Dominion Bridge Co.

OBITUARIES

James Russell Wood, B.Sc.

James Russell Wood, B.Sc. (McGill), A.M.E.I.C., of Peterboro, died of pneumonia following influenza, on October 29th, 1918. The late Mr. Wood graduated from McGill University in 1911 in civil engineering, his first position being assistant engineer on construction of the Magog Power Plant. Later he was ass'stant on construction, Monreal Harbour Elevator, No. 12, and in 1913 went to Welland where he was doing general enginering work.

The late Mr. Wood was born at Rockland, Ont., August 1st, 1884, and was transferred from Student to Associate Member of *The Institute*, October 20th, 1914.

Captain John Atkinson Tuzo.

Captain John Atkinson Tuzo, A.M.E.I.C., was killed in action in German East Africa, April, 1918, word of which was received from his mother from Warlingham, Surrey, England, on January 13th. The late Captain Tuzo, was born on September 15th, 1874, and was a graduate of Leeds University, England. He came to Canada in 1897, where for eight years he engaged in mining in the Yale district, B.C., and later took up railway work in the Northwestern States and in British Columbia. In 1907 he was resident engineer of the Spokane, Portland and Seattle Railway, Washington, and 1910 was resident engineer, Kettle River Valley Railway, with headquarters at Midway, B.C.

When war broke out he returned to England and received a commission as Captain with the Imperial Forces, and was engaged with them in the successful struggle which ended in the defeat of the German forces in East Africa.

Major Alfred deCourcy Meade, M.C.

Major Alfred deCourcy Meade, A.M.E.I.C., M C., was killed in a motor accident at Painstown near Droheda, Ireland, on Saturday, December 14th. The motor car in which Major Meade was being driven collided with a hackney car.

Previous to enlisting, in 1914, in the Royal Engineers, Major Meade was engaged in railway construction work in Western Canada. He went to France in March, 1915, and won the Military Cross on December of the same year. He left France on the signing of the armistice, having seen three and a half years in the fighting line.

This information was conveyed to *The Institute* by J. C. Meade, A.M.E.I C., of Regina, a brother of Major Meade, to whom, as well as to the widow and infant son, the sympathy of *The Institute* goe; out.

The late Major Meade was born on November 3rd, 1884, and wa elected an Associate Member of *The Institute* in November, 1912. He was also an Associate Member of the Institution of Civil Engineers of Great Britain.

Lieut.-Col. Howard L. Bodwell, C.M.G., D.S.O.

The circumstances surrounding the death of Lieut.-Col. Howard Bodwell, A.M.E.I.C., were particularly sad, as he died in St. John, from pneumonia, while returning from the front, and while his wife was on the road from Vancouver to meet him. The late Lieut.-Col. Bodwell, who was honoured by receiving the C.M.G., D.S.O., Croix de Guerre, was one of the shining examples of a successful military career, having been assistant director of light railways in the military area in France. Born at Ingersoll, Ontario, October 13th, 1881, Howard Lionel Bodwell was educated at and a graduate of the Royal Military College, Kingston.

Lieut.-Col. Bodwell's engineering career was for the most part on railway work and particularly with the Grand Trunk Pacific Railway. Later he was instructor in Civil Engineering at Royal Military College and in 1907 was appointed resident engineer of the Canton, Hankow Railway, Kwong Tung, China, which position he held for two years. Returning to Vancouver he took up his residence at the Coast where he was living when war broke out.

Lieut -Col. Bodwell was associated in railway work in British Columbia with J. W. Stewart and his rise in the service was on a par with the distinguished services rendered by his chief, who is now Brigadier-General, and in charge of all railway operation on the western front.

He was wounded at St. Eloi in April, 1916, and after ten weeks in the hospital, returned to the firing ine. In September of that year he was awarded the D.S.O. for building a piece of roadway under heavy shell fire. In December, 1916, Lieut.-Col. Bodwell was made assistant director of light railways. In January he was made a Companion of St. Michael and St. George, " for services rendered in connection with military operation."

Lieut.-Co'. Bodwell received the Croix de Guerre from the French Government. The official Gazette says: " Lieut -Col. H. L. Bodwell, C.M.G., D.S.O., has directed with great competence and sustained energy and carried to a successful completion in the minimum of time, in spite of conditions of working which were often difficult, the construction and putting into operation of a new system of sixty kilometres of railway which has greatly facilitated supply of the French troops."

He was a member of the well known Bodwell family and a cousin of the late E. V. Bodwell, K.C. His father was Eliphalet Bodwell, of Ingersoll, Ont. His widow was formerly Miss Dulcie Hornby, and she is left with two children to mourn his loss.

Lieut.-Col. Bodwell returned to Canada on the Scandinavian, his death occurring at St. John, N.B., on Wednesday, January 15th.

EMPLOYMENT BUREAU

Situations Vacant

Engineering Salesman.

Splendid opening for a graduate engineer with a large industrial organization. Must be young man, not long out of college; must speak French fluently; be thoroughly reliable; have business instincts which will enable him to develop salesmanship of a high order. This is a very desirable position for an ambitious man of the type required. Address Box No. 26.

Preliminary Notice of Application for Admission and for Transfer

The By-Laws now provide that the Council of the Society shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in February, 1919.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BROWN—GEORGE J., of Winnipeg, Man. Born at Lamberton, Minn., Jan. 4th 1881. Educ., Elec. engr., Univ. of Minnesota, 1908. Elec. dftsman and asst. supt. for W. I. Gray & Co., elec. contrs., Minneapolis (6 mos.); elec. dftsman with Chas. L. Pillsbury Co., conslt. engrs., Mpls. (3 mos.); asst. engr. with Electric Construction Co., St. Paul, Minn., (2 yrs.); ch. dftsman of Lt. & pr. dept., of Portland Ry. Lt. & Pr. Co., Portland, Ore. (1 yr.); 1912-16, vice-pres. & supt. of constrn. & erect., for Schumacher Gray Co., Winnipeg, 1916-18, asst. elec. engr., Prov. of Man.: 1918-19, asst. engr. of mech. services, prov. of Man.

References: J. M. Leamy, E. V. Caton, M. A. Lyons, J. Rochetti, G. L. Guy, F. H. Farmer.

CHRISTIE—GERALD MOFFAT, of Kamloops, B.C. Born at Moosamim, Man. Aug. 15th, 1888. Educ., D.L.S. & B.C.L.S., 1910-14 with Christie, Dawson & Heywood, Civil Engrs., of Kamloops, in chg. of parties on survey of land, mines, and timber and city sub divs. & survey of townsites; 1914 practicing as a land surveyor in Kamloops; engaged chiefly in making surveys of right of way for C.N.Ry., through B.C., also irrigation work, laying out flumes, ditches, etc.

References: F. J. Dawson, W. H. Powell, P. Philips, F. W. Anderson, A. Lighthall, H. L. Johnson, E. P. Heywood.

COURTICE—EDMUND DEAN WADE, of Hamilton, Ont. Born at Holmesville, Ont., Sept. 11th, 1892. Educ. B.A.Sc., Toronto Univ. 1914. Apprentice G.T.R., shops, Stratford, Ont. (3 mos.); with Clinton Motor Car Co., 4 mos.; 1913, asst. in dept. of waste water prevention, Toronto, (2 mos.); 1914-1916, asst. & acting supt. of constrn. with the City of Toronto; 1916 asst. engr. with Hare Eng. Co. (3 mos.); 1918, engr. with Gordon Hutton of Hamilton, Ont. (2 mos.), from Sept. 1916, chief of Dept. of Mechanical & Architectural Drawing, Hamilton Tech. and Art. School.

References: E. R. Gray, C. L. Fellows, F. W. Paulin, E. H. Darling.

DENIS—LEOPOLD GERMAIN, of Ottawa, Ont. Born at Gomont, France, May 26th, 1878. Educ. B.Sc., McGill Univ. 1899. 1897, elec. ry. surveys, central station asst.; 1898-1899, testing dept., Royal Elec. Co.; 1900-10. ch. elec. engr. of Jacques Cartier Elec. Co., Quebec; 1910 to present time, hydro elec engr., Comm. of Conservation, Ottawa.

References: J. White, A. A. Dion, J. B. Challies, R. deB. Corriveau, W. J. Dick.

DUPERRON—ARTHUR, of Montreal. Born at Nicolet, Que., Sept. 29th, 1889. Educ. B.A.Sc., Polytech. school, Laval Univ., 1911. On survey work during vacations, wth W. E. Boucher, consl. engr. April 1911-Sept. 1911, with E. Loignon, as dftsman., hydro. elec. & bldg. constrn.; 1911, Jan. 1912, with Central Ry. of Can. as topog. on location, Hawkesbury to Ottawa; Jan. 1912-Sept. 1912, under W. K. Bishop, on hydro. elec. surveys on the St. Francis River & on constrn. work at Drummondville, Que.; Sept. 1912-May 1913, with C.P.R., office of constrn. dept. Montreal; May 1913-June 1915, bridge dept. C.P.R., design work & preparation of plans; Aug. 1915 to date with Quebec Streams Comm., as follows; 1915 ch. of party on survey of Lake St. John; 1916 in chg. of constrn. of superstructure, Sauvage River; Jan. 1917 to date in chg. of design.

References: O. Lefebvre, A. Surveyer, W. I. Bishop, B. O. Eriksen, J. B. D'Aeth, H. Massue.

EAGER—ALBERT HENRY, of Winnipeg, Man. Born at Waterloo, Que., July 15th, 1868. Educ. High School; entered railway service June 1st, 1885, June 1st. 1893, Machinist apprentice, Southeastern Railway and C.P.R. Farnham, Que.; 1893-1899, Machinist, C.P.R., Farnham, Que.; Aug. 1899-Mach, 1903, Locomotive Foreman, C.P.R., Farnham, and Megantic, Que.; 1903-1906, General Foreman, C.P.R., Cranbrook, B.C. and Calgary, Alta.; 1907-1908, Dist. Master Mechanic, C.P.R., Kenora, Ont.; 1908-1910, Locomotive Foreman, C.P.R., Calgary, Alta.; 1910-1915, Sup. of Shops, Canadian Northern Railway, Winnipeg; Aug. 1st, 1915 to Dec. 1918, Asst, Supt. of Rolling Stock, Western Lines, Canadian Northern Railway, Winnipeg; at the present time, mech. supt. Western Lines, Can. National Rys. Winnipeg.

References: J. G. Legrand, E. C. Hanson, J. G. Sullivan, G. Pratt, W. G. Chace, G. L. Guy, T. Turnbull.

GRAY—ANDREW JACK, of Hamilton, Ont Born at Victoria, B.C., Sept., 15th, 1890. Educ., B.A.Sc., Toronto Univ. 1913. 1907-09, apprentice; 1913-14, asst. engr, Marine Iron Works; 1914-17, on active service; 1917-18, asst. engr., Marine Iron Wks ; 1918, mech. engr. & dftsman, Steel Co. of Can.

References: E. R. Gray, E. H. Darling, C. F. Whitton, R. L. Latham, W. Janney.

HARPER—RICHARD DOBSON, of Winnipeg, Man. Born at Bayfield, N.B., March 30th, 1890. Educ., high school, 2 yrs. Mt. Allison, & I.C.S. 1906-09, rodman, topog., levelman, transitman, res. engr. dftsman,; 1909-10, instrumentman on constrn., N.T.C.Ry. (4 mos.); 1910, transitman with G. Ross, Sydney, N.S, (3 mos.); Sept, 1911-June 1912, trans. man. C.N.R.; June 1912-April 1913, highway engr., Man. Public Works, 1913-June 1914, munic. engr. Rosser Municip.; June 1914-Sept. 1914; highway engr. Man. Good Roads Board; Jan 1915-June 1915, dftsman, C.G.Ry., Moncton, N.B.; June 1915-May 1917, with C.G.Ry., as ch. dftsman, etc.; May 1917-Sept. 1918, munic. engr., St. Francois Xavier, Man.; Sept. 1918 to date, dist. engr., with Good Roads Board, Man.

References: C. B. Brown, A. V. Redmond, A. McGillivray, E. P. Goodwin, M. A. Lyons.

HUBBARD—FRANK WILLIAM, of Hamilton, Ont. Born at Geneva, Ohio, Sept. 14th, 1882. Educ. Geneva High school. 1902-04 with L.S. & M.S.Ry.; 1904-06, rodman, L.S. & M.S.Ry.; 1906-13, instrumentman, L.S. & M.S.Ry.; 1913 to present time asst. engr., T. H. & B. Ry., had chg of constrn. of E. & O. branch (Smithville to Port Maitland, Ont.); Port Mailtand Harbor facilities, including slip dock & apron, Bridgeburg yard, etc.

References: R. L. Latham, E. R. Gray, A. S. Going, H. A. McFarlane, F. W. Paulin, E. W. Oliver.

HUNGERFORD—SAMUEL JAMES, of Toronto, Ont. Born near Bedford, Que., July 16th, 1872. Educ. high school. May 1886-Feb. 1891, mach. apprentice, S.E.Ry. & C.P.R., Farnham, Que.; May 1891-Aug. 1894, machinist in Que., Ont. & Vermont; Sept. 1894-1897, with C.P.R., Montreal; Aug. 1897-Apr. 1900, asst. foreman; C.P.R., Farnham; Apr. 1900-Feb 1901, locomotive foreman, C.P.R. Megantic, Feb. Sept. 1901, gen. foreman, CP.R.; Sept. 1901-Feb. 1903, loco. foreman, C.P.R. Cranbrook, B.C.; Feb. 1903-Jan. 1904, master mech., C.P.R., Calgary; Jan. 1904-Feb. 1910, with C.P.R. Winnipeg; Mar. 1910-Nov. 1917, supt. of roll. stock, with C.N.R ; Nov. 1917-Dec. 1918, gen. mgr., C.N.R., Toronto, Dec. 1918 to date, asst. vice-pres., C.N.R., C.G Rys. Toronto.

References: H. H. Vaughan, J. M. R. Fairbairn, W. H. Winterrowd, E. W. Oliver, M. H. Macleod, H. K. Wicksteed, H. Cameron.

JOSLYN—CECIL EARLE, of Ottawa, Ont. Born at Hartney, Man., Nov., 24th, 1889. Educ. B.Sc., (Honors) Queen's Univ. 1916, D.L.S. 1916. 1914, asst. to G. H. Blanchet, D.L.S., on base line surveys, Alta. 1915, asst. to A. L. Cummings, D.L.S., on sub. div. surveys, So. Alta.; 1916, asst. to G. A. Bennet, D.L.S., on reclamation work, Sask.; 1917 to present time, asst. to Inspector of shell components, Imp. Min. of Munitions.

References: N. P. Dalziel, E. A. Stone, H. W. B. Swabey, D. Wyand, H. R. Younger, J. M. M. Laforest.

NEWMAN—JOHN JAMES, of Windsor, Ont. Born at Mersey Township, Ont., March 10th, 1872. Educ. S.P.S. Toronto, 1896-97; apprenticed for OLS. in 1897, passed final exam, and admitted to practice in 1898. Since April 1900, engaged in and responsible charge of gen. surveying also engr. practice in vicinity of Windsor particularly engaged in drainage and paving. At the present time; town engineer of Leamington, Amherstburg, and Township Engineer of Anderson, Sandwich West, Colchester South, Tilbury North and Tilbury West.

References: O. McKay, M. E. Brian, A. J. Stevens, G. A. McCubbin, J. A. Bell.

NEWMAN—WILLIAM, of Winnipeg, Man. Born at Essex County, Ont., Jan. 22nd, 1866. Educ., C.E., S.P.S., Toronto, 1891. Jan. 1893-Mar. 1906, gen. eng. practice & city engr., of Windsor, Ont.; 1906 to date, head of W. Newman Co., Ltd., Winnipeg.

References: W. P. Brereton, W. G. Chace, T. R. Deacon, J. Haddin, H. N. Ruttan, W. M. Scott.

RANDLESOME— HUGH GOFFEN (Lieut.) of Vancouver, B.C. Born at Reedham, Eng., Dec. 20th, 1882. Educ. Grammar & pub. schools. 1906-07 on Dom. surveys. topog. and instrument work; 1907-08, topog. and instrumentman, White Pass & Yukon Ry.; 1908, instrumentman, B.C.E.Ry.; 1908-09, surveys Prince Rupert Harbor and townsites, B.C.; 1909, in chg., work road & bridge constrn., Prince Rupert; 1910, res. engr. and locator, Portland Canal; 1911-12, asst. eng., Powell River Paper & Pulp Mills & hydro elec. development, chg. of portion trans-provincial road reconnaissance & location; 1913-15, private work; 1914, in chg. of party, Govt. Water Rights; 1916-19, on active service with Can. Engineers.

References: E. A. Cleveland, M. J. Leahy, J. A. Kilmer, W. R. Pilsworth, D. O. Lewis, J. R. Grant, F. G. Aldous, J. B. Holdcroft.

ROBERTS—STANLEY OXLEY, of Ottawa, Ont. Born at Cleckheaton, Eng., July 26th, 1889. Educ. high school Eng., private study, Winnipeg, survey. & mapping course, Halifax Tech. Coll. 1914, rodman, D.L.S. work, also instrument, levelling, transit, etc., work; Oct. 1916-June 1918 in chg. of radio apparatus on H.M. C.S. ships, at the present time, dftsman. in radio branch, Naval Service, Ottawa.

References: J. H. Thompson, J. Murphy, A. B. Lambe, C. P. Edwards, J. B. Challies.

SCHOLES—JOSEPH, of Regina, Sask. Born at Chadderton, Eng., May 19th, 1876. Educ. Tideswell coll. 1893, private tuition and articled pupil, 3 years with Chambers Colliery Co. afterwards manager's asst. for nine years and later manager; 1909-16 Supt. P.W.D. Weyburn, Sask., 1917-18 acting city engr.; Sept. 1918 to date supt. of works Regina, Sask.

References: N. Murray, G. Power, E. M. Proctor, A. E. K. Bunnell, C. R. Murdock.

STOUT—CLIFFORD VIER, of Winnipeg, Man. Born at Winnipeg, May 12th, 1884. Educ. B.C.E., Univ. of Man., 1910, 2 yrs. in Arts. 1908-09, survey work; 1910, testing laboratory work (4 mos.); 1910-11, with C.NR.; bridge dept. (6 mos.); 1911-12, engr. of constrn. of trestles & foundation, C.N.R.; 1912-15, in chg. of contstrn. of bridges on Yellowhead div., C.N.R.; 1915-17, farming; 1917 to present time with C.E.F.

References: H. A. Dixon, E. Brydone-Jack, A. W. Smith, W. Walkden, J. A. O'Rielly, W. Aldridge.

TARR—CHARLES WINTHROP, of Windsor, Ont. Born at Lawrence, Mass. Dec. 14th, 1876. Educ. scientific dept., Phillipps Andover. 1897-1902, eng. asst.,with Metropolitan Water Board, Boston; 1903, asst. engr., with Comm. investigation,water supply for N.Y.C., from Long Island; 1904, asst. engr. with Hering & Fuller, in chg. of constrn., design, &c.; 1905, asst. engr. with Hudson Cos., during constrn. of tunnels under Hudson River; 1906, res. engr. for Cape May Real Estate Co., in chg. of hydraulic dredging, and bldg. of townsite, etc.; 1907-08, asst. engr. with Board of Water Supply, N.Y.C., on further investigations; 1909, asst. ch. engr., Dept. of Water Supply, Gas & Elec. Brooklyn, 1912-13, office engr., in chg. of design, plans, reports, &c., in connection with bldg. tunnels, dams, intakes, &c., in Puebla, Mexico; 1914-15 supt. of constrn. & operation with Aetna Chem. Co., at Oakdale, Pa.; 1916 asst. engr. with Morris Knowles, Pittsburgh, Pa.; 1917-18, vice-pres. & gen. mgr., Morris Knowles Ltd., Windsor, Ont., in chg. constrn. ,dsgn., reports, &c.

References: J. V. Davies, J. Forgie, M. Knowles, F. C. McMath, O. McKay, M. E. Brian, R. Hering, J. S. Nelles.

TEMPLEMAN—GEORGE EARL, of Montreal. Born at Waubaushene, Ont, June 26th, 1879. Educ. High school, matric, 1st yr., S.P S., Toronto, 1896. 1900-02 gen. operating experience on hydro elec. & transmission lines in BC.; Jan.-Oct. 1903, direct current testing dept. of Western Elec Co., Chicago; Oct. 1903-Oct. 1904, alternating current test. work, Can. Gen. Elec. Co., Peterboro, Ont.; 1904-12, with Allis Chalmers Bullock Ltd., as follows: 1904-07, erect. engr.; 1907-08, gen. foreman of test. & winding depts.; 1908-10, supt. of constrn.; 1910-11 gen. supt. of works; 1911-12, gen. engr. on hydro elec. work; 1912-14, in partnership, Dietrich Ltd., contr engrs., supervision of all contracts; 1915 to present time with Elec. Comm. of Montreal, as follows; 1915-July 1917, supt. of constrn. & maintenance; July 1917 to date, ch. engr.

References: L. A. Herdt, R. H. Balfour, G. M. Mynn, F. B. Brown, R. S. Kelsch.

VIENS—EPHREM, of Ottawa, Ont. Born at Ange Gardien, Que., Jan. 19th, 1896. Educ., B. A., McMaster Univ., 1905., part of M. A. course 1905-06, and course of C.E. with I.C.S. 1906-07, with Int. Portland Cement Co., Hull, Que. (5 mos.); Apr. 1907 analytical chem. and physicist, D.P.W.; winter 1913-16, acting director of the Laboratory for Testing Materials, D. P. W., Ottawa. May 1916 to date, date, director of same.

References: A. B. Lambe, J. Murphy, C. R. Coutlee, A. St. Laurent, E. D. Lafleur, R. deB. Corriveau, J. B. McRae.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

EMRA—FREDERIC HARCOURT (Capt.) of London, Eng. Born at Salisbury Eng., June 13th, 1881. Educ., prep. school, Bromsgrove school, Eng. 1904-08, with T.C.Ry., on constrn., &c., 1910-11, res. engr., with T.C.Ry. 1915, asst. dist. engr., S.E.L.C. & D.Ry.; July 1915-Oct. 1916, on active service; Aug. 1917, invalided to England; at present time asst. ch. engr. Ministry of Shipping & Extensions Dept. of the Admiralty, London, Eng.

References: C. H. Keefer, W. P. Anderson, D. MacPherson, F. Moberly, V. E. A. Belanger, E. P. Goodwin.

McKENZIE—BERTRAM STUART, of Winnipeg, Man. Born at Almonte, Ont. July 3rd, 1876. Educ., B.A., 1900, B.Sc., 1901. McGil Univ. 1896-97, munic. work, Brookline, Mass.; 1898-1900, hydraulic and ry. work, T. Pringle & Sons; 1901, exploratory work, Algoma Commercial Co., Soo, Ont.; 1907, ch. dftsman, C.P.R., bridge dept.; 1907-09, asst. div. engr., C.P.R., East, Div.; 1910-12, asst. bridge engr. G.T.P.Ry., Wpg.; 1912 to date, consl. engr.

References: J. G. Legrand, C. N. Monsarrat, W. M. Scott, W. G. Chace, W M. Macphail, W. P. Brereton.

SWABEY—HAROLD WILLIAM BIRCHFIELD, of Ottawa, Ont. Born at Woburn Sands, Eng., July 26th, 1879. Educ. Crystal Palace Engr. School & English Coll., Bruges, Belgium. Jan. 1900-Aug. 1901, asst. engr. with Baldry & Yerburgh, on constrn. of L. & Y.Ry. (England); Aug. 1901-June 1902, asst. engr. with Naylor Bros., on constrn. of Dearne Valley Ry. (Eng.); Jan. 1903-Feb. 1904, engr. in chg. of measuring and laying out work, with T. Wrighley & Sons, contrs.; Feb. 1904-Jan. 1906, engr. with Baldry & Yerburgh, Canada Branch Dock, Liverpool, Eng.; June 1906, 1911, engr. in chg. of constrn. with New Canadian Co, on A.Q. & W.Ry.; Jan. 1911. April 1912, acting ch. engr. on same; April 1912-Oct. 1912, res. engr. Que. & Sag. Ry.; Oct. 1912-May 1914, res. engr., Ont. Lake Shore line, C.P.R.; Aug. 1914-Dec. 1914. Inspection of asphalt pavement, City of Verdun; April 1915 to date, officer in chg. of inspec. of steel (Canada) for Ministry of Munitions.

References: N. P. Dalziel, G. R. Ballock, A. F. Stewart, E. S. M. Lovelace, J. H. Larmonth, R. J. Durley, Sir Alex. Bertram, P. B. Motley.

FOR TRANSFER FROM THE CLASS OF JUNIOR TO HIGHER GRADE

CALVERT—DAVID GORDON, of Dayton, Ohio. Born at Napier, Ont., Oct. 13th, 1888. Educ. 2½ yrs. Toronto Univ., S.P.S., 1906-07 (summers) survey work for Dom. Gov.; 1907-08, testing dept., Toronto St. R.R.; 1909-12, instr. man, T.C. Ry., Cochrane, Ont. 1912-13, with Geo. Fuller Constrn. Co., Winnipeg.; 1913-14, asst. engr., C.P.R., Transcona, Man.; 1914-17, engr. for Con. Stewart Co. Ltd., 1917-18, engr. in chg. of constrn. & maintenance, with Dayton Wright Airplane Co., Dayton, O

References: N. D. Wilson, E. G. Hewson, W. E. Janney, F. Goedike, A. W. Lamont, J. R. W. Ambrose.

HUNT—WILLIAM HAROLD, of Winnipeg, Man. Born at Lennoxville, Que., Nov. 24th, 1884. Educ., B.C.E., Man. Univ. 1913. 1902-05, apprentice machinist, Northern Iron Works, Winnipeg; 1905-07, with C.P.R.; 1907-11, eng. student, employed, during summer months on ry. surveys and constrn., with Hudson's Bay Co., C.P.R., and C.N.R.; 1912, asst. engr., C.N.R., bridge dept.; 1913-15, asst. city engr., Moose Jaw, Sask.; 1916 to present time, road engr., Prov. of Man., Dept. of Pub. Wks.

References: E. Brydone-Jack, A. McGillivray, N. B. MacTaggart, M. A. Lyons, T. W. White.

McCULLY—ROBERT CHESLEY, of Sarnia, Ont. Born at Shediac, N.B., 21st, Dec. 1888. Educ., B.Sc. (C.E.) McGill, 1916. B.A. 1909, Mt. Allison Univ., M.A. 1910. July 1910-Nov. 1911, with Topo. Surveys, Ottawa; 1911-14, asst. to chief astronomer, Ottawa; Mar. 1915-Nov. 1915, asst. Surveyor on D.L.S. Prov. of Man., in chg. of party; May 1916-Dec. 1916, asst. surveyor on L.D.S., Prov. of Sask., chg. of stadia field party; Jan.-Feb. 1917, instr. man with Foundation Co. Ltd., Port Colborne, Ont., laying out lines & grades for constrn. of Internat. Nickel Co. plant; Feb. 1917, received comm. as D.L.S.; April 1917-Feb. 1918, inspector in chg. of constrn. G.W.W.D.; Feb. 1918-April 1918, dftsman for G.T.R., Wpg.; Mar. 1918-Oct. 1918, in chg. of constrn. with Imperial Oil Ltd., including testing, bearing power, design, of foundations, etc.; Oct. 1918 to present time, designing and estimating concrete structures under supervision of ch. engr.

References: G. F. Richan D. L. McLean, G. M. Pitts, E. M. Salter, H. W. Harris.

PORTER—JOHN EARLE, of Windsor, Ont. Born at Wingham, Ont., Dec. 6th, 1891. Educ. B.A.Sc., Toronto Univ. 1915. Summers 1912 & 1913 with A.C.Ry., as rodman, timekeeper, &c.; summer 1914, instru. man, D.P.W., Windsor,Ont.; May 1915-May 1918, asst. engr. D.P.W., Dist. of Western, Ont., in chg. of various surveys in connection with harbor developments, improvements, estimates, prep. of plans, etc.; May 1918 to present time, field engr., Can. Steel Copr., Ojibway, Ont., in chg. of surveys, inspec. of constrn., &c.

References: A. J. Stevens, H. B. R. Craig, W. P. Merrick, H. Thorne, R. Carlyle, C. R. Young.

VALIQUETTE—JOSEPH HENRI, of Montreal, Que. Born at La Conception, Que., Jan. 24th, 1884. Educ. B.A.Sc., C.E., Laval Univ., 1907. 1906, tran. man with Shaw. Water & Power Co.; 1907-13, inspec. of mines, Prov. of Que., in chg. of road constrn.; 1913-15, consl. engr., Montreal; 1915-18, engr. in chg. of West. div., P.W.D, Montreal, and at present time asst. engr., in chg., Dept. of Surveys & Design, City of Montreal.

References: G. R. MacLeod, J. A. Bernier, A. B. Normandin, F. C. Laberge, P. E. Mercier, J. C. Gwillim, A. Walls, J. R. Barlow.

WATSON—McCLELLAND BARRY, of Toronto, Ont. Born at Toronto Jan. 22nd, 1889. Educ., B.A.Sc., 1910, C. E., 1916, M.E., 1918, Toronto Univ, 1905-07, asst. engr., Munic. Power System, Weston, Ont.; 1908, asst. engr., C.N.Ry. (5 mos. vac.); 1910, asst. engr., Can. Westinghouse Co. (5 mos. vac.); May 1911-Oct. 1912, res. engr., for Chipman & Power, in chg. of dsgn., installation, sewerage, etc., Dauphin, Man.; Nov. 1912-July 1913, asst. mech. engr., Toronto Power Co.; Aug. 1913-Aug. 1914, asst. engr., Dept. of Pub. Highways, Prov. of Ont.; Aug. 1914-Sept. 1917, military eng. work, lieut., Royal Engineers, both in Eng. and France; Dec. 1918, aviator & flight comm., Royal Air Force, employed as ch. instructor in Aeroplane design, etc., in School of Aeronautics. At the present time asst. engr Dept. of Pub. Highways, Toronto.

References: W. A. McLean, R. P. Fairbairn, G. Hogarth, P. Gillespie, W. Huber G. C. Parker, R. C. Muir, J. A. P. Marshall..

FOR TRANSFER FROM THE CLASS OF STUDENT TO HIGHER GRADE

SMYTH—EDWARD STANLEY, of Kitchener, Ont. Born at Kitchener, Ont., July 7th, 1891. Educ., B.Sc. (honors) Queen's Univ. 1912. Summer 1910, dsgning. and drafting on reinforced concrete; 1911, asst. town engr., Waterloo, Ont.; May-Oct. 1912, res. engr. in chg. of constrn. on sewerage work, with Chipman & Power; Oct, 1912, with Malcolm & Rudd, Guelph, in chg. of concrete constrn.; April 1913-Oct. 1914, with Chipman & Power, as res. engr.; in chg. of constrn. of sewerage & waterworks, at Waterous,Sask.; April 1913-Oct.1913; April 1914-Oct. 1914, on elec. light and power installation; Dec. 1st, 1913-April 1914, making plans and surveys for storm water sewerage system, London, Ont.; Nov. 1914-March 1918, on active service, lieut., Can. Engrs., C.E.F ; April 1918 to present time, dist. vocational officer, with Dept. of Soldiers, Civil Re-Establishment.

References: W. Chipman, H. E. T. Haultain, J. A. McPhail, W. H. Breithaupt, C. R. Murdock.

TRUDEL—PHILIPPE, of Quebec, Que. Born at St. Irenée, Que., 28th Feb. Feb. 1896. Comm. course, Levis Coll., and Ecole Poly., 2½ yrs. course. Summers 1914-16, instrumentman with Tremblay & Belanger; 1917-19, 1st asst. to E. W. Gauvreau, ch. engr. of Que. Roads Comm., on highway constrn.

References: A. Tremblay, A. Pepin, J. O. Montreuil, R. Savary, J. A. Lefebvre, J. P. Heroux, G. Henry.

ENGINEERING INDEX

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MECHANICAL ENGINEERING

AIR MACHINERY

Turbo-Blowers. Coppus Turbo Blower. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 74-75, 2 figs. Mechanical features of machine constructed by Coppus Eng. & Equipment Co.

Combined Motor and Turbine Driven Blast-Furnace Blower. Iron & Coal Trades Rev., vol. 47, no. 2645, Nov. 8, 1918, p. 523, 1 fig. Operation of unit consisting of synchronous motor driving blower, this motor being operated in addition as a power-factor adjuster on a 3000-volt 50-cycle supply.

Ventilators. The Largest Round Ventilator in the World. Metal Workers, vol. 91, no. 1, Jan. 3, 1919, pp. 28-29, 3 figs. Details of special construction to withstand wind pressure and secure permanence and service.

CORROSION

Aircraft Parts. Corrosion Prevention on Aircraft Metal Parts. H. A. Gardner. Aviation, vol. 5, no. 9, Dec. 1, 1918, pp. 565. Quotes standard procedure of Navy Department for protection or iron, steel and aluminum aircraft parts.

Pipe. Investigation of Pipe Corrosion in Chicago Buildings, with Special Reference to Durability of Pipe Materials, Thomas J. Claffy. Mun. & County Eng. vol. 55, no. 6, Dec. 1918, pp. 208-210. Data secured from inspection of 63 buildings. Rating of cast iron, wrought iron and steel.

FORGING

Density of Steel. Does Forging Increase Specific Density of Steel? H. E. Doerr. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 79-81, 2 figs. Table of specific densities of ten ingots of basic open-hearth steel both before and after forging shows little or no change in density with steel initially free from cavities

Drop Forging. Drop Forging in Automobile and Aircraft Work. Part VI. Automobile Engr., vol. 8, no. 120, Nov. 1918, pp. 328-331, 13 figs. Details of typical plant, with description of modern tools and methods.

Gun Forgings. Making Gun Forgings Under War Demands, E. C. Kreutzberg. Iron Trade Rev., vol. 63, no. 22, Nov. 28, 1918, pp. 1240-1242, 6 figs. General character of work done by Tacony Ordnance Coprs., Philadelphia.

Operation. Recommendations for Economical Operation of Iron Works (Dispositions générales qui peuvent être recommandées dans les installations de forges), O. Duperron. Géne Civil, vol. 73, nos. 20 and 21, Nov. 16 and 23, 1918., pp. 387-389 and 404-407, 3 figs. Concerning regenerative devices, use of powdered fuel, continuousness of operation, use of compressed air. Plans of ideal modern smithy.

FOUNDRIES

Brass Melting. Melting Brass in a Rocking Electric Furnace, H. W. Gillett and A. E. Rhoads. Department of Interior, Bur. of Mines, Bul. 171, Min. Technology 23, 131 pp., 6 figs. Sets forth in detail possibilities and limitations of electric brass melting and compares various types of furnaces. Also Water & Gas Rev., vol. 29, no. 6, Dec. 1918, pp. 9-11.

Chaplets. Obtaining Best Results from Use of Chaplets, Ernest Schwartz. Foundry. vo. 47, no. 317, Jan. 1919, pp. 14-15, 14 figs. Removal or prevention of rust and precautions against excessive moisture essential to prevent blowholes; choosing types and sizes for various purposes.

Core Room. Core Room of T. H. Symington Co., Rochester, Donald S. Barrows. Can. Foundryman, vol. 9, no. 12, Dec. 1918, pp. 296-299, 9 figs. Arrangement intended to provide good ventilation and lighting.

Efficiency in the Core Room, J. B. Conway. Am. Mach., vol. 50, no. 1, Jan. 2, 1919, pp. 11-14, 6 figs. Conclusions reached as result of investigation into conditions of efficiency and production in southern factory and remedies applied.

Cupola. Operation of a Cupola, William Lauten. Metal Trades, vol. 9, no. 11, Nov. 1918, pp. 461-463, 2 figs. Account of experiments with colums charging.

Foundries. Continous Two-Story Foundry Proves Economical, J. F Ervin. Foundry, vol. 47, no. 317, Jan. 1919, pp. 40-42, 2 figs. States that extensive handling operations in modern foundry are most readily performed in building of multi-story design. From paper before Am. Foundrymen,s Assn.

Unique Features of an Illinois Foundry, Charles Lundberg. Iron Age, vol. 102, no. 26, Dec. 26, 1918, pp. 1563-1569, 13 figs. Electric steel, gray iron and semi-steel departments; continuous operations with large production in small space; use of molding machines. Description of plant of Avery Co., Peoria, Ill.

Molding. How Gear Cases for Tractors Are Molded, Foundry, vol. 47, no. 317, Jan. 1919, pp. 2-5, 8 figs. Molding machines of large capacity and special core-room equipment are employed; special rigging for economies.

Patterns and Their Relation to Molding Problems, Joseph A. Shelly, Machy., vol. 25, no. 4, Dec. 1918, pp. 310-314, 12 figs. First of series of articles dealing with construction and application of patterns, including use of woodworking tools, art of joinery, and various methods of building patterns and core boxes.

Salvage Work. Reclaiming Wealth in the Foundry Yard, F. B. Hicks. Can. Foundryman, vol. 9, no. 12, Dec. 1918, pp. 302-303. Salvage work conducted by a superintendent of Sawyer-Massey works.

War Demand. Shell Need Found Foundries Ready. Iron Trade Rev., vol. 63, no. 22, Nov. 28, 1918, pp. 1229-1236, 15 figs. Methods developed in American foundries to meet increased demand of production.

See also ELECTRICAL ENGINEERING, Furnaces (Industrial Furnaces, Steel Furnaces).

FUELS AND FIRING

Blast-Furnace Gas. The Use of Blast-Furnace Gas for Heating Boilers and Metallurgical Apparatus (L'emploi du gaz pour le chauffage des chaudières et des appareils métallurgiques), H. Thiry. Génie Civil, vol. 73, no. 21, Nov. 23, 1918, pp. 401-404, 8 figs. Precautions necessary to insure successful operation of Cowper system. Abstract of discussion before South Wales Inst. Engrs. and Cleveland Inst. Engrs.

Briquetting. The Economy of Briquetting Small Coal, J. A. Yeadon. Traus. Instn. Min. Engrs., vol. 56, part 1, Nov. 1918, pp. 31-34 and (discussion), pp. 34-36. Considerations on conservation of coal and utilization of waste materials; advantages of briquetting; method of manufacture; rectangular and ovoid forms of briquets.

Chimney Design. Saving the Waste in the Chimney, Robert Sibley and Chas. H. Delany. Jl. Elec., vol. 41, nos. 10 and 11, Nov. 15 and Dec. 1, 1918, pp. 463-464 and 511, 4 figs. Nov. 15: Fundamental laws of chimney design as applied to economic operation of oil-fired power plant. Dec. 1; Draft formula for modern power plant.

Combustion Characteristics of Coal. Combustion Characteristics of Coals. Blast Furnace, vol. 6, no. 12, Dec. 1918, pp. 495-497, 5 figs. Factors entering into success of equipment selected for burning different kinds of coal; performance of various types of stokers; data on grades of coal.

Generation of Heat from Bituminous Coal and Its Absorption by the Boiler. Henry Misostow. Power, vol. 48, no. 25, Dec. 17, 1918, pp. 898-899, 3 figs. From paper before National Assc. of Stationary Engrs., Cincinnati, Sept. 1918.

Combustion Characteristics of Coal, Joseph G. Worker. Ry. Rev., vol. 63, no. 23, Dec. 7, 1918, pp. 824-827. Behavior of different grades of stationary boiler plant fuel with reference to type of mechanical stoking apparatus best suited for it. Fuels treated range from small sizes of anthracite through several grades and qualities of bituminous and lignites.

Combustion Characteristics of Coals and Selection of Suitable Stoker Equipment, Joseph G. Worker. Railroad Herald, vol. 23, no. 1, Dec. 1918, pp. 9-14, 7 figs. Results of tests on overfeed type of stoker with smaller sizes of nos. 1, 2 and 3 buckwheat coal and tables giving performance of underfeed stoker as applied to various sizes of boilers and burning different grades of coal.

Fuel Conservation. The Fuel Situation in New England, B. B. Pollock. Official Proc. N. Y. R. R. Club, vol. 29, no. 1, Dec. 1918, pp. 5455-5456. Measures taken to meet coal shortage by Federal Administrator, Boston & Maine R. R.

Some Important Points in Fuel Conservation, Robert Collett. Ry. Age, vol. 65, no. 25, Dec. 20, 1918, pp. 1121-1123. Why we must still save fuel; plan of organization; lessons learned from personal experience. From paper before New England Railroad Club.

Hand-Fired Plants. Fuel Economy in Hand-Fired Power Plants—V. Power Plant Eng., vol. 22, no. 24, Dec. 15, 1918, pp. 987-989. Feed water heating and purification. Abstract of circular 7, Univ.Ill. Eng. Experiment Station.

Indiana Coals. Burning Indiana Coal on the Chain Grate, T. A. Marsh. Power, vol. 49, no. 1, Jan. 7, 1919, pp. 17-19, 7 figs. Characteristics of Indiana screenings from four seams supplying most of steaming coal; need of large grate area, large furnace volume and strong draft to give capacity, and long, high-pitched arches.

IOWA COALS. Burning the Low-Grade Coal of Iowa, T. A. Marsh. Power, vol. 48, no. 27, Dec. 31, 1918, pp. 940-941, 4 figs. Burning Iowa coal on chain grate Being low in heat value, high in ash and of clinkering, non-coking variety, this coal requires, for successful burning, practically continuous ash disposal and non-agitation of fire. Also Elec. World, vol. 72, no. 25, Dec. 21, 1918, pp. 1166-1168, 4 figs. General considerations to observe in selecting stokers and in designing furnaces; specific changes which can be made in order to adapt existing stokers to low-grade fuels.

LIGNITES. The Firing of Pulverized Lignite. M. C. Hatch. Jl. Elec., vol. 41, no. 12, Dec. 15, 1918, pp. 539-541. Advantages in pulverizing; methods of handling furnace design for pulverized fuel; caculation of total cost.
Notes on Lignite. Its Characteristics and Utilization, S. M. Darling. Power House, vol. 11, no. 11, Nov. 1918, pp. 328-331. Abstract of U. S. Bureau of Mines paper.

POWDERED COAL. Pulverized Coal and Its Preparation, J. M. Wadsworth. Jl. Elec., vol. 41, no. 11, Dec. 1, 1918, pp. 511-512, 2 figs. Arrangement of machinery in small coal pulverizing plant. Compiled for Western needs by technical staff of Fuel Administration. First of series.

STOKERS. Power Plant Management VI Mechanical Stokers, Robert June, Refrig. World, vol. 53, no. 12, Dec. 1918, pp. 2325, 3 figs. Efficiency of stokers; smoke alleviation; characteristics of individual chain-grate stokers.

STORAGE. Effect of Storage on Coal (II), Coal Trade Jl., year 50, no. 51, Dec. 1918 pp. 1481-1482. Analytical data accumalated during weathering tests made by Eng. Experiment Station of Univ. of Ill. Tests covered period of six years. Coals used were from Illinois field. (Continuation of serial.)

WOOD. Waste Wood as a Fuel Possibility, O. F. Stafford. Jl. Elec., vol. 41, no. 12, Dec. 15, 1918, pp. 541-543. Suggests conversion of wood waste into ethyl alcohol, direct fuel and powdered charcoal which might be sued directly in specially designed Diesel engine.

FURNACES

ANNEALING FURNACES. Continuous Type Annealing Furnace, Philip D'H. Dressler. Iron Trade Rev., vol. 63, no. 25, Dec. 19, 1918, pp. 1416-1417, 5 figs. Deals specially with a form of continuous car-type annealing furnace. Disscusion of H. E. Diller's paper before Am. Foundrymen's Assn.

HEAT TREATING. Equipment Data on Heat Treat Furnaces, Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 437-439, 6 figs. Discusses refractory material, fuel-oil burners and other furnace equipment.

INSULATION. Value of Heat Insulation in Furnaces, A. W. Knight. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 451-453. Discusses particularly use of insulation as applied to annealing ovens.

PRESSURES. Graphical Examination of Pressures of Hot Gases and Vapors in Furnaces and Chimneys (Etude de quelques cas généraux de pression de gaz chauds et fumées dans les fours et cheminées par représentation graphique), J. Seigle. Bulletin et comptes rendus mensuels de la Société de l'Industrie Minérale, series 5, vol. 14, 3d issue 1918, pp. 133-151, 17 figs. Variation of pressure at different points of enclosure containing hot gases when (1) enclosure is open at top (2) open at bottom, and when (3) it connects with another enclosure by conduit at top.

HANDLING OF MATERIALS

DUMPER. Dumper at Sewalls Point Handles Two Cars at Once. Eng. News-Rec., vol. 81, no. 24, Dec. 12, 1918, pp. 1086-1088, 5 figs. New facilities of Virginian Ry. at coal pier near Norfolk also incude cars of 120 tons capacity, and long incline.
Double Car Dumper for Handling Coal, A. F. Case. Iron Age, vol. 102, no. 24, Dec. 12, 1918, pp. 1435-1438, 7 figs. Description of new Sewalls point plant of Virginian Ry. Co.

HEAT TREATING

MALLEABLE IRON. Tests in Annealing Malleable Iron, H. E. Diller. Iron Trade Rev., vol. 63, no. 25, Dec. 19, 1918, pp. 1414-1416, 4 figs. Experiments conducted to determine time necessary for annealing; study of results and indication of possibility of annealing in 48 hr.: microphotographs, description of continuous car-type heating furnace. Paper at annual meeting of Am. Foundrymen's Assn.

STEEL

STEEL. Art of Heat Treating. D. N. A. Blacet. Ry. Jl., vol. 25, no. 1, Jan. 1919, pp. 18-20. Economical aspect of adding metalurgist to personnel of plants manufacturing steel parts; general considerations regarding selection of specifications. From Jl. Am. Steel Treaters' Soc.

SURFACE COMBUSTION. Application of the Surface Combustion Process to Heat Treating and Similar Work, John H. Bartlett, Jr. Proc. Steel Treating Soc., vol. 1, no. 11, pp. 18-32, 12 figs. Generation and application of heat; proportioning of gas and air mixture; description of several installations for heat treating; automatic heat-treating furnaces for large-size shells.

HEATING AND VENTILATION

CIRCULATING HEATING. Heating Shop Floors by Circulation. Metal Worker, vol. 90, no. 24, Dec. 13, 1918, pp. 662-663, 6 figs. Scheme to draw cold air form the floor.

FACTORY HEATING. Fuel Wastes in Factory Heating.! Charles L. Hubbard. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 23-25. Sources of losses; suggestions for economies; means for temperature control suited to different systems of heating.

HOSPITALS. Heating and Power Plant Economies for Hospitals, J. D. Kimball. Modern Hospital, vol. 11, no. 6, Dec. 1918, pp. 437-439. Fundamentals and recommendations of National Economy Program. Paper for convention of Am. Hospital Assn.

MOISTURE REMOVAL. The Removal of Moisture from Special Rooms and Buildings, Charles L. Hubbard. Domestic Eng., vol. 85, no. 8, Nov. 23, 1918, pp. 283-285 and 313-315, 6 figs. Notes on installation of ventilating systems in laundries, dye houses, paper mills, foundries, flax mills, etc.

OFFICE-BUILDING, VENTILATION. Air Supply for a Large General Office Building, Samuel R. Lewis. Heat & Vent. Mag., vol. 15, no. 12, Dec. 1918, pp. 21-26, 16 figs. Past and present practice illustrated in remarkable installation for Swift & Co., Chicago.

RADIATORS. Figuring Direct Radiator Heating Service, W. B. Gray. Metal Worker, vol. 90, no. 24, Dec. 13, 1918, pp. 653-655 and 658, 2 figs. Describes method said to insure correctness and to be of practical application by heating contractors.

RECTOR SYSTEM OF GAS HEATING. New Heating System, Geo. S. Barrows. Gas Indus., vol. 18, no. 12, Dec. 1918, pp. 363-369, 7 figs. Extensive description of Rector system of gas heating.

STEAM HEATING. Care of Heating and Ventilating Equipment, Harold L. Alt. Power, vol. 48, no. 26, Dec. 24, 1918, pp. 910-912, 3 figs. Describes gravity one-pipe steam system. (Sixth article.)

HOISTING AND CONVEYING

CABLEWAYS. Aerial Cableways Successful in Northwest Shipyards. Eng. News-Rec., vol. 82, no. 1, Jan. 2, 1919, pp. 37-40, 5 figs' Similar to loggers cableways; ability to get men expert in handling them is one secret of success; well-planned installations are fast and flexible.

CRANES. Stothert-Pitt 35-Ton Locomotive Crane (Grue-locomotive de 35 tonnes système Stothert et Pitt.) Génie Civil, vol. 73, no. 11, Sept. 14, 1918, pp. 201-203, 5 figs. General arrangement and plans showing dimensions.

HYDRAULIC MACHINERY

CONDUITS, LOSS OF PRESSURE HEAD. On the High Velocities of Water in Conduits (Sur les grandes vitesses de l'eau dans les conduites), C. Mamichel. Revue Générale de l'Electricité, vol. 4, no. 21, Nov. 23, 1918, pp. 788-790, 1 fig. Experimental results said to have demonstrated loss of pressure head for velocities up to 260 ft. per sec, to be the same as for velocities of 30 ft. per sec.

PENSTOCK PIPE. Saving the Waste in Penstock Pipe Design (11), B. F. Jakobsen. Jl. Elec., vol. 41, no. 11, Dec. 1, 1918, pp. 504-505, 2 figs. Presentation and discussion of various formulæ to determine manner in which available money should be distributed among different items in order to get maximum economy. (Continued from Nov. 1, issue.)

WATER HAMMER. Maxima Excess Pressures Produced by Water Hammer (Sovrapressioni massime nei fenomeni die colpo d'ariete), Maurice Gariel. Abstract of article published in Revue Générale de l'Electricité, Sept. 21, (See Eng. Index, Jan., Mech. Eng., Hydraulic Machy., Water Hammer.)
Notes on the Size and Location in Forced Conduits of Water Hammer Relief Devices. (Remarques au sujet des conditions à remplir par certains dispositifs destinés à atténuer les coups de bélier dcas les conduites forcées), Compte de Sparre. Revue Générale de l'Electricité, vol. 4, nos. 19 and 20, Nov. 9 and 16, 1918, pp. 685-690 and 731-740, 1 fig. Nov. 9: Mathematical analysis of phenomena taking place, by reason of elasticity of water and conduit, in surge tank which opens a compensating orifice when water hammer reaches a certain value, the orifice having such dimensions that water hammer will never exceed a permissible maximum. Nov. 16: Application of principles established in proceding installment to calculation of permissible minimum dimensions of surge tanks which will insure a constant value of water hammer during compression.

INTERNAL-COMBUSTION ENGINES

BUCKEYE BARRETT ENGINE. Buckeye Barrett Crude Oil Engine. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 72-73, 2 figs. Low-compression type burning heavier grades of fuel and designed for service where an engine must run for weeks under full load without a stop.

DESIGN. The Working Process of Internal Combustion Engines, E. H. Sherbondy. Aerial Age, vol. 8, no. 11, Nov. 25, 1998, pp. 564-568, 7 figs. Historial review of inventions which have tended to improve engine efficiency.
Internal Combustion Engine Development, R. E. Neale. Eng. Rev., vol. 32, no. 5, Nov. 15, 1918, pp. 130-132. Indicates lines open to further development particularly in direction of lightening low-speed engines by adoption of higher piston speeds. (To be continued.)

DIESEL ENGINE FUEL PUMPS. The Design and Construction of Diesel Engine Fuel Pumps, G. L. Kirk. Engineering, vol. 106, no. 2759, Nov. 15, 1918, pp. 549-551, 10 figs. Four systems of oil distributon; system of regulation; determination of clearances; constructional details; control lever.

IGNITION. Operation of Internal-Combustion-Engine Magnetos (Sul funzionamento del magneti di accensione dei motori a scoppio), Emilio Biffi. L'Elettrotecnica, vol. 5, no. 29, Oct. 15, 1918, pp. 407-411, 6 figs. Various aspects of spark; study of its oscillatory character; conclusions in regard to magneto operaion., (Concluded.)
Ignition Timing and Valve Setting, Vermont Wells. Am. Blacksmith, vol. 17, no. 12, Sept. 1918, pp. 291-293, 4 figs. Rules for timing ignition in different makes of cars.
British Magneto Manufacture. Gas & Oil Power, vol. 14, no. 158, Nov. 7 1918, pp. 20-22, 3 figs. General dimensions and brief outline of magneto manufactured by British Lighting and Ignition Co.
Dixie Standard Aircraft Magnetos. Automotive Indus., vol. 39, no. 23, Dec. 5, 1918, pp. 954-957, 6 figs. Type which may be adapted to various engines; methods used in manufacture of magneto magnets.

Semi-Diesel Engines. Semi-Diesel Oil Engines, F. D. Weber. Jl. Elec., vol. 41, no. 12, Dec. 15, 1918, pp. 549-550, 4 figs. Types being used to equip auxiliary wooden schoo ers of 500 to 3000 tons capacity and straight motor schooners up to 1000 tons capacity.

The Semi-Diesel Oil Engine, James Richardson. Gas & Oil Power, vol. 14, no. 158, Nov. 7, 1918, pp. 23-25, 9 figs. Development and operation. From paper before Diesel Engine Users' Assn. Also Macy. Market, no. 944, Dec. 6, 1918, pp. 17-18, 9 figs. Definition; compression pressure; flexibility; range of working.

Valves, Poppet, Air-Flow Through. Air Flow Through Poppet Valves. Automotive Indus., vol. 39, no. 25, Dec. 19, 1918, pp. 1047-1051, 5 figs. Experimental investigation from which writer concludes that co-efficient of efflux is practically constant for all pressure drops and nearly the same for valves of different sizes, at equal lifts expressed in per cent, of their respective diameters; considerations on number of inlet valves to use.

Air Flow Through Poppet Valves. Automotive Eng., vol. 3, no. 10, Dec. 1918, pp. 461-463, 1 fig. Data on valve sizes; investigation of merits of multiple valves. (To be continued.)

Winton Marine Engine. The Latest Winton Marine Oil Engine. Automotive Eng., vol. 3, no. 10, Dec. 1918, pp. 447-450, 5 figs. Review of mechanical details of 500 and 250-hp. units of Diesel-type revirsible mitor.

See also ELECTRICAL ENGINEERING, Electrophysics (Spark Plug Insulators).

LUBRICATION

Bearing Design. Oiling System and Bearing Designs, A. E. Windram. Tran. Inst. Marine Engrs., vol. 30, no. 238, Oct. 1918, pp. 209-216, 13 figs. Method of making main bearing, crankpin and crosshead brasses oiltight by means of drilling crank webs into oil rings or grooves turned round center of journal, and corresponding oil ring or groove in center of brasses connected with pipes from brasses to brasses, which are made oiltight by sealing rings on ends of brasses.

Oils. Properties of Oils and Their Relation to Lubrication (Propiedades de los aceites; su relacion con la lubricacion). Boletin de la Sociedad de Fomento Fabril, year 35, no. 8, Aug. 1918, pp. 537-542. Significance of tests for acidity, carbon-residue, oxidation, volatility, surface tension, emulsion, heat and density.

See also MARINE ENGINEERING, Ships (Lubrication).

MACHINE ELEMENTS AND DESIGN

Crankshafts. Hair-Line Defects in Crankshafts, P. J. Piccirilli. Automotive Industries vol. 39, nos. 25 and 26, Dec. 19 and 26 ,1918, pp. 1041-1044, 1104-1105 and 1122, 15 figs. Metallographic study and physical tests of chromenickel steel crankshafts to determine nature and effect of so-called hair-lined efects on their physical strength.

Springs. A new theory of Plate Springs, David Landau and Percy H. Parr. Jl. Franklin Inst., vol. 186, no. 6, Dec. 1918, pp. 699-721, 8 figs. Mathematical generalization of propositions advanced in first paper, vol. 185, Apr. 1918, p. 481. Special attention given to effect of tapering ends and constructing springs so that leaves continue in contact everywhere on application of load. (To be concluded.)

The Springs of the Car (IV) F. M. Paul. Am. Blacksmith, vol. 17, no. 12 Spt. 1918, pp. 298-299, 9 figs. Considers effect of thickness in regard to deflection and load.

MACHINE SHOP

Chisel. The Cold Chisel, J. A. Lucas. Power, vol. 48, no. 24, Dec. 10, 1918, pp. 838-841, 27 figs. Description of various types of cold chisels and their uses.

Cylinder Manufacture. Cylinder Boring and Reaming, Franklin D. Jones. Machy., vol. 25, no. 5, January 1919, pp. 383-394, 20 figs. First of series of articles dealing with boring, reaming and grinding of cylinders, and tools, fixtures and machines used.

Manufacture of Cylinders for the Hall-Scott Aeroplane Engine, Richard Vosbrink. Metal Trades, vol. 9, no. 12, Dec. 1918, pp. 475-479, 11 figs, Operations followed at California plant to produce accurate results.

Design. Novel Plant of American Tool Company, C. L. Smith. Iron Age, vol. 103, no. 1, Jan. 2, 1918, pp. 29-33, 10 figs. Latest ideas in heating and ventilating, lighting features, transportation facilities, sanitation, handling turnings; unusual drive for planers; machine foundations.

Designing a Shop for Present Day Needs, C. E. Edmund. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 431-433. Considerations on location, construction and operation of forge plant.

Gages. Notes on the Computing of Gage Tolerances, M. H. Potter. Can. Machy, vol. 20. no. 24, Dec. 12, 1918, pp. 670-672, 6 figs. Classifies and studies the more frequent troubles experienced with gages and gives rules and formulæ for computing allowable tolerances for various gages. A square hole gage and a depth gage are referred to but the rules proposed apply in general to all gages.

Apparatus for Checking Screw Threads. Automotive Indus., vol. 38, no. 24, Dec. 12, 1918, pp. 1008-1010, 4 figs. Methods of operating machines used for inspection nf plug and ring thread gages and similar threaded parts requiring great accuracy.

Flush-pin, Sliding Bar and Hole Gages, Erik Oberg. Machy. vol. 25, no. 5 Jan. 1919, pp. 404-412, 34 figs. Principles involved and procedure, followed by Pratt & Whitney Co. in developing gaging systems for interchangeable manufacture. Fourth article.

Contour or Profile Gages, Erik Oberg. Machy., vol. 25, no. 4, Dec. 1918, pp. 301-308, 31 figs. Principles involved and procedure followed in developing gaging systems for interchangeable manufacture. Based upon experience of Pratt & Whitney Co. in furnishing gaging equipment for small arms and heavy ordnance work. Third article.

Gear Cutting. The Manufacture of Spiral Bevels. Automobile Engr., vol. 8, no. 121, Dec. 1918, pp. 336-339, 6 figs. Description of Gleason machine for that purpose.

Problem of the Theoretically Correct Involute Hob, Nikola Trbojevich. Machy., vol. 25, no. 5, Jan. 1919, pp. 429-433, 3 figs. Mathematical theory developed.

Grinding. Grinding of Hardened Work, C. H. Norton. Proc. Steel Treating Research Soc., vol. 1, no. 11, pp. 15-17. Norton Grinding Co.'s experience; suggestion in regard to grinding.

Grinding Operations on "Caterpiller" Tractor Parts, Frank A. Stanley. Am. Mach., vol. 50, no. 1, Jan. 2, 1919, pp. 1-417 figs. Grinding operations include finishing of great variety of gears, bushings, shafts, piston pins, case covers, etc.; details of wheels, limits of accuracy, etc.

Grinding Round Work Without Centers. Am. Mach., vol. 50, no. 1, Jan. 2, 1919, pp. 4-5, 4 figs. Describes new grinding machine built by Detroit Tool Co.

Pistons and Rings. The Manufacture of Pistons and Rings, A. Thomas. Automobile Engr., vol. 8, no. 121, Dec. 1918, p. 358, 3 figs. Notes on operation of Potter-Johnson automatic machine.

Repair Work. Automotive Repair Work in the Machine Shop, Donald A. Hampson. Can. Machy., vol. 20, no. 21, Dec. 12, 1918, pp. 665-668, 7 figs. Practical observations on methods of increasing pedal leverage, making a working clutch, inserting cotters in unseen holes, fitting rings in cylinder, increasing size of cast iron parts, reaming undersize in cast iron and other similar operations.

The Repair Shop, Automobile Engr., vol. 8, nos. 120 and 121, Nov. 1918 and Dec. 1918, pp. 312-315 and 341-345, 25 figs. Nov. 1918; Notes on heavy vehicle design from viewpoint of repair and maintenance. Radiator; engine; clutch; engine suspension; gear box; universal joints and brakes. Dec. 1918; Deals with rear axle; road wheels and bearings; chassis lubrication, spring and pins; frame; steering and front axle; controls.

MACHINERY, METAL-WORKING

Boring Mill. Blomquist-Eck Horizontal Boring Mill. Machy., vol. 25, no. 5, Jan. 1919, pp. 465-466, 2 figs. General description with illustrations.

Lathes. Large Lathes for Machining Turbine Spindles, A. M. M. Machy, vol. 25, no. 5, Jan. 1919, pp. 439-442, 3 figs. Illustrated description of some large lathes.

Planer. Newton Upright Generating Planer, Machy., vol. 25, no. 5. Jan. 1919, pp. 473-474, 4 figs. Description of machine built by Newton Machine Tool Works, Inc., Philadelphia, Pa.

Reamers. Types of Reamers and Their Use, E. C. Peck. Machy., vol. 25, no. 4, Dec. 1918, pp. 335-337, 6 figs. Description of various types of reamers.

Relieving Machine. Universal Relieving Machine for Hobs and Cutters. Machy., vol. 25, no. 5, Jan. 1919, pp. 467-468, 2 figs. Description of machine built by T. C. Mfg. Co., Harrison, N.J.

Steel High-Speed. The Evolution of a High-Speed Steel Tool, T. L. Thorne. Proc Steel Treating Research Soc., vol. I, no. 11, pp. 33-43. Analyses of several high-speed steel specimens; influence of silicon, manganese, sulphur, plosphorus chromium, vanadium and tungsten on characteristic properties of steel; practice followed in its manufacture; forms of furnaces used; heat-treating and tools.

A New Air-Hardening High-Speed Steel. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 435-436, 2 figs. Experiences of users of a steel made without tungsten by Cuyahoga Crucible Foundry Co.

Stellite. Stellite and High-Speed Steel Compared. Iron Age, vol. 102, no. 26, Dec. 26, 1918, pp. 1584-1585, 2 fig. Hardness at different temperatures; stellite softer in raw state; relative cutting tests on three materials.

See also RAILROAD ENGINEERING, Shops (Tools, Brass-Working); MUNITIONS AND MILITARY ENGINEERING, Tools for Shell Manufacture.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

Notched Bars. Some Experiments on Notched Bars, H. T. Philpot. Jl. Soc Automotive Engrs., vol. 3, no. 6, Dec. 1918, pp. 347-357, 3 figs. Tests to obtain dimensions and shapes for round notched bar for use in acceptance tests on heat-treated steels in place of standard square type A test piece. Paper befor Instn. Automobile Engrs. of Great B itain.

Hardness. The Ludwik Hardness Test, W. Cawthorne Unwin. Jl. Instn. Mech, Engrs., no. 6, Nov. 1918, pp. 485-492. Traces relationship between indentation hardness tests of ductile metals.

The Value of the Indentation Method in the Determination of Hardness, R. G. C. Batson. Jl. Instn. Mech. Enger., no. 6, Nov. 1918, pp. 463-483, 6 figs. Deals with determination or hardness by means of indentation produced by a static load and by impact of a ball or cone.

Malleable Iron. Malleable Iron in Engineering Construction, H. A. Schwartz. Foundry, vol. 47, no. 317, Jan. 1919, pp. 19-24, 16 figs. Engineering properties and characteristics of malleable iron which recommend it for wide range of uses, From paper before Am. Foundrymen's Assn.

Optical Stress Determination. Stress Optical Experiments, A. R. Low. Flight, vol. 10, nos. 48-49, Nov. 28 and Dec. 5, 1918, pp. 1355-1356 and 1379-1381, 12 figs. Determination of stress by optical methods. Nov. 28; Elementary theory; changes in uniform field as stress increases; null method of measurement; appearances in non-uniform field; enutral, isochromatic and isoclinic lines Dec. 5; Simplifications in case of bar under flexure; error of obliquity; observation of errors of parallax; general accuracy of optical obsevations of stress. Paper before Royal Aeronautical Soc. (To be continued.)

Rubber. Ageing cf Vulcanized Plantation Rubber, Henry P. Stevens. Jl. Soc. Chem. Indus., vol. 37, no. 21, Nov. 15, 1918, pp. 305T-306T, 4 figs. Tests or ordinary pale rolled sheet and unrolled sheet.

Testing Machines. Testing Machines in Industrial Laboratories H. S. Primrose and J. S. Glen Primrose. Can. Machy., vol. 20, nos. 23 and 25, Dec. 5 and 19, 1918, pp. 64-647 and 696-699, 17 figs. Necessity of establishing specifications properly controlled by analysis and test in purchasing engineering materials and features of various testing machines. From Engineering.

Testing of Materials. The Experimental Study of the Mechanical Properties of Materials, W. Cawthorne Unwin. Jl. Instn. Mech. Engrs., no. 6, Nov. 1918, pp. 405-439, 13 figs. Early researches; chain-cable testing machines; large testing machines; Emery testing machine at Bureau of Standards; tests of reception tension tests, Wöhler test, hardness tests, notched-bar tests.

Wood. Some Tests of Douglas Fir after Long Use, Arthur C. Alvarez. Univ. of Cal. Publications in Eng., vol. 2, no. 2, Nov. 18, 1918, pp. 57-118, 17 figs Results of 1200 tests on strength, elastic properties and moisture content; includes 27 tables of measured and computed mechanical coefficients.

MEASUREMENTS AND MEASURING APPARATUS

Calibration. On the Choice of a Uniform Temperature for the Calibration of Measuring Instruments (Sur le choix d'un degré uniforme de température pour l'étalonnage des instruments de mesure), Ch. Cochet. Revue Générale de l'Electricité, vol. 4, no. 20, Nov 16, 1918, pp. 740-742. Report of Commission, de Normalisation des Ingénieurs des Arts et Métiers de Boulogne-sur-Seine, recommending adoption of 0 deg. cent. as standard.

Calorimeters. Calorimetric Methods and Devices, Walter P. White, Jl. Am. Chem. Soc., vol. 40, no. 12, Dec. 1918, pp. 1887-1889, 3 figs. Application of rules for calorimetric precision derived by writer to jacket covers and stirrers; vacuum-jacketed vessels; adiabatic method; aneroid or dry calorimeters; double or differential calorimeters; measured-shield calorimeters.

Coke Testing. Coke Factors Affecting Furnace Operation, G. D. Cochrane, Blast Furnace, vol. 6, no. 12, Dec. 1918, pp. 502-504, and 512 1 fig. Coke-testing machine employed in experiment for determining coke hardness. Mechacinal condition of coke an important factor in furnace operation.

Picnometer. A Picnometer Operated as a Volumeter, H. G. Schurecht. Jl. Am. Ceramic Soc., vol. 1, no. 8, Aug. 1918, pp. 556-558, 1 fig. Same as ordinary picnometer but of sufficiently large size and opening to permit introduction of a briquet into the bottle. Volume of briquet determined from standard formula in terms of weight and specific gravity of liquid.

Salinometers. An Instrument for Recording Sea-Water Salinity, A. L. Thuras, Jl. Wash. Acad. Sci., vol. 8, no. 21, Dec. 19, 1918, pp. 676-687, 3 figs. Surface salinity of ocean determined by measuring ratio of resistances of sea water in two similar electrolytic cells. Accuracy limited by that with which salinity of standard sea water carried in sealed cell is known. Table given showing conductivity of sea water throughout range of concentration found in open ocean.

Scales. Oscillations in Scales, Eugene Motchman. Scale Jl., vol. 5, no 3, Dec. 10, 1918, pp. 7-9, 4 figs. Use of modern 150-ton beam applied to railroad track scales without loose weight. (Continuation of serial.)

MECHANICAL PROCESSES

Boilers. Boiler Making in an English Shop, A. L. Haas. Boiler Maker, vol. 18, no. 12, Dec. 1918, pp. 333-337, 11 figs. Hopwood, Cornish, Lancashire and Britannia types; shop conditions; position drilling; combustion chamber crown; seven-hour tests.
Manufacturing Marine Steam Boilers, E. A. Suverkrop. Am. Mach., vol. 49, no. 26, Dec. 26, 1918, pp. 1155-1163, 21 figs. Description of building operations of single-ended, three-furnace Scotch marine boilers at shop of Sun Shipbuilding Co., Chester, Pa., where production has reached as high as nine per month.

Cans. A Modern Can-Making Plant in a Baking Powder Factory, J. V. Hunter. Am. Mach., vol. 49, no. 26, Dec. 26, 1918, pp. 1173-1176, 11 figs. Description of process of making tin cans.

Chains. The Manufacture of Diamond Transmission Chain, J. V. Hunter. Am. Mach., vol. 49, no. 23, Dec. 12, 1918, pp. 1077-1080, 11 figs. Assembling work. Fourth article.

Clocks. Applications of Magnetic Gears in Electric Clockmaking (Engrenages magnétiques. Application à l'horlogerie électrique), Pierre Seve. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 19, Nov. 4, 1918, pp 681-683. Mutual action of two disks having magnets attached at regular intervals in their perpheries; disposition to provide magnetic escapement.

Engines, Oil. Quautity Production of Engines at the Skandia Pacific Plant, Geo. N. Somerville. Metal Trades, vol. 9, no. 11, Nov. 1918, pp. 429-434, 10 figs. Operations in various sizes of oil engines.

Lubricator. Manufacturing a Mechanical Lubricator, M. E. Hoag. Am. Mach., vol. 49, no. 26, Dec. 26, 1918, and vol. 50, no. 1, Jan. 2, 1919, pp. 1183-1185 and 23-26, 18 figs.

Plates. See Rolling Mills below.

Quarrying. Rock Quarrying for Cement Manufacture, Oliver Bowles. Department of Interior, Bur of Mines, bul. 160, min. technology 22, 160 pp., 31 figs. Chief types of cement; growth of cement industry in U. S.; character of raw materials used; quarrying method and equipment with special reference to drilling and blasting; rock mining and prospecting.

Radiators. Building Radiators for Automobiles and Other Purposes, Ellsworth Sheldon. Am. Mach., vol. 49, no. 26, Dec. 26, 1918, pp. 1165-1169, 18 figs. Description of certain processes involved in manufacture of cellular type of radiator.

Rolling Mills. Design of Rolls for Making Ship and Boiler Plates, S. W. Staniford. Machy., vol. 25, no. 5, Jan. 1919, pp. 396-400, 1 fig. Rolling-mill practice; drafts of slabbing and plate-mill rolls; universal mill; surface speed of rolls, rolling tin plate.
The Liberty Mill of the Carnegie Steel Company, Charles A. Menk and F. L. Hunt. Elec. Jl., vol. 15, no. 12, Dec. 1, 1918, pp. 483-489, 18 figs. Layout of buildings and equipment of completely electrically-driven plate mill.
Valley Company Now Rolls Plates, Iron Trade Rev., vol. 63, no. 25, Dec. 19, 1918, pp. 1403-1406, 3 figs. Operation and details of electrically-driven steel plant with annual capacity of 350,000 tons.
Selecting Proper Size Mill Rolls, F. Johnson. Iron Trade Rev., vol. 63, no. 26, Dec. 26, 1918, pp. 1466-1468, 7 figs. Outline of relative advantages obtained by using rolls of small or large diameter for effecting a given reduction; effect of cold-working on physical properties of various metals. From paper before Birmingham Metallurgical Soc., England.
A New Departure in Rolling Mills. Iron Age, vol. 103, no. 1, Jan. 2, 1919, pp. 41-44, 6 figs. Neither lifting tables nor reversing drive employed; design developed by Mackintosh, Hemphill & Co.
Lukens Plate Mill is Largest in the World. Iron Age, vol. 103, no. I, Jan. 2, 1919, pp. 56-59, 5 figs. Description of the mill.
Brier Hill Steel Co.'s New Plate Mill. Iron Age, vol. 102, no. 25, Dec. 19, 1918, pp. 1521-1524, 6 figs. World's largest mill building; houses and 84 and 132-in. units; power entirely electric; boiler plant dispensed with.
Blooming Mill Now Rolling Plates. Iron Trade Rev., vol. 63, no. 23, Dec. 5, 1918, pp. 1285-1288, 4 figs. Account of rebuilding of mill, orginally designed for breaking down ingots, to air rapid transformation from shell steel to peace-time commercial product.

Sawmills. Small Sawmills: Their Equipment, Construction and Operation, Daniel F. Seerey. U. S. Department of Agriculture, bul. 718, Dec. 17, 1918, 68 pp. Suggestions to portable sawmill operators regarding methods of organization, milling, and lodging which have been proved by experience to give the best results. Written particularly for operators in National Forest timber.

Shell and Ivory Articles. Making Shell Buckles and Brooches, Robert Mawson. Am. Mach., vol. 50, no. 1, Jan. 2, 1919. pp. 20-22. 13 figs. Making of buckles and brooches from shells and ivory performed as far as possible on machines, but some operations are done by hand.

Shovels. Shovels Made Out of Old Locomotive Tires, W. S. Standiford. Can. Machy., vol. 20, no. 25, Dec. 1918, pp. 693-695, 3 figs. Description of manufacturing process.

Tanks, Pressure. Tables for the Design of Pressure Tanks. John A. Cole. Boiler Maker, vol. 18, no. 12, Dec. 1918, pp. 349-351. Specifications for cylindrical pressure tanks; single-riveted lap girth seams, for use when girth and longitudinal seams are the same size; safe working pressures for cylindrical tanks of various diameters; safe working pressures on convex and dished heads.

Tractor. Manufacturing of Farm Tractor, M. E. Hoag. Am. Mach., vol. 49, no. 25, Dec. 19, 1918, pp. 1135-1137. Description of shop arrangement of Moline Plow Co.

MECHANICS

Balancing. Dynamic and Static Balancing ,Edward K. Hammond. Machy., vol. 25, nos. 4 and 5, Dec 1918 and Jan. 1919, pp 285-292 and 422-426, 26 figs. Two articles explaining conditions which must be fulfilled in balancing machine members, and methods of conducting work.

Stress Theory. The Specification of Stress, Part V, R. F. Gwyther, Memoirs & Proc. Manchester Literary & Phil. Soc., vol. 62, part 1, Aug. 7, 1918, pp. 1-11. Formal solution of elastic stress equations; theory of displacements of materials bodies as consequence of stress; results of hypothesis that nine elements of stress may be functions of nine first differential co-efficients of components of some vector; fundamental equations estimating forces causing rate of change of momentum and expression of corresponding rate of change of momentum.

Vibration. Vibration: Mechanical, Musical and Electrical, Edwin H. Barton. Sci. Am. Supp., vol. 87, no. 2241, Jan. 4, 1919, p. 5. Analogies and experimental verification of laws governing vibratory motion. Discourse delivered at Royal Instn. From Engineering.

MOTOR-CAR ENGINEERING

Acceleration Determined by Mechanical Differentiometer. Automobile Performance Analyzed by Mechanical Differentiation. Armin Elmendorf. Automotive Indus., vol. 40, no. 1, Jan. 2, 1919, pp. 11-46, 17 figs. Determination of accelaration from time and distance observations by means of mechanical differentiometer.

Carburetors. Carburetor Adjustments of Twenty Leading Automobiles. George H. Murphy. Am. Blacksmith, vol. 17, no. 12, Sept. 1918, pp. 301-303, 9 figs. Instructions for making adjustments. (To be concluded.)

Design. Post-War Chassis. Automobile Engr., vol. 8, nos. 120 and 12I, Nov. and Dec. 1918, pp. 304-305 and 339-340. Nov. 1918; possible effects of aircraft engine experience and other factors bearing upon design. Pistons; valve position and actuation; valves. Dec. 1918, Valve springs; valves rockers; connecting rods; crankshafts; lubrication.
Analysis of Gas and Gasoline High-Speed Engine Design, Harry R. Ricardo Int. Mar. Eng., vol. 23, no. 12, Dec. 1918, pp. 673-677. Gorups of mechanical losses depend upon form of pipe work; volumetric efficieny and piston design. Second article.

Differentials. The Allen Self-Locking Differential. Automotive Indus., vol. 39 no. 26, Dec. 26, 1918, p. 1099, 2 figs. Device embodying reversible ratchet principle. Drive on curves is through inner wheel.

Engines. Used Airplane Engines for Automobile Installation, Frank F. Tenney. Automotive Eng., vol. 3 no. 10, Dec. 1918, pp. 457 and 463. Why engines which have outlived their usefulness in air service may still be of service of other uses.

Exports. Export Opportunities for Automotive Products, (11). Automotive Eng., vol. 3, no. 10, Dec. 1918, pp. 454-456. Export of American combustion engine from 1914 to 1917; motor boats and marine machinery in Siam; demand for motor boats in Denmark; high fuel limits in South America; market tractors in Cuba; tractors in farming sections of Walves. Continuation of serial.)
Cultivating Japanese Automotive Field (III), Tom O. Jones. Automotive Indus., vol. 39, no. 23, Dec.5, 1918, pp. 970-971. Types of automobiles desired; equipment and finish; automobile building in Japan. (To be continued).

France. The Automobile after the War, Georges Côté. Automotive Indus., vol. 39, no. 25, Dec. 19, 1918, pp. 1057-1058 and 1075. Views and suggestions to automobile manufacturers of France as to means and methods of meeting reconstruction problems and foreign competition.

Fuels. Benzol Superior to Gasoline as Auto Fuel. Gas Age, vol. 42, no. 12, Dec. 16, 1918, pp. 548-550, 2 figs. Result of comparative tests made by Automobile Club of America; 90 per cent benzol said to give higher brake hp. at less fuel consumption by the motor.

Liberty Fuel. Liberty Fuel. A Chemical Marvel, E. W. Roberts. Gas Eng. vol. 21, no. 1, Jan. 1919, pp. 1-4, 8 figs. Description of fuel with reportof U. S. Government tests.
Properties of Liberty Fuel and Results of Economy Tests. Power, vol. 49 no. 1, Jan. 7, 1919, pp. 9, 2 figs. Particulars as to nature and characteristics of new fuel.

Headlights. Headlamp Glare. Jl. Soc. Automotive Engrs., vol. 3, no. 6, Dec. 1918, pp. 364-366. Account of work done and bases followed by committee of Illum. Eng. Soc. in preparation of headlight specifications.

Manufacturing Problems. Why So Many Motor Models? George F. Crouch. Motor Boat, vol. 15, no. 23, Dec. 10, 1918, pp. 18-20, 3 figs. Osbcrves that concentration by manufacturer on fewer sizes would mean better moters, better service and lower cost.

Radiators. Principles of Tractor Radiator Design, E. Goldberger. Automotive Indus., vol. 38, no. 24, Dec. 12, 1918, pp. 1000-1003, 3 figs. Equations showing dependence of radiator capacity on temperatures, rates of flow and inherent characteristics; advantages of thermosiphon cirulation in tractor work.

Steam Vehicles. A New British Coke-Fired Steam Commercial Vehicle. Automotive Indus., vol. 39, no. 22, Nov. 28, 1918, pp. 919-922, 6 figs. Three-ton chassis having automatic control of steam-generating functions and manual control of devices arranged as on a gasoline vehicle.

Suspension. Houdaille Brings Out Adjustable Car Suspension, F. W. Bradley Automotive Indus., vol. 38, no. 24, Dec. 12, 1918, pp. 1004-1005, 2 figs. Device which permits moving points of attachment of springs to car frame.

Tractors. S. W. H. Tractor, a New Cleveland Product. Automotive Indus., vol. 39, no. 26, Dec. 26, 1918, pp. 1085-1088, 5 figs. Three-plow machine with pressed-steel semi-frame bolted to front end of transmission housing; engine and transmission independent.
The Auto-Tiller, a Two-Horse Team Replacement Unit. Automotive Eng., vol. 3, no. 10, Dec. 1918, pp. 473-477, 5 figs. Field of unity and mechanical details of motor tractor for farm work operated by one man from a fixed position.

Trucks. Regulation of Speed, Weight, Width and Height of Motor Trucks Discussed, George M. Graham. Eng. News-Rec., vol. 81, no. 25, Dec. 19, 1918, pp. 1109-1112. Regulation, while necessary, should not restrict expansion of motor truck; table of proposed dimensions, speeds, weights, and fees presented. From paper before Joint Highway Congress, Chicago, Dec. 1918.
Double Reduction Gear Drive for Heavy Duty Trucks. Am. Blacksmith, vol. 18, no. 2, Nov. 1918, pp. 32-33. Operation of drive in new 3 and 5-ton, White models.

Wheel. An Elastic Wheel (La roue élastique I. D.). Génie Civil, vol. 73, no. 20 Nov. 16, 1918, pp. 393-394, 2 figs. Design which by means of helical springs attached to rim permits tangential effort on wheel to be distributed over a number of contact points of spring.

PIPE

See MECHANICAL ENGINEERING, Corrosion (Pipe).
See also MECHANICAL ENGINEERING, Mechanical Processes (Radiators); Internal Combustion Engines (Buckeye Barrett Engine); Machine Shop (Repair Work).

POWER GENERATION

Exhaust Steam. Utilization of Exhaust Steam in Collieries for the Generation of Electrical Energy (Considérations sur l'utilisation des vapeurs d'échappement dans les bouillères en vue de la production d'énergie électrique), A. Barjou. Industrie Electrique, year 27, nos. 621, 623, 627, 631 and 634, May 10, June 10, Aug. 10, Oct. 10 and Nov. 25, 1918, pp. 166, 171, 212, 217, 287, 293, 373, 379 and 425-430, 26 figs. May 10: theoretical aspect of problem. June 10: systems of regulating exhaust steam. Aug. 10: utilization of exhaust steam in low-pressure turbines. Oct. 10: Westingbouse-Leblanc system of condensation. Nov. 25; Brequet-Delaporte condenser.

Tides. Tides as a Source of Mechanical Power (Etude sur l'utilisation des marées pour la production de la force motrice), F. Maynard, Revue Générale de l'Electricité, vol. 4, nos. 19, 20 and 21, Nov. 9, 16 and 23, 1918, pp. 697-715, 749-762 and 793-802, 14 figs. Brief description of 87 patents granted in France concerning devices for utilization of tidal energy and analyses of their practical values. (To be continued.)

POWER PLANTS

Boiler Water. Control of Concentrated Boiler Water is Essential, Hartley LeH. Smith. Elec. Ry. Jl., vol. 52, no. 25, Dec. 21, 1918, pp. 1087-1091, 1 fig. Methods used for control of concentration in boilers; how ratio of concentration from headwater to boiler water is determined; calculation of boiler concentration control charts.

Coal Economy. Coal Economy in a Small Steam Generating Station. Elec. Rec., vol. 24, no. 6, Dec. 1918, pp. 27-28, 3 figs. Results secured in 290-kw. plant given as example of coal saving.

Flue-Gas Analysis. Controlling Efficiency of Combustion, E. A. Uebling. Power, vol. 48, no. 26, Dec. 24, 1918, pp. 921-923. Use of flue-gas analysis for controlling combustion.

Furnace Indicating Instruments. Meters and Gages in Boiler Operation, E. A. Uehling. Power, vol. 48, no. 24, Dec. 10, 1918, pp. 842-844. Use of meters and gages in diagnosing condition of furnace.

Hand Firing. Power Plant Management; Hand Firing, Robert June. Power House, vol. 11, no. 11, Nov. 1918, pp. 315-317, 3 figs. Standard practice; proper combustion conditions; thickness of fire; minimization of smoke.

Individual Plants. Steam-Generating Equipment of Mark Plant, Gordon Fox and F. E. Grenley. Power Plant Eng., vol. 22, no. 24, Dec. 15, 1918, pp. 981-894, 3 figs. Description of certain features of new plant of Steel & Tube Co. of America.

Power Plants in 1918. Review of the Year in the Power Field. Power, vol. 49, no. 1, Jan. 7, 1919, pp. 2-8. What has been new and of especial interest during 1918.

Scale in Boilers. Scale in Water-Tube Boilers. Monthly Jl. Utah Soc. Engrs., vol. 4, no. 9, Sept. 1918, pp. 175-176. Results of cleaning a 400-hp. Babcock & Wilcox boiler after operating it or six months, with table indicating the amount of scale taken from each of its 14 sections.

Transmission Losses. Wasting Power in the Using, L. W. Alwyn-Schmidt. Power Plant Eng., vol. 22, no. 24, Dec. 15, 1918, pp. 984-987. Transmission losses, waste of power at machine and methods suggested for overcoming them.

Turbo-Generator Plants. Operating Methods That Increase Economy, C. F. Hirshfeld and C. L. Karr. Elec. World, vol. 72, no. 24, Dec. 14, 1918, pp. 1120-1124, 2 figs. Apply to turbo-generator plants; distribution of loads on boilers and turbines and economical operation of auxiliaries discussed.
Economic Operation of Steam Turbo-Electric Stations, T. C. Hirshfeld and C. L. Karr, Elec. Rev., vol. 73, nos. 23 and 24, Dec. 7 and 14, 1918, pp. 886-890 and 923-928, 5 figs. Bureau of Mines Technical Paper discussing fuel-economy factors, load, distribution between units, boiler room and auxiliairies operation.

Waste Heat. Waste Heat for Steam Generation. Thomas B. Mackenzie. Engineering vol. 106 no. 2759 Nov. 15 1918 pp. 567-569, 2 figs. Utilization of waste heat from open-hearth furnaces for generation of steam. Paper before Iron & Steel Inst. Sept. 1918.

PRODUCER GAS

Kiln Gas-Fired. Heat Balance on a Producer-Gas Fired Chamber Kiln, R. K. Hursh. Jl. Am. Ceramic Soc. vol. 1 no. 8, Aug. 1918, pp. 567-577, 1 fig. Data based on tests of a kiln of 16 chambers, each holding 50,000 standard sized brick and on three 6-ft. water-scaled gas producers of the pressure type.

Open-Hearth Furnaces. Waste Heat from Open Hearth Furnaces, Thomas B. Mackenzie. Blast Furnaces, vol. 6, no. 12, Dec. 1918, pp. 488-492, 3 figs. Analysis of producer gas supplied to furnace; theoretical principles governing operation of waste-heat boilers; suggestions concerning layout of plant and boiler setting. Paper before British Iron & Steel Inst. (Concluded.)

Wood. The Production of Power-Gas from Wood, Leslie B. Williams, Min. Mag., vol. 19, no. 5, Nov. 1918, pp. 246-250. Discusses composition of power gas from wood and methods of obtaining largest amounts of most effective components.

PUMPS

Motor-Driven Pumps. High Efficiencies Shown by Motor-Driven Water Works Pumps at St Paul, Minn. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 202-204, 2 figs. Results obtained from tests of two 12-in. centrifugal pumps.

REFRACTORIES

Classification. Refractories. Clay-Worker, vol. 70, no. 6, Dec. 1918, pp. 504-505. Reasons for classification into acid, basic and neutral; construction, effectiveness and uses of each of these classes; properties of some refractory clays.

Firebrick. How Slag Temperatures Affect Firebrick, Raymond M. Howe. Iron Trade Rev., vol. 63, no. 23, Dec. 5, 1918, pp. 1288-1289. Penetration of slag into brick was determined after allowing bricks, which were previously heated to required temperature, to retain in cavity 35 grams of slag for 2 hrs.; tables given for various temperatures. Paper before Refractories Mfrs. Assn. Also Blast Furnace, vol. 6, no. 12, Dec. 1918, pp. 484-485.

Silica. Silica Refractories, Donald W. Ross, Jl. Am. Ceramic Soc., vol. 1, no. 7, July 1918, pp. 477-499, 6 fifs, and (discussion) pp. 499-501. Experimental data on raw materials, manufacture and burning of silica brick, and properties of burned ware.

REFRIGERATION

Ammonia. What Becomes of the Ammonia in Refrigerating Systems? George L. Reuschline, Am. Soc. Refrig. Engrs. Jl., vol. 5, no. 3, Nov. 1918, pp. 161-167. Production of ammonia from normal sources; amount used in ice and refrigerating plants; actual needs and unavoidable losses; actual ammonia loss per ton of ice made; avoidable losses and how to stop tem; purging; piston-rod leakage; bonus system.

Ammonia, Compression System. The Ammonia Compression Refrigerating System—XXV. W. S. Doan. Refrig. World, vol. 53, no. 12, Dec. 1918, pp. 33-34. 1 fig. Testing of lubricating oil; petroleum oils; necessary quantity to feed bearings. (To be continued.)

Ammonia Piping. Discussion of the Topic — Size of and Proper Vapor Velocity in Ammonia Suction and Discharge Mains. Am. Soc. Refrig. Engrs. Jl., vol. 5, no. 2 Sept. 1918, pp. 120-124, 1 fig. Discussion at Milwaukee meeting.

FORECOOLING. Discussion of the Topic — Advantages of Forecooling Liquid Ammonia Between Receiver and Expansion Valve with Coldest Water Available. Am. Soc. Refrig. Engrs. Jl., vol. 5 no. 2, Sept. 1918, pp. 125-130. Discussion at annual meeting, New York.

HOUSEHOLD REFRIGERATING MACHINE. The Household Refrigerating Machine John E. Starr. Am. Soc Refrig. Engrs. Jl., vol. 5 no. 3, Nov. 1918, pp. 157-160. Attributes difficulty of designing commercial type of small compression machine to leakage at stuffing box small quantity of liquid circulated per minute and gradual projection of lubricant from high-pressure to low-pressure side.

ICE MANUFACTURE. Ice Plant Investments, George E. Wells, Am. Soc. Refrig. Engrs. Jl., vol. 5. no. 3. Nov. 1918, pp. 145-152. Detailed ice-manufacturing costs in 1915 of 20 southwestern ice plants using Corliss steam engines.
Power and Labor Requirements of Detroit Type Ice Plant Donald Cole. Am. Soc. Refrig. Engrs. Jl., vol. 5 no. 2, Sept. 1918 pp. 110-115 and (discussion) pp. 115-119. Operation of electrically driven raw-water plant, low-pressure, drop-pipe system having in conjunction an ice storage house holding full output of thirty to one hundred days.
Motor Driven Raw Water Ice Plant, George E. Chamberlin. Am. Soc. Refrig. Engrs. Jl., vol. 5 no. 2, Sept. 1918, pp. 87-109, 11 figs. Description of electrically driven high-pressure plant making 120 tons of ice per day.

LOW-TEMPERATURE COMPRESSION SYSTEM. The Low-Temperature Compression System in Practice, H. Sloan. Power, vol. 48, no. 25, Dec. 17, 1918, pp. 896-897, 2 figs. From paper before Am. Soc. of Refrig. Engrs., Milwaukee.

RESEARCH

BRITISH. National Laboratory for Industrial Research, Richard T. Glazebrook. Contract Rec., vol. 32, no. 47, Nov. 20, 1918, pp. 924-926. Need of sepcial laboratories for research work; research for trade associations; study of industrial problems in central laboratory. From lecture delivered at Royal Instn.
Science and the Future, A. A. Campbell Swinton. Machy, Market, no. 944, Dec. 6, 1918, pp. 19-20. From address to Roy. Soc. Arts.

NATIONAL RESEARCH COUNCIL, U. S. The Engineering Work of the National Research Council, Henry M. Howe. Bul. Am. Inst. Min. Engrs., no. 144, Dec. 1918, pp. 1715-1719. Purpose, status in October, 1918, and character of researches on pyrometry and electric welding.

STANDARDS AND STANDARDIZATION

ENGINE-TESTING FORMS. Standard Engine Testing Forms. Jl. Soc. Automobile Engrs., vol. 3, no. 6, Dec. 1918, pp. 378-381, 3 figs. Four sheets: one giving rules and direction for use of forms and three providing means for giving information regarding engine conditions of test and plotting curves of results.

GASOLINE. Government Standard Gasoline and Oil Specifications. Jl. Soc. Automotive Engrs., vol. 3, no. 6, Dec. 1918, pp. 405-406. Specifications for aviation gasoline, motor gasoline, and fuel, gas and bunker oils, adopted by Committee on Standardization of Petroleum Specifications.

OILS, ILLUMINATING. Specifications for Illuminating Oils. Oil & Gas Jl., vol. 17, no. 31, Jan. 3, 1919, pp. 50-52. Methods of test and specifications adopted by Committee on Standardization of Petroleum Specifications. Rules were drafted with view to allow making of products from any satisfactory crude petroleum.

STEAM ENGINEERING

BOILERS. Modern Boilers (Les chaudières modernes), L. Conge. Revue Générale de l'Electricité, vol. 4, no. 19, Nov. 1918, pp. 715-718, 11 figs. Several French and American types are considered as usuable in large central turbo-electric stations.

Feeding and Circulating the Water in Steam Boilers, John Watson. Trans. Inst. Marine Engrs., vol. 30, no. 239, Nov. 1918, pp. 225-246 and (discussion) pp. 246-264, 7 figs. Historical account of schemes evolved and experimental work undertaken; analysis of present practices in the various types of boilers; effect of maxing hot boiler water with incoming feed in proportions up to 200 per cent. boiler water.
Mechanical Department Circular No. 11, U. S. Ry. Administration Frank McManamy. Ry. Jl., vol. 25, no. 1, Jan. 1919, pp. 21-22, 1, fig. Rules and instructions for inspection and testing of stationary boilers.
How to Design and Lay Out a Boiler — II, William C. Strott. Boiler Maker, vol. 18, no. 12, Dec. 1918, pp. 353-354, 5 figs. Calculation of proper tube expansion; purpose of beading; use of scant tube lengths; figuring " line-up." (To be continued.)

CONDENSERS. Keeping Up Condenser Performance. Hartley LeH. Smith. Power, vol. 48, no. 25, Dec. 17, 1918, pp. 868-870, 4 figs. How to determine economy which should be obtained and how to correct causes of low vacuum.

STEAM PRESSURE, HIGH. High Steam Pressure and Superheat, Eskil Berg. Power, vol. 48, no. 24, Dec. 10, 1918, pp. 832-835, 3 figs. From a paper before joint meeting of Western Soc. of Engrs., Chicago Section of Am. Soc. of Mech. Engrs. and Am. Inst. of Elec. Engrs.

TURBINES. Steam Turbines for Natural Steam. Power Plant Eng., vol. 22, no. 24, Dec. 15, 1918, pp. 990-993, 7 figs. Power plant at Larderello, Italy, operating large turbine units with natural steam taken from crevices and fissures in ground.
Turbine Engines for Cargo Vessels. Marine Rev., vol. 49, no. 1, Jan. 1919, pp. 31-34, 6 figs. Mechanical features of the geared drives.
Steam Turbine Progress and Possibilities. Blast Furnace, vol. 6, no. 52, Dec. 1918, pp. 481-483, 5 figs. Higher boiler pressures; intermediate steam reheating in large multiple-cylinder machines; feedwater heating; use of economizer.
The Historical Development of Steam Turbine (1). Power House vol. 11, no. 11, Nov. 1918 pp. 311-314, 10 figs. Growth in capacity and in size of individual units during last 30 years. (To be continued.)

VALVES BALANCED SLIDE. Balanced Slide Valve for Andrews-Cameron Steam Engine (Tiroir équilibré pour machine à vapeur système Andrews et Cameron). Génie Civil, vol. 73, no. 17, Oct. 26, 1918, pp. 333-334, 8 figs. Description of two types, one with two and other with three parts.
See also MECHANICAL ENGINEERING, Motor-Car Engineering (Steam Vehicles.)

THERMODYNAMICS

HEAT TRANSMISSION. Heat Transfer Tests of Building Materials L. M. Arkley. Jl. Eng. Inst. Can. vol. 1, no. 8, Dec. 1918 pp. 386-393 6 figs. Account of tests (1) to determine selection of proper materials to be used in buildings, (2) to determine effect on transfer of heat through a 12-in. hollow tile well of laying it up, first with hollow spaces horizontal and second with hollow spaces vertical and directly over each other, (3) to investigate heat-insulating qualities of a number of materials suitable for refrigerating room including buil-up walls, cork walls, and ordinary building papers.
New Heat Transmission Tables, William R. Jones. Heat. & Vent. Mag., vol. 15, no. 12, Dec., 1918, pp. 36-40. Third series of tables.

WELDING

ALUMINUM. How to Use a "Chill" on Aluminum Welding. David Baxter Jl. Acetylene Welding, vol. 20, no. 6, Dec. 1918, pp. 280-282, 3 figs. Method of backing up hole in aluminum crankcase with plate of heavy galvanized iron and welding across to fill hole with aluminum, the iron acting as a sort of chill.

ARC-WELDING TOOL. Improved Arc Welding Tool. Aerial Age, vol. 8, no. 12, Dec. 2, 1918, pp. 619-634, 2 figs. Designed to make operation of changing electrodes definite to permit any amount of pull when electrode freezes to work and capable of eperating for voluntary release.

ELECTRIC WELDING. Comparisons of Processes of Electric Butt Welding, J. B. Clapper. Boiler Maker, vol. 18, no. 12, Dec. 1918, pp. 345-346. Operations in butt welding; transformer control; strength of butt weld; application of point and spot welding; use of resistance process.
Modern Welding by Use of Electricity, Elec. Rev., vol. 73, no. 25, Dec. 21, 1918, pp. 959-962, 3 figs. Principles of electric arc and spot welding; advantages; methods of application; recent developments; extent of field.

Some Recent Developments in Machines for Electric Spot Welding as a Substitute for Riveting, J. M. Weed. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 928-934, 9 figs. Writer claims his experiments have demonstrated that the thickness of parts to be welded is governed by capacity of apparatus available for doing the work..
Electric Welding — A New Industry, H. A. Hornor. Contract Rec., vol. 32, no. 47, Nov. 20, 1918, pp. 931-934. Status of industry; uses of alternating current; methods of welding and of testing a joint: developments. Paper before Am. Inst. Elec. Enger.
Comparative Characteristics of Arc Welders, J. F. Lincoln. Elec. World, vol. 72, no. 24, Dec. 14, 1918, pp. 1119-1120. Discussion to bring out comparative advantages and costs of a. c. and d. c. welders.
Features of Arc Welding Development, O. A. Kenyon. Elec. Rev., vol. 73, no. 25, Dec. 21, 1918, pp. 963-965, 2 figs. Control of welding heat; selection of kind and size of electrodes; kinds of joints and their characteristics; systematic planning of welding method to be used.
The Constant-Energy Arc-Welding Set. P. O. Noble. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 938-940, 6 figs. Type of equipment designed to facilitate maintenance of a short arc and to make it difficult to continue a long one.

Electric Welding at the Erie Works, General Electric Company, H. Lemp and J. R. Brown, Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 915-918, 12 figs. Applications of process to welding saws, butt-welding high-speed steel to shank of machine steel in manufacture of machine tools, and various other mechanical purposes.
A Review of Electric Arc Welding, John A. Seede. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 881-886, 10 figs. Evaluation of present practice, with special consideration of carbon electrode welding, metallic electrode, welding electrodes, fluxes, holders, a. c. arc welding, automatic welding and apparatus employed.

INSPECTION OF WELDS. Inspection of Electric Welds, O. H. Escholz. Power, vol. 48, no. 25, Dec. 17, 1918, pp. 872-873, 3 figs. Describes various tests and their efficiencies.
Inspecting Metallic Electrode Arc Welds, O. S. Escholz. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 448-450, 4 figs. Comments on significance and value of visual inspection, adhesion of deposit, penetration and electrical tests.

JOINTS. Lloyd's Experiments on Electrically Welded Joints, H. Jasper Cox. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 864-870, 16 figs. Results concerning modulus of elasticity, approximate elastic limit, utimate strength, ultimate elongation, alternating stresses, chemical and microscopic analysis, and strength of welds.

NON-FERROUS METALS. The Butt Welding of Some Non-Ferrous Metals, E. F. Collins and W. Jacob. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 958-961, 5 figs. Describes process said to be outcome of search for satisfactory method of connecting end rings to rotor bars of induction motor.

OXIDATION. The Welding of Iron and Steel, W. H. Cathcart. Iron Age, vol. 102, no. 26, Dec. 26, 1918, pp. 1587-1583, 10 figs. Principles governing smithy and forge; effect of oxidation; use of a flux; annealing essential; conditions to be fulfilled. From article in Apr., 1918, issue of Jl. of West of Scotland Iron and Steel Inst., Galsgow.

OXY-ACETYLENE WELDING. Oxy-Acetylene Pipe Welding and Cutting, Gas Age, vol. 42, no. 12, Dec. 16, 1918, pp. 515-516, 5 figs. Practical suggestions on manipulation of blowpipe. (Continuation of serial.)
Handling Acetylene Welding Outfits, E. Wanamaker. Ry. Rev., vol. 63, no. 25, Dec. 21, 1918, pp. 869-871. Discussion of acetylene and oxygen gases and instructions for handling outfits in shops. Paper before Ry. Fire Prevention Assn. Chicago.

Research. Research in Spot Welding of Heavy Plates, W. L. Merrill, Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 919-922, 7 figs. Record of experiments with specially built welding machine of 36 tons pressure capaticy and 100,000 amperes current capacity, showing probability that new field of application for spot welding will be developed.

Structure of Iron. Microstructure of Iron Deposited by Electric Arc Welding, George F. Comstock. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 43-50, 10 figs. From microscopic examination of a weld writer concludes that pale crystals typical of steel fusion welds are not cementite or martensite or any similar carbide product, but probably nitride of iron. Discussion of S. W. Miller's paper. (Bul. A. I. M. E., Feb.-May, 1918.)

A Study of the Joining of Metals, J. A. Capp. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 947-956, 36 figs. Microscopic study of welds made (1) with high current applied for long periods, (2) smaller current applied for shorter time, and (3) current just large enough to procure welding temperature when applied for minimum time; made to determine best practice in making butt welds by Thompson electric welding machine.

The Metallurgy of the Arc Weld, W. E. Ruder. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 941-946, 15 figs. Notes based on microscopical examination of crystal structure, gas holes, slag inclusions, impurities, and composition.

Tank Manufacture. Electric Arc Welding in Tank Construction, R. E. Wagner. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 899-911, 25 figs. Qualifications of successful operator; value of intelligent study of work in hand and its preparation for welding; application of arc welding to tank construction; tabular data for determining cost of process.

Welded Seams. Welded Seams Correct Faults in Converters. Boiler Maker, vol. 18, no. 12, Dec. 1918, pp. 347-348, 6 figs. Experiments on welded-type heaters; difficulties in welding materials of varying thicknesses; automatic cutting machine. From Jl. Acetylene Welding.

Welding. Principles and Practices of Fusion Welding, S. W. Miller. Am. Soc. Refrig. Engrs. Jl., vol. 5, no. 3, Nov. 1918, pp. 168-215, 83 figs. Differences between various systems; principles of successful welding; composition of weld; testing welds; welding practices and materials; metallurgy and heat treatment of welds; variety of welds.

See also ELECTRICAL ENGINEERING, *Transformers, Converters Frequency Changers* (*Welding, Transformers for*); MARINE ENGINEERING *Yards* (*Welding*); RAILROAD ENGINEERING (*Welding*).

VARIA

Metric System. Reflexions on the Arguments For and Against the Metric System (Réflexions sur les pour et les contre du système métrique). Ch. Ed. Guillaume. Industrie Electrique, year 27, no. 624, June 25, 1918, pp. 225-227. Question of fundamental units; decimalization; possible adoption by Anglo-Saxon nations; arguments based on present situation. Remarks on Atkinson's communication to Instn. Elec. Engrs.

Opportunities for Engineers. Broader Opportunities for the Engineer, Charles T. Main. Jl. Am. Soc. Mech. Engrs., vol. 41, no. 1, Jan. 1919, pp. 6-11. Fields of activity opened to engineering societies and individual engineers in consequence of technical and social poportunities which have been created with the advent of world peace. Presidential address delivered at annual meeting of the Society.

Packing Machinery. The Problem of Packing. Cassier's Eng. Monthly. vol. 54, no. 5, Nov. 1918 pp. 257-262, 6 figs. Suggestions in regard to packing machinery for home market and export.

Society Engineering. Aims and Organization of the Society, L. C. Marburg. Jl. Am. Soc. Mech. Engrs., vol. 41, no. 1, Jan. 1919, pp. 12-15. Relations of the mechanical engineer to his work, to the community and other engineers. Report of Committee on Aims and Organization of the Society.

Technical Writing. Obtaining Ideas for Technical Articles, Albert M. Wolf. Wis. Engr., vol. 23, no. 2, Nov. 1918, pp. 40-41. Value of observation and diligent application of menta faculties to gathering technical date.

ELECTRICAL ENGINEERING

ELECTROPHYSICS

A. C. Circuits. The Calculation of Alternating Current Circuits, Gordon Kribs. Power House, vol. 11, no. 11, Nov. 1918, pp. 318-321, 2 figs. Tables of constants offered as readily usable in computing size of wire in a. c. 25-and 60-cycle circuits.

Harmonic Analysis. Harmonic Analysis of Alternating Currents by the Resonance Galvanometer (Sur l'analyse harmonique des courants alternatifs par le galvanomètre de résonnance), André Blondel Comptes rendus des séances de l'Académie des Sciences ,vol. 167, no. 20, Nov. 11, 1918, pp. 711-717, 1 fig. Characteristics of method proposed as modification of Pupin's and Armagnat's Considers (1) non-inductive resistances in circuits of galvanometer, and (2) a circuit having one or several capacities connected in series.

Spark Plug Insulators. Resistance of Hot Spark Plug Insulators, R. H. Cunningham. Automotive Indus., vol. 39, no. 22, Nov. 28, 1918, pp. 907-911, 8 figs. Experimental tests to determine loss of resistance at working temperatures; how such loss affects action of plug.

Vapor Arcs. Low-Voltage Arcs in Metallic Vapours, J. C. LeLennan. Proc. Phys. Soc., Lond., vol. 31, no. 176, Dec. 15, 1918, pp. 30-48, 6 figs. Repetition of experiments by Millikan and Hebb whose results writer believes to be in conflict with quantum theory. Results showed that quantum relation holds good with moderately heated incandescent cathodes and a moderate supply of metallic vapor. It was possible to obtain questioned phenomena, however, by increasing temperature of incandescent cathode.

ELECTROCHEMISTRY

Copper Plating. Automatic Copper Plating, Joseph W. Richards. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 27-31, 4 figs. Patented process. Basic principle involved lies in application of plating copper while iron sheet is cold and then melting metal under conditions favorable to formation of plating.

FURNACES

Electric Furnace Improvements During 1918, A. V. Farr. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 20-24, 9 figs. Efforts to increase output; linings, tilting apparatus and cooling; power supply; comparative date.

Electrodes. Electrodes for Electric Furnaces: Their Manufacture, Properties, and Utilization (11), Jean Escard. Gen. Elec. Rev., vol. 21, no. 11, Nov. 1918, pp. 781-792, 37 figs. Form, dimensions, grouping, and composition of electrodes, and their arrangement in the various types of furnaces; life, wear, and protection of electrodes; electrode holders, cooling systems, and methods of attaching connections. Trnaslated from Le Génie Civil.

Industrial Furnaces. Electric Heated Industrial Furnaces, George J.Krikgasser. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 26-32, 14 figs. Type of furnaces and accessory apparatus used in melting irons, brasses and bronzes in foundries; for heat-treating metal parts; in the manufacture of special alloys; for annealing, hardening and tempering tools; and for determining decalescent and recalescent points in tool steels.

Nitrogen-Fixation Furnace. Nitrogen Fixation Furnaces, E. Killburn Scott. Gen. Elec. Rev., vol. 21, no. 11, Nov. 1918, pp. 793-804, 16 figs. Salient points of difference between electric furnaces for fixation of nitrogen and those for metallurgical purposes. Discussion of various features in operation, such as phase balance, starting, losses, electrodes, stabilizing arc, power factor, air supply, preheater, absorption, cooling the gas, and theory of reaction. Abstract of paper before Electrochemical Soc.

Steel Furnaces. The Status of the Electric Steel Industry, Edwin F. Cone. Iron Age, vol. 103, no. 1, Jan. 2, 1919, pp. 60-62. United States still leads in output with 287 furnaces; progress since 1910; furnaces in world's industry probably over 815.

Electric Furnaces for the Production of Steel and Ferro-Alloys, J. O. Seede. Gen. Elec. Rev., vol. 21, no 11, Nov. 1918, pp. 767-780, 28 figs. Fundamentals of high-grade steel manufacture; author perfers electric furnace to all other types; classification and sketches of important furnaces.

Adds Electric Unit to Melting Equipment. Iron Trade Rev., vol. 63, no. 24, Dec. 12, 1918, pp. 1353-1354, 10 figs. Installation in which power is supplied through bank of two single-phase, 500-kva. transformers connected to a 2300-volt, 3-phase, 60-cycle supply line. Furnace hearth acts as neutral electrode, bottom connection being made to central point on transformer. Arcs are formed independently of one another.

Electric Furnaces in Metallurgy. Elecn., vol. 81, no. 2113, Nov. 15, 1918, pp. 588-590, 7 figs. Description of Héroult furnace.

The Electric Furnace in the Grey Iron Foundry. Can. Foundryman, vol. 9, no. 12, Dec. 1918, pp. 291-292 and 295, 4 figs. Work being done by Bowmanville Foundry Co. Mechanical feature and electrical control of furnace.

Electric Furnace Data for Ferro-Tungsten, Robert M. Kenney. Blast Furnace, vol. 6, no. 12, Dec. 1918, pp. 486-487. Data and description of ferro-tungsten production; smelting of ferberite concentrate; possibilities of making in one single operation ferro-tungsten containing less than one per cent carbon. Paper before Am. Inst. Min. Engrs.

GENERATING STATIONS

Canada. Electric Power Generation in Ontario on Systems of Hydro-Electric Power Commission, Arthur H. Hull. Can. Engr., vol. 35, no. 25, Dec. 19, 1918, pp. 532-533. Details of generation and electrical distribution: Rideau and Niagara systems: Queenstown development. (Concluded.)

Centralization of Power. Wholesale Power, F. P. Royce. Stone & Webster Jl., vol. 23, no. 5, Nov. 1918, pp. 357-360. Conditions favorable to centralization of electric power. Memorandum of statement made at meeting of New England Section of Nat. Elec. Light Assn.

Hydroelectric Stations. Electric Power Generation in Ontario on Systems of Hydro-Electric Power Commission, Arthur H. Hull. Can. Engr., vol. 35, no. 24, Dec. 12, 1918, pp. 520-523. Paper before Toronto Section Am. Inst. Elec. Engrs. Also Elec. News, vol. 27, no. 23, Dec. 1, 1918, pp. 25-29, 1 fig. General plan and particulars of canal development work and power generation.

The Present Status of Hetch Hetchy, Rudolph W. van Norden. Jl. Elec., vol. 41, no. 10, Nov. 15, 1918, pp. 348-443, 8 figs. Survey, score and present progress of water and power project undertaken by city of San Francisco.

Data Existing in Regard to the Construction of Hydroelectric Power Plants (Sur les données actuelles en matière de construction d'usines hydro-électriques), Denis Eydoux. Annales des Ponts et Chaussées, year 88, vol. 4, no. 18, July-Aug. 1918, pp 7-96, 34 figs. Résumé of theroetical considerations, general equations and present practice, with special reference to groups of French plants in Dauphiné and the arrangement existing between water-courses of the Société Pyrénéenne (Toulouse and Tarn) with those of the Société Méridionale (Aude and Hérault). (To be continued.)

Steam-Electric Stations. A Good Instance of Utilization of Italian Products in Argentine (Uno forte impronta dei produttori italiani nell' Argentina). L'Industria, vol. 32, no. 21, Nov. 15, 1918, pp. 638-464, 13 figs. Details and plans of steam-turbine central station distributing 30 million kw.hr. at 7000 volts to five substations. Substation also described.

GENERATORS AND MOTORS

Dynamical Theory. The Dynamical Theory of Electric Engines, Elecn., vol. 81, no. 2114, Nov. 22, 1918, pp. 616-617, 4 figs. Abstracted from 10th Kelvin lecture delivered by L. B. Atkinson before Inst. of Elec. Engrs.

Alternators. High-Frequency Alternators (Les alternateurs à haute fréquence), O. Billeux. Revue Générale de l'Electricité, vol. 4, no. 21, Nov. 23, 1918, pp. 803-805, 5 figs. Principles of these machines, particularly of the Alexanderson type (frequency, 30,000 per sec.), built for experimental purposes by the Société Française Radio-électrique.

Generators. Construction and Use of Generators Driven by Waterwheels. Elec. Rec., vol. 24, no. 6, Dec. 1918, pp. 60-66, 24 figs. Important features in both vertical and horizontal types.

Induction Motors. Reconnecting Induction Motors — For Change in the Number of Poles, A. M. Dudley. Power, vol. 49, no. 1, Jan. 7, 1919, pp. 9-14, 15 figs. (Third article.)

Rotors. Turbo-Alternator Rotors: Features of Mechanical Design (II), S. F. Barclay. Power House, vol. 11, no. 11, Nov. 1918, pp. 323-327, 17 figs. Suggested specifications for guidance in purchasing equipment.

Synchronous Motors. Magnetization Curves for Synchronous Motors.(Fätkurvordingram och magnetiseringskurvor for fierfasiga synkronmaskiner), John Wennerberg. Teknisk Tidskrift, Elextroteknik, vol. 48, no. 11, Nov. 6, 1918 pp. 138-146.

LIGHTING AND LAMP MANUFACTURE

Fixtures. Linking Science and Art. in Lighting, M. Luckiesh. Elec. Rev., vol. 73, no. 23, Dec. 7, 1918, pp. 884-885. Suggestions for fixture dealer in demonstrating lighting effects. Third article. (First and second appeared in Elec. Rev. Oct. 5 and Nov. 2.)

Lamps, Manufacture. Methods of Manufacturing Incandescent Lamps, H. M. Robins. Wis Engr., vol. 23, no. 3, Dec. 1918, pp. 67-76, 6 figs. Description of required operations with reference to advantageous working conditions of manufacturing establishments.

Light Generation and Distribution. Light Electricity and the Shop C. E. Clewell. Am. Mach. vol. 49 no. 24 Dec. 12 1918 pp. 1051-1055 10 figs. From coal pile to machine tool and lamp losses are considered.

MEASUREMENTS AND TESTS

Loader. The Loader Ross B. Mateer. Jl. Elec. vol. 41 no. 12 Dec. 15, 1918, p. 553, 4 figs. Suggests composite symbol to indicate lead center, density and character of load served.

Meters. Three-Wire D-5 Meters. Jl. Elec., vol. 41, no. 10, Nov. 15, 1918, pp. 474-475. Wiring diagram and features of watthour meter consisting of two- and three-wire elements placed side by side in common base and registering on common recording train so that sum of revolutions of both elements will be added and indicated on dial.

Power-Factor Indicators. Removing Obstacles to Power-Factor Charge, Will Brown. Elec. World, vol. 72, no. 26, Dec. 28, 1918, pp. 1220-1222, I fig. Necessity o standard method of measuring power factor and instrument that would be universally applicable; examination into methods now employed in widely separated plants.

Calibration of Power Factor Indicators, Walter Wescott Hoke. Elec. World, vol. 72, no. 23, Dec. 7, 1918, pp. 1076-1078, 4 figs. Method of calibrating polyphase power-factor indicators of which resistances of potential circuits are not equal; also applies to indicators in which current coil is in one phase of a two-phase line.

Rubber-Goods Testing. Safeguarding Electrical Employees. Elec. World, vol. 72, no. 26, Dec. 28, 1918, pp. 1223-1225, 5 figs. How companies which take active interest in well-being of their employees have made use of protective devices to guard against personal injuries; care and testing of rubber goods.

Transmission Factor for Glass. The Measurement of Transmission-Factor, M. Luckiesh and L. L. Mellor. Jl. Franklin Inst., vol. 186, no. 5, Nov. 1918, pp. 529-545, 8 figs. Investigation of various arrangements of apparatus designen to determine transmission factors for several diffusive glasses for illuminatiod (1) by a narrow beam of light directed perpendicularly to surface of specimen, and (2) uniformly diffused light reaching specimen from all directions; examination of effect on value of transmission factor of position of specimen with respect to light and character of side, smooth or rough, upon which light strikes it.

POWER APPLICATIONS

Alloy Production. New Materials Developed in Germany for Electrical Industry (Les nouveaux matériaux dans l'industries électrique en Allemagne), S. Frid. Industrie Electrique, year 27, no. 624, June 25, 1918, pp. 227-250. Application of alloys such as electron (10 Al + 90 Mn), magnalium, duralumin and other compositions; regulation governing material to be used in various types of electric lines; instruments and apparatus; machines and transformers.

Dairy Farms. Use of Electricity on Dairy Farms to Increase Production. Elec. Rev., vol. 73, no. 26, Dec. 28, 1918, pp. 995-997, 3 figs. Proper lighting and use of electric fans in Georgia farm stables result in greater quantity and better quality of product.

Electrochemical Processes. Electricity Releases Chemistry's Power, James M. Matthews. Gen. Elec. Rev., vol. 21, no. 11, Nov. 1918, pp. 727-750, 46 figs. Some of the uses of electricity in the chemical industry are illustrated with descriptions of uses of electric furnaces and electrically-driven motors and installations of electrolytic works.

Electrolytic and Electrothermic Processes and Products. Gen. Elec. Rev., vol. 21, no. 21, no. 11, Nov. 1918, pp. 756-766, 12 figs. Brief outline of sodium, calcium, magnesium and aluminum; more detailed description of electric-furnace methods of manufacturing calcium carbide, carborundum, silicon, graphite, alundum, fused silica and carbon bisulphide; methods of fixation of atmospheric nitrogen and oxidation of nitrogen; sketches of Birkland-Eyde, Schonherr, and Pauling furnaces.

Gold Dredges. Use of Electricty on Gold Dredges. Elec. Rev., vol. 73, no. 23, Dec. 7, 1918, pp. 881-883, 3 figs. Description of typical dredge; value of central-station service for work; points to observe in selecting apparatus required; description of electrical equipment used.

Harbors. Extensive Use of Electricity for San Francisco Harbor. Elec. Rev., vol. 72, no. 26, Dec. 26, 1918, pp. 1001-1005, 4 figs. Pier, dock and street lighting; electric clock system; harbor lights and fog signals; fire-alarm and telephone system; electric repair and maintenance service; features of wiring.

Shipbuilding. The Application of Electricity in Ships and Shipbuilding, J. F. Nielson. Elecn., vol. 81, no. 2114, Nov. 22, 1918. pp. 621. Abstract paper before Scottish Local Section of Inst. of Elec. Enrgs., Nov. 1918.

Steel Mills. Operating-Electrically-Driven Steel Mills, J. T. Sturtevant. Iron Trade Rev., vol. 63, no. 23, Dec. 5, 1918, pp. 1292-1293, 4 figs. Layout, equipment, power consumption, tonnages and capacities of 11 installations at Lehigh plant of Bethlehem Steel Co.

TELEGRAPHY AND TELEPHONY

Antenna. The Vertical Grounded Antenna as a Generalized Bessel's Antenna, A. Press. Proc. Inst. Radio Engrs., vol. 6, no. 6, Dec. 1918, pp. 317-322, 1 fig. General expression for current at any point of antenna formulated by taking account of variable distribution of inductance and capacity; particular solution for current and voltage distribution in case of antenna having zero current at top and maximum current at bottom.

Capacity of a Horizontal Antenna (Capacité d'une antenne horizontale), J. B. Pompey. Revue Générale de l'Electricité, vol. 4, no. 21, Nov. 23, 1918, pp. 790-792, 1 fig. Modification of original derivation of Pederson's formula.

Duplex Polar Transmission. Improving Polar Duplex Transmission. Telegraph & Telephone Age, no. 24, Dec. 16, 1918, pp. 564-565, 5 figs. Diagrams of five different schemes tried in long lines operated polar duplex.

Photographs, Wireless Transmission of. The Design and Construction of Apparatus for the Wireless Transmission of Photographs, Marcus J. Martin. Wireless World, vol. 6, no. 69, Dec. 1918, pp. 509-513, 7 figs. Describes system outlined in handbook on the Wireless Transmission of Photographs as at present developed. Writer's intention is to provide practical groundwork for improvements. (To be continued.)

Radio Telephony. Some Aspects of Radio Telephony in Japan, Eitaro Yokoyama. Wireless World, vol. 6, no. 69, Dec. 1918, pp. 484-487, 5 figs. Influence of gas clearance, dimensions and shape of electrodes upon discharge. From Proc. Inst. Radio Engrs. (Continuation of serial)

Radio Transmitter. On the Electrical Operation and Mechanical Design of an impulse Excitation Multi-Spark-Group Radio Transmitter, Bowden Washington Proc. Inst. Radio Engrs., vol. 6, no. 6, Dec. 1918, pp. 295-315, 31 figs. Discussion of impulse excitation; description of three forms of gaps suitable for extreme quenching; oscillograms showing operation of such gaps; operation of actual 0.5-kw. and 2-kw. sets.

Spark Discharges. The Revolving Mirror and Spark Discharges, Lindlay Pyle. Wireless World, vol. 6, no. 69, Dec. 1918, pp. 489-490, 1 fig. Shows diagrammatically and describes briefly method of observing and photographing oscillatory nature of " wireless " spark. From Electrical Experimenter.

Spark Gap. A Ventilated Spark Discharge Gap. Wireless Age, vol. 6, no. 3, Dec. 1918, pp. 44-45, 3 figs. Internal construction and action of apparatus said to be silent in operation and to maintain a predetermined operating characteristic.

On the Possibility of Tone Production by Rotary and Stationary Spark Gaps, Hidetsugu Yagi. Proc. Inst. Radio Engrs., vol. 6, no. 6, Dec. 1918, pp. 323-343, 17 figs. Results produced by needle and spherical gaps with a. c. transformer, spark-gap method and with high-tension d. c. spark-gap method; brief treatment of transient conditions existing before establishment of stable tone régime.

Telephone, Sound-Detecting Devices. Telephone Service Standards. Telephony, vol. 76, no. 1, Jan. 4, 1919, pp. 22-23, Investigation of service and transmission standards and experimental work on sound-detecting devices by telephone section of Bureau of Standards, from 1917-1918 report Secretary of Commerce.

Telephone Troubles. How to Locate Telephone Troubles, J. Bernard Hecht. Telephony, vol. 76, no. 1, Jan. 4, 1919, pp. 26-27. Care and maintenance of primary batteries. Instructions to managers, wire chief and troublemen of local battery telephone exchanges. Sixth article.

Vacuum-Tube Electrodes. A Method of Constructing Gas-Free Electrodes. Wireless World, vol. 6, no. 69, Dec. 1918, pp. 488-489. Process of manufacturing vacuum tube in which anode consists of coating of metal sprayed on inside of bulb by incandescing rafractory metallic conductor, such as tungsten, in partial vacuum. From Wireless Age.

Time Signaling. Wireless Time-Signaling Device, Wireless Age, vol. 6, no. 3, Dec. 1918, pp. 13-14, 3 figs. Apparatus for synchronizing time clocks from one main radio station, permitting at predetermined intervals a correction of errors encountered in clock mechanisms.

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

Radio Frequency Changers. Radio Frequency Changers, E. E. Bucher, Wireless Age, vol. 6, nos. 3 and 4, Dec. 1918 and Jan. 1919, pp. 20-22 and 20-22, 13 figs. Reported progress in their application to wireless telegraphic and telephonic communication Control of antenna currents.

Rectifiers. Incandescent-Cathode Arc Device for the Rectification of Alternating Currents. Wireless Age, vol. 6, no. 3, Dec. 1918, pp. 14 and 43-44, 3 figs. Construction and electrical connections of tube; arc started by means of a high-voltage discharge from a pointed cathode.

An Enclosed Rectifier. Wireless Age, vol. 6, no. 3, Dec. 1918, pp. 12-13, 3 figs. Incandescent cathode type. Argon at considerable pressure is injected into enclosed medium.

ROTARY CONVERTERS. The Effect of Power-Factor on Output of Rotary Converters with Reactance Control, R. G. Jakeman. Elecn., vol. 81, no. 2114, Nov. 22, 1918, pp. 614-616, 4 figs. Dealing with effect of power-factor on size of converter.

TRANSFORMER DIMENSIONS. Dimensions of Transformers, A. R. Low. Elecn., vol. 81, no. 2113, Nov. 15, 1918, pp. 597-599. Object of article is to classify principal problems of transformer discussion and compare certain assumptions, methods and results.

TRANSFORMER OIL. Transformer Oil. W. S. Flight. Elecn., vol. 81, no. 2115, Nov. 29, 1918, pp. 636-638, 4 figs. Author discussion types and characteristics of oils; formation of sludge; minor tests.

WELDING, TRANSFORMERS FOR. Transformers for Electric Welding, W. S. Moody. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 935-937. Requirements of those used for spot welding and for arc welding; construction found best to fulfill service specifications of each type.

See also ELECTRICAL ENGINEERING, Transmission, Distribution, Control (Transformer Losses).

TRANSMISSION, DISTRIBUTION, CONTROL

CENTRAL STATION SERVICE. Twenty-Seven Thousand Dollar Saving in Manhattan Building Plant. Power, vol. 48, no. 26, Dec. 24, 1918 pp. 918-919. By using Edition off-peak service during summer months, substituting motor-driven elevator pumps for inefficient steam pumps, installing a feedwater heater and a stoker.

FREQUENCY CONTROL. Better Frequency Control, Henry E. Warren. Gen. Elec. Rev., vol. 21, no. 11, Nov. 1918, pp. 816-819, 3 figs. Method which records revolutions, thus indicating mean frequency and enabling operator to adjust governor-regulating mechanism to maintain average frequency at its normal value practically exact.

GROWTH OF ELECTRIC SYSTEMS. The Growth of Electric Systems, Julian C. Smith. Can. Engr., vol. 35, no. 25, Dec. 1918, pp. 539-540. Evolution since 1882; direct and alternating transmission systems; why the "hydro" is 25 cycles; thrust bearings and vertical units. From one of the J. E. Aldred lectures on engineering practice, Johns Hopkins University.

INTERCONNECTION. Interconnection of Power Systems. Proc. Am. Inst., Elec. Engrs., vol. 37, no. 12, Dec. 1918, pp. 1207-1333, 12 figs. Technical features of interconnection of electric power systems of California; electric power in northern and central California; function of Pacific Gas and Electric Co. in interconnected operation of power companies of central and northern California. Symposium at meeting of San Francisco Section Am. Inst. Elec. Engrs.

POWER FACTOR. Location for Power-Factor Corrective Apparatus, Will Brown. Elec. World, vol. 72, no. 24, Dec. 14, 1918, pp. 1125-1128, 3 figs. Experience with static condensers; dissimilarities in synchronous machines; using idle alternators as condensers; bset motor rating for correction; effect of condenser location on result.

Improvement of Power-Factor by the Operation of Synchronous Motors (Note sur l'emploi des moteurs synchrones pour améliorer le facteur de puissance), Paul Rieunier. Revue Générale de l'Electricité, vol. 4, no. 21, Nov. 23, 1918, pp. 771-788, 15 figs. Mathematical and graphic study of equation.

ST. LAWRENCE RIVER TRANSMISSION LINE. 111,000-Volt Transmission Line Over the St. Lawrence River, S. Svenningson. Elec. News, vol. 27, no. 23, Dec. 1, 1918, pp. 31-34. Crossing consists of central span 4801 ft. long supported by two 350-ft. towers. Author gives special attention to cables, insulators, ice protection and sag calculations. Paper before Toronto meeting of Am. Inst. Elec. Engrs.

SUBSTATIONS. Effect of a Tie-Line Between Two Substations, H. B. Dwight. Elec. Rev., vol. 73, no. 25, Dec. 21, 1918, pp. 966-968, 1 fig. Methods of calculating effect of tie-lines upon current and voltage; several formulæ given.

The Modern Outdoor Substation, M. M. Samuels. Elec. World, vol. 72, no. 23, Dec. 7, 1918, pp. 1068-1073, 20 figs. Apparatus developed until it is as reliable as indoor equipment; station design not greatly improved; notes on transformers, oil circuit breakers, lightning arresters, air-break switches and bus supports.

A Two-Unit Automatic Substation, Walter C. Slade, Elec. Ry. Jl., vol. 52, no. 24, Dec. 14, 1918, pp. 1038-1044, 13, figs. Description of Rhode Island Co.'s substation at Oakland illustrating latest practice. Economics of automatic substation application.

SYNCHRONOUS CONDENSERS. Synchronous Condenser in Fuel Conservation, L. N. Robinson. Jl. Elec., vol. 41, no. 10, Nov. 15, 1918, pp. 456-458, 2 figs. Possibilities due to quadrature phase relation of energy and wattless components of current in virtue of which a synchronous condenser can deliver, under given line regulations, wattless current corresponding to 10,000-kv-a, and simultaneously absorb as motor or deliver as generator 10,000 kw. with total current corresponding to only 14,100 kv-a.

TRANSFORMER LOSSES. Influence of Distributing System on Transformer Losses in Large Networks (Pertes dans les transformateurs des grands réseaux suivant le système de distribution employé). Revue Générale de l'Electricité, vol. 4, no. 19, Nov. 9, 1918, pp. 721-724, 5 figs. Study and comparison of losses in two systems: (1) uniform distribution at 20,000 to 30,000 volts and (2) distribution at 30,000 to 50,000 volts in main network with reduction to 6,000 to 20,000 volts in secondary lines. From Electrotechnische Zeitschrift.

See also ELECTRICAL ENGINEERING, Generating Stations (Steam-Electric Stations).

VARIA

BATTERY CHARGING, A. C. High-Tension Battery Fed with Alternating Current (Sur une batterie à haute tension alimentée à courant alternatif). Industrie Electrique, year 27, no. 633, Nov. 10, 1918, pp. 416-417, 1 fig. Principle and diagram of apparatus which by an arrangement of Grætz valves and condensers connected to secondary winding of transformer permits conversion of alternating current into direct current at voltages up to 10,000. From Bulletin de l'Association Suisse des Electriciens, Apr. 1918.

CONTRACT CLAUSES. Power Factor Clauses in Contracts, Will Brown. Elec. World, vol. 72, no. 25, Dec. 21, 1918, pp. 1164-1165. Commercial problems involved; opinions from widely scattered central stations regarding necessity of considerating power factor; typical clauses of two types of contract which base charges on average power factor.

ELECTROLYSIS PROTECTION. Drainage if Necessary vs. Negative Feeder Electrolysis Protection, D. W. Roper. Elec. Ry. Jl., vol. 52, no. 23, Dec. 7, 1918, pp. 1003-1007, 12 figs. Comparison of plans used in St. Louis and Chicago for eliminating damage to underground structures from power compnay viewpoint. (Abstract of paper before Am. Inst. Elec. Engrs., St. Louis.)

FIRES IN OIL SWITCHES. R. Frère Process of Extinguishing Fires in High-Tension Oil Switches (L'extinction des feux d'huile dans les cellules d'interrupteurs à haute tension par les procédés R. Frère), Ch. Benjamin. Génie Civil, vol. 73, no. 19, Nov. 9, 1918, pp. 361-363, 10 figs. Fundamental principle of process consists in reducing oxygen in atmosphere by a large quantity of inert gas such as nitrogen.

INTERNATIONAL ELECTROTECHNIC COMMISSION. International Electrotechnic Commission (La Commission Electrotécnica Internacional), German Niebuhr. Boletin de la Asociadion Argentina de Electro-Técnicos, vol. 4, no. 8, Aug. 1918, pp. 783-788. Its origin, development and work. (To be continued.)

LIGHTNING ARRESTERS. Substitution of Copper for Platinum in Lightning Rods on Account of Present Shortage of Platinum (L'emploi du platine et du cuivre sur les paratonnerres et la crise du platine), E. Lignorelles. Génie Civil, vol. 73, no. 18, Nov. 2, 1918, pp. 351-353. States that aluminum, copper and iron are satisfactory for lightning rods; gives suggestions as to proper installation.

Storing Direct-Current Aluminum Arresters for the Winter, F. T. Forster. Gen. Elec. Rev., vol. 21, no. 11, Nov. 1918, pp. 820-821. Ill effects of leaving plates standing in electrolyte when arrester is out of service; method of preparing arresters for storage.

CIVIL ENGINEERING

BRIDGES

ARCH BRIDGE. The Rock Island Builds Two Rainbow Arch Bridges. Ry. Age, vol. 65, no. 23, Dec. 6, 1918, pp. 1003-1005, 4 figs. Limited-weight concrete structure with shallow floor.

ERECTION. Erection Experiences at the Sciotoville Bridge, Clyde B. Pyle, Eng. News-Rec., vol. 81, no. 26, Dec. 26, 1918, pp. 1182-1186, 6 figs. Machines used found efficient; adjustment of bridge easy; deflections agreed with computed values; last of three articles on field work.

PONTOON BRIDGE. The Sardah (India) Pontoon Bridge. Ry. Engr., vol. 39, no. 467, Dec. 1918, pp. 221-222, 6 figs. Principles of construction, method of use and structural details of 420-ft. 7-pontoon bridge. From report of Technical Section of Railway Branch, Puplic Works Department, Government of India.

RAILWAY BRIDGES. General Specification for Steel Railway Bridges. Jl. Eng. Inst. Can., vol. 1, no. 8, Dec. 1918, pp. 367-385, 3 figs. Final draft as approved by meeting of committee of the Institute.

Reinforced-Concrete Flat Slab Railway Bridges, A. B. Cohen. Ry. Gaz., vol. 29, no. 20, Nov. 15, 1918, pp. 528-530, 2 figs. Advantages of this type and details of Lackawanna terminal at Buffalo, N. Y. Paper before joint section of Am. Concrete Inst. and Am. Soc. for Testing Materials.

Stress Measurements on Niagara Gorge Railway Bridge, Charles Evans Fowler. Eng. News-Rec., vol. 81, no. 26, Dec. 26, 1918, pp. 1172-1175, 6 figs. Permissible leading studied by strain gage; dead-load condition of arch determined by forcing crown apart and measuring release of stress.

BUILDING AND CONSTRUCTION

BARRACKS. Temporary Barracks at Rosedale Heights. Contract Rec., vol. 32, no. 52, Dec. 25, 1918, pp. 1019-1022, 6 figs. Disposition and finish of 24 buildings rapidly completed for Toronto demobilization depot.

GYPSUM HOUSES. Houses of Gypsum Have Many Advantages. Contract Rec., vol. 32, no. 51, Dec. 18, 1918, pp. 1006-1007, 1 fig. Mode of constructing walls of gypsum blocks cast from gypsum mortar.

HOSPITALS. Details of Hospital Construction, N. V. Perry. Modern Hospital, vol. 11, no. 6, Dec. 1918, pp. 469-471, 5 figs. Remarks on general requirements, adaptable equipments for ward lighting, suitable arrangement of heating system, and special features demanded in floor construction. Paper before convention of Am. Hospital Assn.

MILLS. The Reconstructed Plant of the Quarker Oats Company at Peterboro, Ont. Contract Rec., vol. 32, no. 47, Nov. 20, 1918, pp. 918-921, 6 figs. Work done in clearing site in plant destroyed by fire; layout of new buildings.

ORNAMENTATION. Structural Ornamentation. Vol. 70, no. 6, Dec. 1918, pp. 506-507. Study in face brick, fancy brick, architectural terra cotta and decorative tile as factors in the clayworking industry.

ROOFING. English Slate and Tile Roofing Methods. Metal Worker, vol. 90, no. 26, Dec. 27, 1918, pp. 703-705, 9 figs. Plain and ornamental slating; single and double-nailing methods; hints on making repairs.

SCHOOL. Test of Chicago and Cook County School for Boys, Meyer J. Sturm. Heat. & Vent. Mag., vol. 15, no. 12, Dec. 1918, pp. 41-44, 5 figs. Description of building and its equipment.

SLABS AND CULVERTS. Practice in the Design of Concrete Floor Slabs and Flat Top Culverts, Geo. H. Tinker. Bul. Am. Ry. Eng. Assn., vol. 20, no. 210, Oct. 1918, pp. 3-19. Summary of replies from bridge engineers connected with various railroads to questionnaire in regard to their practice concerning longitudinal, transverse and vertical distribution of axle loads and impact allowance in designing culverts and slabs; a short analysis of the salient points also presented.

TIMBER FRAMING, STEEL IN. How to Use Steel in Timber Framing, Ernest Irving Freese. Building Age, vol. 41, no. 1, Jan. 1919, pp. 13-15, 9 figs. Practical methods of supporting long-span floors and bearing partitions upon structural-steel girders.

CEMENT AND CONCRETE

COLD-WEATHER CONCRETE. Some Temperature Records of Cold Weather Concrete, L. J. Towne. Stone & Webster Jl., vol. 23, no. 6, Dec. 1918, pp. 414-417, 3 figs. Tests made to secure data on amount of protection necessary to prevent concrete from freezing before setting can take place. On account of heat generated as result of chemical actions incident to setting concrete does not follow daily variations in air temperatures.

COMPRESSION TESTS. Some Compression Tests of Portland Cement Mortars and Concrete Containing Various Percentages of Silt, Arthur C. Alvarez and James R. Shields. Univ. of Cal. Publications in Eng., vol. 2, no. 3, Nov. 19, 1918, pp. 119-130, 1 fig. Concludes that at age of 28 days the compressive strength of 1 :2 :4 concrete stored in water increases with increase in percentage of silt for amounts up to 14 per cent by weight of sand, and that of mortars varying in proportion between 1:1 and 1 :4 is reduced on an average by about 4.5 per cent with 10 per cent silt.

OIL. Oil and Concrete. Ry. Engr., vol. 39, nos. 462 and 466, July and Nov. 1918, pp. 135-137 and 207-210. Results of laboratory tests on different specimens and under varied conditions; L. Waller Page's experiments on water-proofing concrete; W. Lawrence Gadd's conclusions from his investigation of Page's results; accounts of other experimenters. (To be continued.)

POLES. Hollow Concrete Poles Made by New Method. Ry. Age, vol. 65, no. 25, Dec. 20, 1918, pp. 1127-1128, 3 figs. Important savings in weight over solid construction are effected by centrifugal process.

Study of the Construction of Latticed Girder Poles for Electrical Lines (Contributo allo studio delle palificazioni per condutture elettriche), Ettore lo Cigno. L'Elettrotecnica, vol. 5, no. 29, Oct. 15, 1918, pp. 402-407, 7 figs. Analytical investigation of stresses in latticed girder poles of square base with formulæ and graphs for examination of relative significance of mechanical coefficients.

SETTING PROCESS. The Setting Process in Lime Mortars and Portland Cements, Cecil H. Desch. Contract Rec., vol. 32, no. 47, Nov. 20, 1918, pp. 922-923. Review of researches undertaken and hypotheses advanced. Paper before Faraday Soc.

WATERPROOFED FLOORS. Waterproofed Floors for Railway Crossings Over Streets, H. T. Welty. Eng. News-Rec., vol. 81, no. 24, Dec. 12, 1918, pp. 1081-1086, 9 figs. Grade-crossing work makes severe demands; troughing unsatisfactory. concrete slab floor; various mehtods of sealing concrete to girders.

See also CIVIL ENGINEERING, Building and Construction (Slabs and Culverts); Earthwork, Rock Excavation, etc., Dams).

EARTHWORK, ROCK EXCAVATION, ETC.

DAMS. Progress on Concrete Dam at Paris, Ont. Contract Rec., vol. 32, no. 49, Dec. 4, 1918, pp. 955-956, 2 figs. Method of bracing framework.

Construction Features of a Multiple Arch Dam, L. R. Jorgensen. Jl. Elec., vol. 41, no. 11, Dec. 1, 1918, pp. 506-508, 3 figs. Considers details of construction methods with reference to an actual case.

A Veritable Niagara Created in the South—Mammoth Hydro-Electric Development in East Tennessee, Stuart Towe. Mfrs. Rec., vol. 75, no. 1, Jan. 2, 1919, pp. 143-145, 3 figs. Brief description of dam 225 ft. high, 725 ft. long at top and 350 ft. at base, 175 ft. thick at base and 12 ft. at top. For a 90,000-hp. hydro-electric development.

New Concrete Dam and Bridge Over Lynn River at Port Dover. Contract Rec., vol. 32, no. 52, Dec. 25, 1918, pp. 1031-1033, 6 figs. Excavation work; specifications for aggregate.

The Lake Eleanor Dam, Rudolph W. Van Norden. Jl. Elec., vol. 41, no. 12, Dec. 15, 1918, pp. 551-553, 4 figs. Plans, essential features and details of construction. Dam contains 11,000 cu. yd. of concrete.

HARBORS

FLOATING DOCKS. Construction and Trials of 30,000-Ton Black Sea Floating Dock. Engineering, vol. 106, no. 2759, Nov. 15, 1918, pp. 551-552, 3 figs. Drawings with principal dimensions and description.

SAN FRANCISCO HARBOR. Harbor Improvements at San Francisco, Charles W. Geiger. Int. Mar. Eng., vol. 24, no. 1, Jan. 1919, pp. 31-35, 7 figs. Extensive enlargement of piers; large bulkhead warehouses; railroad connection with piers; developments in Islais Creek section.

See also ELECTRICAL ENGINEERING, Power Applications (Harbors).

MATERIALS OF CONSTRUCTION

ROAD MATERIALS. Standard Forms for Tests, Reports, and Method of Sampling for Road Materials. Better Roads & Streets, vol. 8, no. 8, Aug. 1918, pp. 300-306, 2 figs. From Bul. 555, issued by office of Public Roads and Rural Eng.

STUCCO. Review of Stucco Tests by Bureau of Standards, J. C. Pearson. Cement & Eng. News, vol. 30, no. 12, Dec. 1918, pp. 36-37. From paper at annual meeting of Am. Concrete Inst.

MECHANICS

ARCHES. Calculation of Built-In Arches Under the Action of Continuous External Loads (Calcul des arcs encastrés sollicités par des charges extérieures continues), P. Ernest Flamard, Génie Civil, vol. 73, no. 11, Sept. 14, 1918, pp. 207-209, 4 figs. Mathematical study of problem with reference to work of deformation.

BEAMS. Beam Deflections Under Distributed or Concentrated Loading, J. B. Kommers. Eng. News-Rec., vol. 82, no. 1, Jan. 2, 1919, pp. 44-46, 10 figs. New algebraic method proposed for cases usually solved by graphical calculation gives accurate results.

Bending Moments in Grillage Beams, R. Fleming. Eng. & Contracting, vol. 50, no. 26, Dec. 25, 1918, pp. 585-586, 1 fig. Outcome of recent review of calculations for proportioning grillage beams in foundations.

Lines of Influence for a Vierendeel Beam (Lignes d'influence pour une poutre Vierendeel), G. Magnel. Génie Civil, vol. 73, no. 18, Nov. 2, 1918, pp. 344-347, 5 figs. Mathematical investigation of bending moments and other mechanical factors in reinforced-concrete beam.

ROADS AND PAVEMENTS

BOULEVARDS. Boulevards of San Francisco, California, Charles W. Geiger. Good Roads, vol. 17, no. 1, Jan. 4, 1919, pp. 1-3, 5 figs. Notes on history and construction of scenic drives in and near city.

CONCRETE PAVEMENTS. Concrete Pavement Subjected to Severe Test, George C. Swan. Concrete Highway Mag., vol. 2, no. 11, Nov. 1918, pp. 246-247, 3 figs. Dammage at crossing where locomotive was thrown off track and dragged itself 40 ft. over concrete surface.

CONSTRUCTION. Construction Methods Employed in Building Lincoln Highway Cut-Off Across the Desert at Gold Hill, Utah, R. E. Dillree. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 195-197, 12 figs. Building roadway with grade above level of desert under conditions which necessitated using hay to keep beavy equipment from bogging down.

DISINTEGRATION OF ROADS. The Road: Its Paramount Importance as Viewed by a Briton, J. H. A. MacDonald. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 218-221. Concludes necessity of building good roads from analysis of London traffic statistics and considers problem of road disintegration and that of paying for roads. From chambers' Jl.

HARD SURFACE PAVEMENTS. The Prevention of Longitudinal Cracks in Hard Surfaced Pavements, Wm. C. Perkins. Contract Rec., vol. 32, no. 49, Dec. 4, 1918, pp. 972-973. Suggests use of tile in artificial foundation.

MACADAM ROADS. The Maintenance of Macadam Roadways, R. C. Heath. Contract Rec., vol. 32, no. 52, Dec. 25, 1918, pp. 1033-1034. Preventing wear and raveling; carpet treatment; economic importance of road maintenance. Paper before Ky. Highway Engrs. Assn.

SNOW REMOVAL. Organization, Methods and Equipment Employed in Removing Snow from Main Roads in Pennsylvania, George H. Biles. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 216-218. Address before Highway Traffic Assn. of N. Y. State.

Snow Removal on Trunk Line Highways, Charles J. Bennett. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 214-215, 3 figs. Address before Highway Traffic Assn. of N. Y. State.

STATE HIGHWAYS. State Highway Work in 1919. Good Roads, vol. 17, no. 1, Jan. 4, 1919, pp. 4-6. Report of available funds and plans for work in 31 states.

WAR, ROADS DURING. Construction and Maintenance of Roads During War. Better Roads & Streets, vol. 8, no. 8, Aug. 1918, pp. 299 and 324. Policy issued by Council of Nat. Defence.

See also CIVIL ENGINEERING, Materials of Construction (Road Materials).

SANITARY ENGINEERING

SEWAGE DISPOSAL. Sewage Disposal from an Operator's Standpoint, William K. F. Durrant. Can. Engr., vol. 35, no. 24, Dec. 12, 1918, pp. 512-513. Comments on each of features of plant consisting of detritus pit and screen chamber, pump house, plain sedimentation tanks, bacteria beds, disinfecting chambers and humuspond. Abstracted from Western Min. News.

The Private Sewerage Question, D. H. Wyatt. Clay Worker, vol. 70, no. 6, Dec. 1918, pp. 500-501. Analysis of results produced by leaky building drains and sewers. Vitrified pipe advocated as well constituted to withstand chemical action.

The Aqua Privy. Indian Eng. Vol. 64, no. 14, Oct. 5, 1918, pp. 192-103, 3 figs. Special feature is that nightsoil goes straight into small septic tank under seat, where it undergoes septic treatment.

Concrete Septic Tanks and Subsoil Disposal Fields for Country Homes, John H. Perry, Domestic Eng., vol. 85, no. 10, Dec. 7, 1918, pp. 363-365 and 391, 5 figs. Design and construction of such systems.

Sanitary Conveniences and Comforts for Country Homes. Clay-Worker, vol. 70, no. 6, Dec. 1918, pp. 501-503, 3 figs. Illustrates a manner in which ordinary sewer pipe and drain tile may be used.

SEWAGE-PUMPING STATION. Design and Operation of Automatic Sewage Pumping Station at West Haven, Conn., Clyde Potts. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 199-200, 2 figs. Draining sewage to common point for treatment.

WATER SUPPLY

FREEZING. How to Prevent Freezing of Riser Pipes to Elevated Water Supply Tanks. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 213-214. Four means: (1) providing method for artificially heating water; (2) conserving heat in water by providing sufficient insulation; (3) maintaining temperature of water above freezing point by pumping and withdrawal of water; (4) adding chemicals to lower freezing point. From Water Tower.

PURIFICATION. Four Years' Operating Results of Minneapolis Water Purification Plant. Contract Rec., vol. 32, no. 47, Nov. 20, 1918, pp. 926-927. Filtration data of plant having capacity of 96,000,000 gal.

Algal Growths and Chlorine Treatment of London Waters, A. C. Houston. Contract Rec., vol. 32, no. 47, Nov. 20, 1918, pp. 929-930, Report of Director of Water Examination.

Water Treatment at Council Grove, Kansas, Louis L. Tribus. Can. Engr. vol. 35, no. 25, Dec. 19, 1918, pp. 536-538, 4 figs. Results obtained unde highly varying conditions of turbidity at plant in operation for three year: Paper before Am. Waterworks Assn.

Reservoir Capacity. Determination of the Available Water Supply in the Haut-Cher Basin (Contribution à la détermination du régime hydraulique du Cher) P. Morin. Revue Générale de l'Electricité, vol. 4, no. 21, Nov. 23, 1918, pp. 805-806, 1 fig. Account of observations made to determine capacity of reservoirs which would insure continuous delivery.

Stream Pollution. Control of Stream Pollution, Earle B. Phelps. Can. Engr., vol. 35, no. 24, Dec. 12, 1918, pp. 515-518. Considers use of streams for waste disposal, effect of stream pollution, self-purification of streams, chemical methods of sewage treatment, biological treatment of sewage, and purification of water. From J. E. Aldred Lecture on Eng. Practice.

Relation of Main Drainage to River and Harbor Front Improvements in Various American Cities, Morris Knowles and John M. Rice. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 204-205. Special reference to methods adopted for eliminating nuisance caused by discharge of raw sewage at Baltimore, New Bedford, Mass., Cleveland, Toronto, Syracuse, N. Y., Washington, Cincinnati, Waterbury, Conn., and Harrisburg, Pa.

WATERWAYS

Canal Traffic. The Potentialities of Our Inland Water Routes, Robert G. Skerrett, Rudder, vol. 34, no. 12, Dec. 1918, pp. 565-570, 11 figs. Economic and commercial aspects of developing possible canal traffic.

Flumes. Lindsay-Strathmore Irrigation Flume, Stephen E. Kieffer. Can. Engr., vol. 35, no. 25, Dec. 19, 1918, pp. 525-527, 5 figs. Self-supporting, high-level flume with 2-in walls built on inside forms at rate of 130 lin. ft. per 8-hr. day; nearly $1,500,000 expended in improvements to 15,500 acres in Cal.

Groynes. Groynes as Applied to Water Control and Silt Exclusion. Indian Eng. vol. 64, nos. 14, 15 and 16, Oct. 5, 12 and 19, 1918, pp. 194-195, 205-208 and 222-223, 16 figs. Experiments with silt bags from the results of which writer concludes that when a canal is added to a Bell Bund system, flow behing groyne is introduced, but head still exists in pockets so that arrangement retains power of checking and diverting silt.

Navigable Rivers. The Study of Currents in Navigable Rivers (L'étude des courants dans les rivières navigables). P. Dupont. Génie Civil, vol. 73. no. 17, Oct. 26, 1918, pp. 327-329. Recommends study of currents by engineers in order not to differ so often with mariners in regard to construction of improvements.

Calculations in Regard to Improvement of Rivers (Calculs concernant les améliorations de rivières), Alf. Bijls. Génie Civil, vol. 73, no. 19, Nov. 19, 1918, pp. 371-373, 1 fig. Concludes from examination and comparison of formulæ generally use, that in calculations it is advisable to deduce the coefficient of velocity from observations on long sections of 10 to 20 km. and to gage water at all possible levels.

Sediment in Rivers. Sediment in River Waters, J. S. Ryan. Tran. Inst. Marine Engrs., vol. 30, no. 238, Oct. 1918, pp. 217-218, 2 figs. Experience with propeller and shaft due to working amid water mingled with sand.

St. John River. St. John River Affords Big Opportunities, Frank S. Small. Can. Engr., vol. 35, no. 23, Dec. 5, 1918, pp. 489-495, 3 figs. Topographical features; reclamation of waste land by drainage; utilization of water powers; site proposed for tideless harbor.

St. Lawrence River. Canada's Heritage in the St. Lawrence River, Arthur V, White. Can. Engr., vol. 35, no. 24, Dec. 12, 1918, pp. 507-510, 2 figs. Indicates power sites on river and refers to canalization of river as a unit. Address before Elec. Club of Toronto.

Canada's Heritage in the St. Lawrence River, Arthur V. White. Elec. World, vol. 72, no. 26, Dec. 28, 1918, pp. 1216-1217, 1 fig. Estimated low-water power aggregates 2,000,000 h.p., of which greater part is wholly within territorial area of Dominion and capable of development. From address before Elec. Club of Toronto, Nov. 12, 1918.

MINING ENGINEERING

COAL AND COKE

California. Tesla Coal Mine, J. W. Beckman. Jl. Elec., vol. 41, no. 12, Dec. 15, 1918, p. 559. Indicates possibilities of a lignite mine in California.

Colliery Output. South Staffordshire and Warwickshire Institute of Mining Engineers. Presidential address, William Charlton. Trans. Instn. Min. Engrs., vol. 56, part I, Nov. 1918, pp. 13-26. Considers question of output in collieries under two aspects: 1, immediate and pressing need for United Kingdom to produce utmost possible quantity of coal; 2, standpoint of output per unit of person employed, and its bearing on prosperity of coal industry, and those other industries whose ultimate economic position is affected by use and cost of fuel.

What One Coal Mine Has Done. Stone & Webster Jl., vol. 23, no. 5, Nov. 1918, pp. 354-356. Mine in question hoisted 32,514 tons in one week.

GEOLOGY

Lake Michigan District. Explanation of the Abandoned Beaches About the South End of Lake Michigan, G. Frederick Wright. Bul. Geol. Soc. Assn., vol. 29, no. 2, June 1918, pp. 235-244, 3 figs. Peat deposits; series of moraines; supposed changes of level; glacial and clay deposits underneath Chicago; provisional estimates of glacial time afforded in this area. Presented in abstract before the Soc.

MAJOR INDUSTRIAL MATERIALS

Tungsten. Chief Materials Needed in the Electrical Industry; Tungsten (De quelques matières premières nécessaires à l'industrie électrique; le tungstene). D. Pector. Revue Générale de l'Electricité, vol. 4, no. 4, July 27, 1918, pp. 121-125. Metallurgy, uses and ore deposits. Bibliography of documents.

Zinc Concentration. Concentration of Lead-Zinc-Silver Ore at the Zinc Corporation's Mine, George C. Klug. Min. Mag., vol. 19, no. 5, Nov. 1918, pp. 243-245, 1 fig. Methods employed at Broken Hill. Gravity concentration by jigging and tabling for production of high-grade lead concentrate; treatment of zincy tailing by flotation methods (De Bavay, and Delprat); Seale-Shellshear method of cascading as modified by Lyster and Hebbard for selectively separating galena from mill pulp.

Zinc Tailings. Treatment of Accumulated Tailing as Practised by the Zinc Corporation, George C. Klug. Min. Mag., vol. 19, no. 6, Dec. 1918, pp. 298-300, 1 fig. Plant recovering zinc, silver and lead by mineral-separation process of removal in collective float and subsequent separation of a lead concentrate from collective float by tabling methods.

MINES AND MINING

Field Tests. Field Tests for the Common Metals in Minerals, George R. Fansett. Univ. of Ariz. Bul., bul. 93, Min. Technology Series no. 21, Nov. 1918, 20 pp. Compiled for Ariz. State Bur. of Mines and intended as text for lectures on Prospector's Mineralogy.

Fire Protection. Smothering Mine Fires (Note sur l'embouage des feux de mine), M. Cabane. Bulletin et comptes rendus mensuels de la Société de l'Industrie Minérale, series 5, vol. 14, 3d issue 1918, pp. 67-77, 6 figs. Principal features of system developed at Commentry Collieries; arrangement at Decazeville mines designed to deliver dust under pressure; materials used to form dust.

Safety. Miners' Safety and Health Almanac for 1919, R. C. Williams. Department of Interior, Bur. of Mines, Miners' Circular 24; 48 pp., 7 figs. Responsibility of miners concerning their own safety and that of others; pure drinking water for mining camps; prevention of accidents and promotion of sanitation; miners' anemia; disposal of human excreta in rural districts; sewage disposal in mines; mine-rescue cars of Bureau of Mines. Other articles dealing with health conditions and tending to impart information to miners are included in bulletin.

Sampling. Sampling, F. W. Bunyan. Min. & Sci. Press, vol. 117, no. 25, Dec. 21, 1918, pp. 827-832, 2 figs. Emphasizes importance of sampling in analytical work and illustrates with examples value of systematic procedure in performing it.

Stoping Methods. Mining Methods of United Verde Extension Mining Co., Charles A. Mitke. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 9-22, 3 figs. Considerations which influenced selection and planning of adaptable stoping method. Ore deposit considered as replacement of volcanic schist. Mineralization believed to have taken place after intrusions of diorite and quartz porphyry had folded and faulted schist.

Ventilation. Cooling and Drying the Air in Deep Mines, Sydney F. Walker. Iron & Coal Trades Rev., vol. 47, no. 2645, Nov. 8, 1918, p. 518. Writer believes coal may be mined successfully at depths from 5000 to 6000 ft. by treating each individual mine, each pair of shafts and the workings connecting them, in same manner as modern cold stores are treated. Gives recommendations and refers to actual installations.

Welfare Work. Welfare Work in the Mining Work in the Mining Industry, H. Lipson Hancock. Chem. Eng. & Min. Rev., vol. 10, no. 121, Oct. 5, 1918, pp. 6-13, 18 figs. Betterment work being done by South Australian company.

MINOR INDUSTRIAL MATERIALS

Arsenic. Arsenic and Its Occurrences in South Queensland (1), H. I. Jensen. Queensland Government Min. Jl., vol. 19, no. 221, Oct. 15, 1918, pp. 455-458. Notes on arsenic as a source of trouble in metal extraction and on its origin and extraction.

OIL AND GAS

Gas Pressure. Record of Gas-Pressure from a Borehole, Charles J. Fairbrother. Trans. Instn. Min. Engrs., vol. 56, part 1, Nov. 1918, pp. 6-8, 2 figs. and (discussion) pp. 8-10. Photographs showing gas blowing out of borehole while clear of rods, and borehole with rods in and water being blown in all directions by force of gas.

Gas Storage. Natural-Gas Storage, L. S. Panyity. Bul. Am. Min. Engrs., no. 145, Jan. 1919, pp. 23-25, 2 figs. Scheme to regulate pressure by connecting exhausted well to high-pressure gas line.

Petroleum Hydrology. Petroleum Hydrology Applied to Mid-Continent Field, Roy O. Neal. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 1-8. Method of distinguishing between waters that encroach upon oil-bearing beds from sources in stratum and waters that reach oil sands from planes above.

PRECIOUS MINERALS

Gold. Two Instances of Mobility of Gold in Solid State, Edward Keller. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 33-42, 1 fig. Assay results of gold movement on surface of auriferous copper when latter is subjected to oxidation.

RARE MINERALS

New Minerals. Review of New Mineral Species (Revue des espèces minérales nouvelles), P. Gaubert. Bulletin de la Société Française de Minéralogie, vol 41, no. 4-5-6, Apr.-June 1918, pp. 93-96 and 117-130. General notes on appearance, occurrence and constitution of 29 minerals discovered in recent years. Reference made in each case to publication where first account of substance appeared.

See also INDUSTRIAL TECHNOLOGY, *Yttrium*.

METALLURGY

BLAST FURNACES

Development in 1918. 1918 Blast Furnace Development Reviewed, F. H. Wilcox. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 30-31. Analysis indicates tendency has been toward large hearths, steep and low boshes, high inwall batters and moderate thickness of lining.

Gases. Remarks on the Composition of Blast-Furnace Gases and Volumetric Methods of Measuring the Gas Produced and the Air Blown In (Remarques relatives à la composition des gaz de haut fourneau et méthodes volumetriques pour le calcul du gaz produit et du vent soufflé). J. Seigle. Bulletin et Comptes rendus mensuels de la Société de l'Industrie Minérale, series 5, vol 14, 3d issue 1918, pp. 113-131, 1 fig. Methods of measuring gases by weight (Gruner and Ledebur); volumetric methods based on combination of carbon or on combination of oxygen; examples of applications; comparison of theoretical results and practical analyses.

Manganese. How to Save Manganese and Coke. Iron Trade Rev., vol. 63, no. 21, Dec. 12, 1918, pp. 1347-1348. Table of operating data of 12 blast furnaces producing ferromanganese and spiegeleisen and 40 per cent of output of manganese alloys in U. S. Conclusion reached that large savings can be effected by using low-ash cokes.

Research. Study of Blast Furnaces, Based on the Researches Undertaken by Francis Mulet (Etude sur les hauts fourneaux d'après les travaux de Francis Mulet), E. Damour. Bulletin et Comptes rendus mensuels de la Société de l'Industrie Minérale, series 5, vol. 14, 3d issue 1918, pp. 5-47, 1 fig. Economical operation of furnaces; analysis of charge and of gaseous products; heat required by chemical reactions; influence of temperature of blast on coke economy; utilization of gases; variation in coke consumption with output.

See also MECHANICAL ENGINEERING, Fuels and Firing (Blast-Furnace Gas).

COPPER

Brass, Cartridge. A Comparison of Grain-Size Measurements and Brinell Hardness of Cartridge Brass, W. H. Bassett and C. H. Davis. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 57-78, 16 figs. It was found that grain sizes of brasses annealed at low temperatures are greatly affected by previous grain size and reduction by rolling, consequently hardness of cartridge brass may be better determined by Brinell-hardness measurement than from grain size.

Bronzes. The Constitution of the Tin Bronzes, Samuel L. Hoyt. Bul. Am. Inst. Min. Engrs., no. 144, Dec. 1918, pp. 1721-1727, 1, figs. Explains upper heat effect over $a + B$ range.

Chloridizing Roasting. Chloridizing-Roasting of Burnt Pyrites on the Ramen-Beskow System, Peter Klason. Min. Mag., vol. 19, no. 6, Dec. 1918, pp. 301-313, 4 figs. Suggests improvement of Longmaid-Henderson process for extracting copper from pyrites that have been burnt by alkali manufacturers.

Copper-Aluminum Alloys. Constitution and Hardness of Copper-Aluminum Alloys Having High Percentage of Copper (Constitution et dureté des alliages cuivre-aluminium riches en cuivre). La Metallurgie, year 50, no. 45, Nov. 6, 1918, pp. 1631-1633, 1 fig. Effect of temperature of hardening on hardness of alloys containing 9 to 16 per cent. aluminum. (Continuation of serial)

FLOTATION

Ruth Flotation Machine. Ruth Flotation Machine, Arthur J. Hoskin. Queensland Government Min. Jl., vol. 19, no. 222, Nov. 15, 1918, pp. 500-501, 3 figs. Machine for concentrating minerals by oil flotation; designed on principle that best attachment of minerals to bubbles takes place when there is least amount of relative motion.

STEEL AND IRON

Basic Steel. Formula for Strength of Basic Steel, Andrew McWilliam. Iron Age, vol. 102, no. 25, Dec. 19, 1918, pp. 1508-1511, 3 figs. Calculations made from composition; influencing principal elements; application to basic steel. Paper before Iron & Steel Inst., London, Sept. 1918.

Cast Iron. The Mixing and Melting of Cast Iron, J. F. Mullan. Can. Foundryman, vol. 9, no. 12, Dec. 1918, p. 301. Review of opinions expressed by several experts leads writer to assert that success of foundry depends more on proper management of furnace than on any other branch of the trade.

Electric Steel. Making Electric Steel for Roller Bearings, Edward K. Hammond Machy., vol. 25, no. 4, Dec. 1918, pp. 318-326, 20 figs. Methods of operating Héroult electric furnaces, forging ingots, rolling billets and col-drawing steel into solid bars and seamless tubing.

Ferro-Alloys. The Ferro-Alloys, J. W. Richards. Gen. Elec. Rev., vol. 21, no. 11, Nov. 1918, pp. 751-755. Composition of these alloys, method of manufacture, and properties imparted to steel by addition of each of the molten metals. Also Metal Trades, vol. 9, no. 12, Dec. 1918, pp. 488-489, 2 figs. Properties of ferromolybdenum, ferro-vanadium, ferrotitanium and ferroboron. Paper read at Nat. Exposition of Chem. Indus.

The Manufacture of Ferro-Alloys, Robert M. Keeney. Automotive Eng., vol. 3, no. 10, Dec. 1918, pp. 464-468. Ores and furnaces used and methods followed to produce ferrochrome, ferromanganese, ferromolybdenum, ferrotungsten, ferrovanadium and ferrouranium; uses of these metals.

The Manufacture of Ferro-Alloys in the Electric Furnace, E. S. Bartell. Min. Jl., vol. 123, no. 4346, Dec. 7, 1918, p. 708. Comparative efficiency of large and small furnaces used in manufacture of ferromanganese. Discussion of Am. Inst. Min. Engrs. paper by Robert M. Keeney.

Record of an Old Ferro-Silicon Furnace, I. Peterman. Blast Furnace, vol. 6, no. 12, Dec. 1918, pp. 492-493. Historical account of plant built in 1792, now a part of Warner Iron Co.

Forged Steel. Influence of Forging and Rolling on the Properties of Steel (Le corroyage de l'acier. Son influence sur les propriétés du metal), Georges Charpy. Revue de Métallurgie, year 15, no. 5, Sept.-Oct. 1918, pp. 427-448, 9 figs. Experiments conducted by engineering staff of large works; records of deformations by forging of straight lines drawn originally on surface of bar and examination of section of hollow threaded cylinder filled with liquid metal of same composition and rolled after solidifying under pressure of 1200 tons from 530 mm. in diameter to 265 mm.

Metallurgy in 1918. Phases of Iron and Steel Metallurgy in 1918, John Howe Hall. Iron Age, vol. 103, no. 1, Jan. 2, 1919, pp. 27-28. Remedies for ingot defects; strides in steel-casting industry; manganese problem; alloy-steel helmets.

Open-Hearth Furnaces. Principles of Open-Hearth Furnace Design, Chas. H. F. Bagley. Blast Furnace, vol. 6, no. 12, Dec. 1918, pp. 505-507, 3 figs. Calculations relating to pressure in furnace, port ends, ratio of air to gas passages. Flue and valve diagrams. Paper before British Iron & Steel Inst. (Concluded.)

Plate and Structural Mills at Fairfield, Ala. Iron Age, vol. 103, no. 1, Jan. 2, 1919, pp. 47-49, 3 figs. New plant of Tennessee Coal, Iron & Railroad Co., to serve Mobile shipyard; producing steel by triplexing at Ensley open-hearth works.

Oxygen in Steel. Determination of Oxygen in Steel. Iron Age, vol. 102, no. 26, Dec. 26, 1918, pp. 1573, 2 figs. Objections to Ledebur method apparently overcome; details of modifications; interesting comparative analyses.

The Heterogeneity of Steel (L'hétérogénéité de l'acier), H. le Chatelier and B. Bogitch. Génie Civil, vol. 73, no. 18, Nov. 2, 1918, pp. 350-351, 6 figs. Concludes, from experiments with Stead's reagent, that microscopic heterogeneity of steel is due to oxygen in solid solution in metal.

Russian Iron Works. Pre-War Russian Iron and Steel Plants. Iron Age, vol. 102, no. 25, Dec. 19, 1918, pp. 1501-1507, 11 figs. Output and equipment of leading works; prospects after war.

Structure of Steel. Inspecting the Structure of Metals, J. J. McIntyre. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 443-444. 2 figs. Shows manner of taking structural photographs of metal or similar opaque objects with ordinary camera.

Development of Grain Boundaries in Heat-Treated Alloy Steels, R. S. Archer. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 51-55, 12 figs. Specimen is etched in 4 per cent solution of picric acid in ethyl alcohol from 5 to 25 min., then carbonaceous smudge is rubbed off on moist broadcloth or kersey.

See also MECHANICAL ENGINEERING, Heat Treating (Malleable Iron): Machinery, Metal-Working (Steel, High-Speed); ELECTRICAL ENGINEERING, Furnaces (Steel Furnaces)

AERONAUTICS

AEROSTATICS

Ascending and Landing. Military Aerostatics, H. K. Black. Aerial Age, vol. 8, no. 16, Dec. 30, 1918, p. 811. Precaution in ascending and in landing. (Continuation of serial.)

Balloons. Manufacture of War Balloons in U. S., Allen Sinsheimer. Automotive Indus., vol. 39, no. 22, Nov. 28, 1918, pp. 925-927, 6 figs. Adaptation of French Caquot type.

Free Ballooning. Military Aerostatics, H. K. Black. Aerial Age, vol. 8, no. 14, Dec. 16, 1918, p. 705, 1 fig. Training in free ballooning. (Continuation of serial.)

Kites. Meteorological Kites (Cerfs-volants météorologiques), L-P. Frantzen. Aérophile, year 26, nos. 19 and 20, Oct. 1-15, 1918, pp. 298-299, 3 figs. Particulars of German design of " Diamant " type.

AIRCRAFT PRODUCTION

Navy Plant. Our Navy Winged Destroyers, Austin C. Lescarboura. Sci. Am., vo. 119, no. 24, Dec. 14, 1918, pp. 480-481 and 486-487, 8 figs. Work done by Navy in establishing Government-owned aircraft plant for supplying giant seaplanes.

Rigging. From a Rigger's Note-Book. Flight, vol. 10, no. 47, Nov. 21, 1918, pp. 1313-1315, 8 figs. General procedure of rigging. Case of a B. E. 2e is taken up in detail.

U. S. Air Service. Report of the Director of Military Aeronautics. Aerial Age, vol. 8, no. 14, Dec. 16, 1918, pp. 720-722. Story of development of personnel, training and organizing phases of present Air Service.

APPLICATIONS

Aeroplane Business. The Future of the Airplane Business, C. F. Kettering. Jl. Soc. Automotive Engrs., vol. 3, no. 6, Dec. 1918, pp. 358-362 and pp. 362-363 (discussion), 2 figs. Present difficulties in civilian use of airplanes as built at present; types of military airplanes. Presidential address before Detroit Section of Society.

American View. Future of the Aircraft Industry, Harry Bowers Mingle, Aviation, vol. 5, no. 9, Dec 1, 1918, pp. 560-562, 3 figs. Enumerates possible uses of airplane in scientific, civil and sporting fields.

British Civil Transport. Civil Aerial Transport. Flight, vol. 10, no. 48, Nov. 28, 1918, pp. 1350-1351. Outline of report of Civil Aerial Transport Committee regarding steps to be taken to develop aviation for civil and commercial purposes and utilizing trained personnel for that purpose. From London Times.

Control of Aircraft. The Two Futures for Flight, H. Massac Buist. Flight, vol. 10, nos. 48 and 49, Nov. 28 and Dec. 5, 1918, pp. 1352-1354 and 1370-1373. Argues against establishment of bureaucracy in connection with development of aviation alike for military, public and private purposes, and for absolutely free scope for development and application by individuals or companies.

Dutch View of Future. Flying Machines and Air Communication and Navigation in the Near Futuro (Vliegmachines, bestuurbare luchtschepen en het luchtverkeer in de naaste toekomst). Ph. Kapteyn. De Ingenieur, year 33, no. 43, Oct. 26, 1918, pp. 827-845, 41 figs.

Italian View of Commercial Aviation. Commercial Aviation, Gianni Caproni. Aeronautics, vol. 15, no. 264, Nov. 6, 1918, pp. 428-430, 3 figs. From Rivista dei Transporti Aerci.

AUXILIARY SERVICE

Trucks. Building Trucks for the Aviation Service, M. E. Hoag. Am. Mach., vol. 49, no. 23, Dec. 12, 1918, pp. 1089-1092, 13 figs. Description of construction and assembly of some special parts. Second article.)

ENGINES

Austro-Daimler. The 200 H. P. Austro-Daimler Aero Engine. Flight, vol. 10, no. 46, Nov. 14, 1918, pp. 1288-1293, 7 figs. Ignition; carburetor and induction system; petrol tanks; air pump; water pump; water cooling system; calibration and endurance test report; metallurgical test report; general data; general analysis by weights. Issued by Technical Department, Aircraft Production, Ministry of Munitions. Also Automobile Engr., vol. 8, nos. 120 and 121. Nov. and Dec. 1918, pp. 316-319, 350-357, 28 figs.

Design. The Design of Airplane Engines, III, John Wallace. Automotive Engr., vol. 3, no. 10, Dec. 1918, pp.458-460. Mean effective pressure; power; construction of a theoretical diagram; modifying diagram to include practical conditions of ignition; comparison of results. Continuation of serial.)

Hispano-Suiza. The Hispano-Suiza Aircraft Engine, Donald McLeod Lay. Jl. Soc. Automotive Engrs., vol. 3, no. 6, Dec. 1918, pp. 367-372, 9 figs. Historical review of design and development; mechanical features; circulating water and gasoline systems; production problems.

Four Hispano.Suiza Models. Automotive Indus., vol. 39, no. 22, Nov. 28, 1918, pp. 914-915 and 946, 2 figs. Details of models A, I, E, and H, built in U. S.

The Hispano-Suiza Airplane Engine. Aviation, vol. 5, no. 9, Dec. 1, 1918, pp. 549-553, 4 figs. History of development and detailed description of latest type.

Liberty. Details of the Liberty Engine, J. Edward Schipper. Automotive Indus., vol. 38, no. 24, Dec. 12, 1918, pp. 991-995, 12 figs. Mechanical description illustrated with sectional drawings.

Electrical System of the Liberty Engine, J. Edward Schipper. Automotive Indus., vol. 39, no. 26, Dec. 26, 1918, pp. 1089-1092, 14 figs. Special type of interrupter comprising three breakers in parallel. Storage battery designed to permit of upside-down flying.

The Liberty Motor, Douglas Wardrop. Aerial Age, vol. 8, nos. 14 and 15, Dec. 16 and 23, 1918, pp. 706-717, 762-765, 39 figs. Dec. 16; Extensive description of machine and outline of its development. Dec. 23: Oiling system; electric ignition; voltage regulator; duplex Zenith carburetor.

Starter. The Liberty Starter. Aerial Age, vol. 8, no. 16, Dec. 30, 1918, p. 816, 3 figs. Elevation and sections of 4-cylinder radial 2-cycle air motor. As starter it has a 9 to 1 gear reduction on final drive to motor.

HISTORY

Official U. S. History. Official History of Aircraft Production. Automotive Indus., vol. 39, no. 23, Dec. 5, 1918, pp. 968-969 and 987-990. Objects, problems, production, and results of air program.

MATERIALS OF CONSTRUCTION

Spruce. Development of the Aircraft Spruce Industry. Lawrence K. Hodges. Automotive Indus., vol. 39, nos. 25 and 26, Dec. 19 and 26, 1918, pp. 1037-1040 and 1100-1101, 8 figs. Organization of Spruce Production Division. Figures of monthly cut; problem of by-products disposal.

See also MECHANICAL ENGINEERING, Corrosion (Aircraft Parts).

METEOROLOGY

Aerographic Records. Uniformity in Aerographic Records, Alexander McAdie. Sci. Am. Supp., vol. 87, no. 2244, Jan. 4, 1919, pp. 15-16. Discusses desirability of universal scientific units. Special reference is made to meteorological work.

MODELS

Ford-Motored Aeroplane. Elementary Aeronautics and Model Notes, John F. McMahon. Aerial Age, vol. 8, no. 14, Dec. 16, 1918, p. 727, 16 figs. Construction of a Ford-motored airplane.

Model Construction. Model Aeroplane Building as a Step to Aeronautic Engineering, Aerial Age, vol. 8, nos. 11, 12, 15 and 16, Nov. 25, Dec. 2, 23 and 30, 1918. pp. 581, 627, 781 and 826, 16 figs. Table of resistance and weight of spruce struts. Table of plates of different aspect ratios at angles from 5 to 60 deg. showing *Ky*, *Kx* and ratio of lift to drift at the different angles. Bracing fuselage. Construction of seat, gas tank and rudder bar.

PLANES

Berg. The Austrian Berg Single-Seater. Flight, vol. 10, no. 46, Nov. 14, 1918, pp. 1285-1287, 9 figs. Wing section; attachment of struts to fuselage and longerons; details of internal bracing ailerons. (Concluded.):

Bombers. The Gotha Bomber, with Notes on Giant Aeroplanes. Flight, vol. 10, nos. 46, 47, 48 and 49, Nov. 14, 21, 28 and Dec. 5, 1918, pp. 1280-1282, 1318-1322, 1340-1347 and 1375-1378, 84 figs. Nov. 14: Principal dimensions; construction; struts; ailerons; propeller accommodation; empennage; fuselage. Nov. 21: Undercarriage; engine mounting; engines; controls; petrol system; armament; bombs; wireless; Instruments; fabric and dope. Nov. 28: Particulars of four engined giant. Dec. 5: Principal items of interest in five-engined giant brought down by allied forces. Issued by Technical Department, Aircraft Production, Ministry of Munitions. Also Engineer, vol. 126, no. 3281, Nov. 15, 1918, pp. 419-421, 8 figs.; Aeronautics, vol. 15, no. 266, Nov. 20, 1918, pp. 473-486, 79 figs.

De Haviland 4. The De Haviland 4, with Liberty " 12 " Engine. Aerial Age, vol. 8, no. 17, Jan. 6, 1918, pp. 860-861, 5 figs. General dimensions and weights.

Design. The Probable Trend of Aeroplane Design, R. F. Mann. Sci. Am. Supp., vol. 87, no. 2244, Jan. 4, 1919, p. 11, 1 fig: Review of present stage in development and changes likely to be introduced by reason of applications of airplanes to various purposes. From Flight.

The Trend of German Aeroplane Design. Flight, vol. 10, no. 49, Dec. 5, 1918, pp. 1383-1385. Comparison with British machine of principal features of captured German aeroplanes. Also in Aeronautics, vol. 15, no. 268, Dec. 4, 1918, pp. 518-520.

Gallaudet. The Gallaudet D-4 Light Bomber Seaplane. Aerial Age, vol. 8, no. 16, Dec. 30, 1918, pp. 817 and 831, 3 figs. General specifications. Machine is a biplane and is fitted with one 400-hp. Liberty " Twelve " engine

Hannoveraner. The German Airplane Hannoveraner, C. L. II. (Avion allemand Hannoveraner C. L. II). Aérophile, year 26, nos. 19 and 20, Oct. 1-15. 1918, pp. 289-296, 10 figs. Comprehensive description of light biplane fitted with 200-h.p. Opel motor.

Junker. The Junker Armored Biplane. Flight, vol. 10, no. 48, Nov. 28, 1918, pp. 1356-1357, 2 figs. Main characteristics of all-metal aeroplane.

L-W-F. The L-W-F Model G-2 Fighting Airplane, Glenn D. Mitchell. Aviation, vol. 5, no. 9, Dec. 1, 1918, pp. 554-558, 7 figs. General features and dimensions of an all-American design.

Martin. The Martin K-111 Single Seater. Aerial Age, vol. 8, no. 15, Dec. 23, 1918, pp. 759-761, 7 figs. Particulars of biplane specially designed as altitude fighter and equipped with oxygen tanks and provision for electrically heating pilot's clothing.

N. C. 1, U. S. Navy. Our Giant Aircraft. Sci. Am., vol. 120, no. 1, Jan. 4, 1919, pp. 7 and 18. General design of N. C. 1 equipped with three 12-cylinder Liberty engines driving three four-bladed tractor screws; wing spread, 126 ft.

Rumpler. Rumpler Two-Seater Biplane. Automotive Indus., vol. 39, no. 23, Dec. 5, 1918, pp. 962-965, 14 figs. Technical description of model German reconnaissance machine. Issued by British Aircraft Department.

PROPELLERS

Metal. The Metal Airscrew, Vladimir Olhovsky. Aerial Age, vol. 8, no. 12, Dec. 2, 1918, pp. 622-623, 2 figs. Results of experiments on wooden and metal propellers; factors entering in design of hollow metal propeller.

Patterns. Propeller Patterns, Joseph A. Shelly. Machy, vol. 25, no. 5, Jan. 1919, pp. 434-438, 8 figs. Describes method of laying out propeller patterns, assembling different section s and working blades to required form. (Second article.)

Research. Experimental Research on Air Propellers, II, William F. Durand. Automotive Eng., vol. 3, no. 10, Dec. 1918, pp. 478-480, 2 figs. Results of work done by Nat. Advisory Committee for Aeronautics. Torque dynamometer; revolution counter; air-speed meter; tests and calibrations of apparatus; uniformity of velocity over cross-section of air stream; relation between depression within experiment room and air-stream velocity. (To be concluded.)

MARINE ENGINEERING

AUXILIARY EQUIPMENT

Barge. Standard Concrete Barge for Use on the New York State Barge Canal. Engineering, vol. 106, no. 2759, Nov. 15, 1918, pp. 554-556, 6 figs. Drawings showing details of construction.

Bark, Auxiliary. Auxiliary Bark—The France, George Douglas. Rudder, vol. 34, no. 12, Dec. 1918, pp. 590-592, 5 figs. Sail plan, deck arrangement and design features of five-masted bark, 418.8 ft. long, fitted with two Schneider heavy-oil engines.

Fishing Cruiser. An Outdoor Motored Cruiser—Complete Plans and Building Instructions, William Atkin. Motor Boat, vol. 15, no. 23, 6 figs. Model is adaptation of flat-bottomed work boats used by clammers of Lower New York Bay.

Life Boats. Two Lifeboats in Place of One. Rudder, vol. 34, no. 12, Dec. 1918, pp. 588-590, 7 figs. Design providing partial collapse of one so it can be stowed under the other.

Producer-Gas Power Lighter. Design and Construction of Producer Gas Power Lighter, Frederick S. Nock. Int. Mar. Eng., vol. 24, no. 1, Jan. 1919, pp. 36-37, 3 figs. Special central control for engine and hoisting apparatus; double rudder installation; compact engine-room planning.

Towboat. Plans and Specifications of New Wood Tow Boats. Int. Mar. Eng., vol. 23, no. 12, Dec 1918, pp. 673-674, 2 figs. Built for hard service; compound engine of 750 hp.; Scotch boiler with three Morison furnaces.

SALVAGE

Salving of the SS. Frank A. T. Wheeler. Tran. Inst. Marine Engrs., vol. 30, no. 238, Oct. 1918, pp. 218-220, 3 figs. Steps taken to prevent falling over of vessel struck by torpedo on her port side in No. 5 hole, holes being blown in her 'tween deck and starboard side; watertight bulkhead at after end of engine room leaked badly and eventually flooded engine room.

SHIPS

Boilers. Sediment in Marine Boilers, Its Bearing on Furnace Collapse, W. R. Austin. Trans. Inst. Marine Engrs., vol. 30, no. 238, Oct. 1918, pp. 189-196, 1 fig. and (discussion), pp. 196-209. Occasions where risk arises and suggestions to eliminate it: Backing strains from unequal expansion and their prevention by keeping uniform temperature in furnaces; dangers arising from circulation of sediment caused by rolling of ship; possibilities of creating critical situation while cleaning a fire at sea; means of avoiding accident while lying under banked fires.

Concrete Ship. What the Year Has Taught About the Concrete Ship. Eng. News-Rec., vol. 82, no. 1, Jan. 1, 1919, pp. 14-15. Much learned regarding design and construction; future depends on ability to build in cost competition with steel; structurally, ship is success.

Concrete Ships and Barges (Los buques i barcos menores de concreto). Boletin de la Sociedad de Fomento Fabril, year 35, no. 9, Sept. 1918, pp. 614-619 History of development of process from 1849 to present time.

Shear in Concrete Ships Critical Point in Design, A. C. Janni. Eng. News-Rec., vol. 81, no. 24, Dec. 12, 1918, pp. 1089-1091. 1 fig. According to accepted theory, usual thin shell monolithic with frame gives rise to dangerous conditions.

Design. V-Bottom or Round Bilge—Which? George F. Crouch. Motor Boat, vol. 15, no. 23, Dec. 10, 1918, pp. 30-34, 3 figs. Advantages of each shape; diagrams showing relations between lenght aand speed and giving approximate form to use for different speeds.

Best Fore-and-Aft Position of Parallel Middle Body in Single Screw Cargo Ship, William McEntee. Int. Mar. Eng., vol. 24, no. 1, Jan. 1919, pp. 18-23, 8 figs. Effect of variation of position of parallel middle body on shaft horsepower, propulsion coefficient and propeller revolutions. Paper before Soc. of Naval Architects and Marine Eng., Philadelphia, Nov. 1918.

Electric Transmission. Electric Propulsion of Vessels (La propulsion électrique des navires), A. Foillard. Génie Civil, vol. 73, no. 17, Oct. 26, 1918, pp. 321-327, 13 figs. Machinery used and characteristic curves of motors in the vessels Wulsty Castle and Mjôlner.

Lubrication. Uniform and Constant Forced-Feed Lubrication of the Steamchests, Cylinders and Other Parts of Steam Engines. Ry. Engr., vol. 39, no. 466, Nov. 1918, pp. 203-209, 8 figs. Describes "Intensifore" Gorton type developed from exhaustive experiments with various mechanical and hydrostatic lubricators by engineering staff of Great Central Ry.

Power Plant. Marine Power Units, J. G. Callan. Wis. Engr., vol. 23, no. 2. Nov. 1918, pp. 42-47. General characteristics of steam turbines and Diesel engines. Reasonableness of adoption of geared unit.

Standards. Adopt British Ship Steel Standards. Iron Trade Rev., vol. 63, no. 22, Nov. 28, 1918, pp. 1245-1246. Decisions of American Steel manufacturers at conference in Philadelphia.

Standardization of Ship Steel. Steel & Metal Digest, vol. 8, no. 12, Dec. 1918, pp. 690-691. Recommendation of mills to Emergency Fleet Corporation.

Structural Steel Standardization Cargo Vessels, Henry R. Sutphen. Int. Mar. Eng., vol. 23, no. 12, Dec. 1918, pp. 695-698, 1 fig. How quantity production was met; use of structural steel expedient; layout of yard.

Submarines. The Surrender of the Submarines. Min. Jl., vol. 123, no. 4345, Nov. 30, 1918, pp. 688-691, 5 figs. General features of construction of the different types, their propulsive machinery and other engineering details.

See also MECHANICAL ENGINEERING, Internal-Combustion Engines Winton Marine Engine).

YARDS

Concrete Vessels. Build Boats in Dry Docks at New Yards in Detroit. Eng. News-Rec., vol. 82, no. 1, Jan. 2, 1919, pp. 21-24, 9 figs. Concrete barges under construction on concrete floors inside dikes which will be flooded for launching; lighters carry construction machinery alongside dry docks.

Reinforced Concrete Shipbuilding in Dorsetshire. Engineer, vol. 126, no. 3281, Nov. 15, 1918, pp. 408-410, 10 figs. Drawings with descritpion of some concrete ships.

Building a Government 3500-Ton Concrete Ship. Eng. News-Rec., vol. 81, no. 24, Dec. 12, 1918, pp. 1058-1065, 16 figs. Fougner yard has concrete ways; reinforcement tacked to outside forms and finish put on with cement gun; air hammers on forms compact concrete.

Control of Construction. Control of the Construction of a 5000-Ton Deadweight Fabricated Steel Ship, "Fabricator." Int. Mar. Eng., vol. 23, no. 12, and vol. 24, no. 1, Dec. 1918, and Jan. 1919, pp. 691-694 and pp. 29-30, 6 figs. Dec. 1918: Special schedule for ordering and installation of machinery and equipment; correlation between order and purchasing departments. (Fourth article.) Jan. 1919: Forms for following up movement and arrival of steel parts; railway shipments of plates and sheets traced. (Fifth article.)

Costs and Estimates. Shipbuilding Costs and Estimates, James M. Robertson. Int. Mar. Eng., vol. 23, n 12, Dec. 1918, pp. 671-672. Careful reading of specifications necessary; system a requisite; list of items; how to deal with individual items. (Second article.)

Cranes. Pre-Assembly System and Efficient Erection Cranes Speed Up Shipbuilding at Ecorse, Eng. News-Rec., vol. 81, no. 24, Dec. 12, 1918, pp. 1076-1081, 8 figs. Pre-assembling extending rapidly in Lake Yards; reduces erection labor on hulls.

Design. Berth Construction and Side-Launching Practice in Great Lakes Shipyards. Eng. News-Rec., vol. 82, no. 1, Jan. 2, 1919, pp. 7-13, 25 figs. Berth structure simple; timber and concrete foundations for support of ships; concrete launching-way stringers at one yard; keel blocks and cradles variously arranged; trip shores to release ships.

Ship-Design and Quantity-Production Methods of Newark Bay Yard. Eng. News-Rec., vol. 81, no. 25, Dec. 19, 1918, pp. 1122-1125, 4 figs. Project for factory-style shipbuilding based on enlisting new labor supply and using commercial steel; methods dictated by delay in ship orders; bridge shops fabricate straight parts.

Equipment. Fabricating Shop and Berth Equipment at Sun Shipyard. Eng. News-Rec., vol. 82, no. 1, Jan. 1, 1919, pp. 57-61, 9 figs. Assembly bay of shop delivers finished material to shipbuilding cranes; multiple punches and roller tables; reinforced-concrete berths served by bridge cranes.

Fabricated Ship. Fabricated-Ship Construction in One Year's Experience. Eng. News-Rec., vol. 82, no. 1, Jan. 2, 1919, pp. 16-17. New System now tested by large-scale working has proved adaptable and free from inherent difficulties or elements of excess cost.

Ford Eagles. Building the Ford Submarine-Chaser "Eagle." Int. Mar. Eng., vol. 24, no. 1, Jan. 1919, pp. 23-27, 7 figs. Simplicity of hull construction; safety devices on unusual launching platform; routing aids production.

Ford Methods in Ship Manufacture, Fred E. Rogers. Ind. Management, vol. 57, no. 1, Jan. 1919, pp. 1-6, 12 figs. Description of boat with features of plan of manufacture. (First article.)

Building the Ford Submarine Chaser "Eagle." Int. Mar. Eng, vol. 23, no. 12, Dec. 1918, pp. 702-705, 4 figs. Straight-line design; two parts of system; hurried development of process.

Hog Island. Hog Island, the Greatest Shipyard in the World, W. H. Blood, Jr. Int. Mar. Eng., vol. 23, no. 12, Dec. 1918, pp. 678-690, 20 figs. Review of conditions that preceded planning of yard; adopting type and design of boat; troubles encountered and overcome. Before Soc. of Naval Architects and Marine Engrs., Philadelphia, Nov. 1918.

Illumination. A Method of Ship Way Illumination, F. D. Weber. Jl. Elec., vol. 41, no. 11, Dec. 1, 1918, p 503. Outlines method followed by western company.

Laying Out. Laying Down and Taking Off, Charles Desmond. Rudder, vol. 34, no. 12, Dec. 1918, pp. 584-587, 5 figs. How to lay out shape of transom stern inclined aft with rounded after face and intended to be made of pieces of material bent to shape. (Continuation of serial.)

New Yards. Large Addition to Plant of the Tidewater Shipbuilders, Ltd., Cap de la Madeleine, P. Q. Contract Rec., vol. 32, no. 51, Dec. 18, 1918, pp. 1001-1004, 6 figs. Extensions necessitated to build four 5100-ton steel cargo boats.

Shipbuilding at the Pensacola Yards, John M. Sweeney. Int. Mar. Eng., vol. 24, no. 1, Jan. 1919, pp. 12-16, 8 figs. Well-constructed plant for 9000-ton fabricated steel ship; use of permanent scaffolding; powerful plate-bending machine.

Routing of Materials. Routing of Fabricated Ship Material at Bristol. Eng. News-Rec., vol. 82, no. 1, Jan. 2, 1919, pp. 25-30, 9 figs. Hull construction operated on basis of shop-to-storage-to-ship system requires accurate timing of material supply, shop work, and assembly; routing handled by production department.

Welding. The Steel Ship and Oxy-Acetylene Welding, J. F. Springer. Can. Machy., vol. 20, no. 25, Dec. 19, 1918, pp. 701-703. Observations on behavior of metal under welding flame and precautions to be taken. Writer believes tensile strength of material at and near weld is much less that that of the plates. Of the restorative measures available, he considers reheating method the most convenient and effective.

Welding Designs for Shipyard Use, E. G. Rigby. Marine Rev., vol. 49, no. 1, Jan. 1919, pp. 22-29, 22 figs. Practical examples of electric welding in deck, tank and bulkhead structures; how it is applied to armor plate.

Electric Welding in Ship Construction, H. Jasper Cox. Int. Mar. Eng., vol 24, no. 1, Jan. 1919, pp. 42-46, 7 figs. Methods of welding and apparatus described; inspection and testing welds; speed and cost of welding; Lloyd's experiments. Paper before Soc. of Naval Architects and Mar. Eng., Philadelphia, Nov. 1918.

The Steel Ship and Oxy-Acetylene Welding, J. F. Springer. Int. Mar. Eng., vol. 23, no. 12, Dec. 1918, pp. 699-701. Autogenous welding decreases strength of steel; behavior under heat; restorative measures.

The First Electrically Welded Boat, John Liston. Geb. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 844-848, 10 figs. Process followed in welding 42-ft. boat of 11-ft. beam said to have been plying Lake Erie for two years when the 275-ton English-built, rivetless welded barge was launched in June 1918.

Electric Welding for Shipbuilding. Elect., vol. 81, no. 2114, Nov. 22, 1918, pp. 619-620. From address by W. S. Abell, Chief Ship Surveyor of Lloyd's Register, before North-East Coast Inst. of Engrs. and Shipbuilders, Tyneside, Nov. 1918.

U. S. Warship Kept on the Job by Oxy-Acetylene Torch. Jl. Acetylen Welding, vol. 20, no. 6, Dec. 1918, pp. 290 and 292. Repair of boiler with oxy acetylene outfit.

Electric Welding for Shipbuilding, W. S. Abell. Nautical Gaz., vol. 94, no. 24, Dec. 14, 1918, pp. 346-347. Past progress; strength of joints; possibility of industry. Paper before British Northeast Coast Instn. Engrs. & Shipbuilders.

The Adequacy of Welding in Constructing Hulls of Ships, H. M. Hobart. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 840-845. Investigations of Welding Research Sub-Committee of Emergency Fleet Corporation in regard to relative merits of different systems and equipments.

Spot Welding and Some of Its Applications to Ship Construction, H. A. Winne. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 923-927, 6 figs. Advantages of spot welding over riveting with respect to strength, time, and labor; limitations of spot welder; application of spot welding to construction of ladders and gratings and to plugging of misplaced holes.

Electric Welding in Navy Yards, H. G. Knox. Gen. Elec. Rev., vol. 21, no. 12, Dec 1918, pp. 849-859, 20 figs. Word conducted in each type of shop in a navy yard; recommendations of welding equipment desirable in each shop; data on speed and cost of welding ship structures; comparative cost data of welding based on records from steam railroads.

The Electric Arc Used in Steamship Overhauling. Can. Machy., vol. 20, no. 24, Dec. 12, 1918, pp. 675-676, 2 figs. Examples of uses of Westinghouse arc welder in repairing marine boiler and furnace while under steam

Arc Welding in Shipyard, W. L. Roberts. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 860-864, 13 figs. Simplification of anglesmith's work by use of arc welding in production of staples; probability of abandoning staples in favor of directly arc-welding parts; application of electric arc to construction of water, oil, a ir tanks, stacks, condensers, and other similar appliances,

Wooden Vessels. Building Wooden Vessels on the Pacific. Int Mar. Eng., vol. 24, no. 1, Jan. 1919, pp. 8-11 8 figs. Record of accomplishment; Hough and Ferris types give way to 5000 ton vessels; wood vessels coming into their own again.

VARIA

Emergency Fleet Corporation. Organization of the U. S. Shipping Board Emergency Fleet Corporation Charles Piez. Jl. Am. Soc. Mech. Engrs , vol. 41, no. 1, Jan. 1919, pp. 32-35, 2 figs. Relationship and functions of Board and construction and operation divisions of Fleet Corporation.

Naval Engineering in War. The Achievements of Naval Engineering in the War, William L. Cathcart. Jl. Am. Soc. Mech. Engrs., vol. 41, no. 1, Jan. 1919, pp. 18-25, 18 figs. Organizations and principal activities of Bureau of Steam Engineering; electric drive for battleships; repair of German merchan ships by oxy-acetylene welding. Delivered at annual meeting of the Society.

U. S. Shipbuilding in 1918. Shipbuilding in the United States in 1918. Int. Mar. Eng., vol. 24, no. 1, Jan. 1919, pp. 5-7. Three million tons of merchant ship completed in first eleven months; rate of production rapidly increasing.

ORGANIZATION AND MANAGEMENT

ACCOUNTING

Expense Distribution. Efficiency and Democracy, H. L. Gantt. Jl Am. Soc. Mech. Engrs., vol. 41, no. 1, Jan. 1919, p. 43. Suggestions in regard to accounting systems. Stress is laid on erroneous process of charging work with expense of idle machines.

EDUCATION

Apprentices. The Training of Engineering Apprentices, T. H. Fenner. Can. Machy., vol. 20, no. 23, Dec. 5, 1918, pp. 641-643, 4 figs. Analyzes necessary standard of education and suggests course of training

Canada. Labor, Apprenticeship and Technical Education. Can. Engr., vol. 35, no. 24, Dec. 12, 1918, p. 511. Report of committee to Ottawa Conference of Assn. of Can. Building and Construction Industries.

Crippled Workers. How to Deal with Crippled Workers, T. Norman Dean. Am Mach., vol. 49, no. 25, Dec. 19, 1918, pp. 1115-1116. Suggestions from deductions from scientific experience to relieve 2,122,000 industrial cripples in United States.

Physical Reconstruction of Crippled Men, Constance Drexel. Blast Furnace, vol. 6, no. 12, Dec. 1918, pp. 508-509. Plan of U. S. Government for rehabilitation and vocational training; schools established giving courses in oxy-acetylene welding, etc.

Re-Educated Soldiers in the Machine Trade, Katherine Freeman. Can. Machy., vol. 20, no. 25, Dec. 1918, pp. 691-692, 2 figs. Instances in which vocational reeducation, together with artificial limbs, have made injured soldiers earn more than in pre-war days.

Industrial Surveys for Physical Readjustment, A. B. Segur. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 63-65, 2 figs. Method of investigating possibilities of employing disabled persons in industry, developed by Red Cross Institute for the Blind; results shown for few operations in a meat-packing house.

Engineers. The Engineer in Foreign Service, L. S. Rowe. Jl. Am. Soc. Mech. Engrs., vol. 41, no. 1, Jan. 1919, pp. 31-32. Plea to broaden training of engineer in order that he may acquire a greater breadth of view which will permit his adaptability to international service.

English Language. Education in English Language Promotes Efficiency, Sarah Elkus. Nat. Efficiency Quarterly, vol. I, no. 3, Nov. 1918, pp. 140-149. Cooperation of Board of Education in promoting English classes in factories; English as a safety-first method.

S. A. T. C. Students' Army Training Corps. Alexander S. Langsdorf. Proc. St. Louis Ry. Club, vol. 23, no. 7, Nov. 22, 1918, pp. 115-127 and (discussion), pp. 127-129. Educational plan as developed by War Department after series of experiments. Special reference made to features and arrangements of Government contracts with Washington University.

Intensive Training, C. R. Dooley. Jl. Am. Soc. Mech. Enbrs., vol. 41, no. 1, Jan. 1919, pp. 37-38. Program set up by Committee on Education and Special Training. It consisted of (1) military training, (2) sorting and training according to ability, (3) trade fundamentals and combinations, and (4) development of originality and initiative.

Shipyards. Industrial Training in War Time E. E. MacNary. Gen. Elec. Rav., vol 21, no. 12, Dec. 1918, pp. 871-875, 4 figs. Procedure followed and accomplishments performed by Emergency Fleet Corporation. Article deals with teaching of eighteen different trades.

Training 350,000 Men for the Shipyards, J. Will Parry. Eng. News-Rec., vol 82, no. 1, Jan. 1, 1919, pp. 53-56, 1 fig. How Fleet Corporation met problem.

Training Workers in Shipyards, R. V. Rickford. Int. Mar. Eng., vol. 24, no. 1, Jan. 1919, pp. 38-42, 12 figs. Short cut over old apprentice system; work progresses from simple to difficult operations; rivet records show results.

Trade Journals. Technical Journal Best Aid to Education, S. Balmfirth. Can. Foundryman, vol. 9, no. 12, Dec. 1918, pp. 307-309. After analyzing advantages and disadvantages of various sources of technical education writer concludes that technical journals, by reason of their ready availability and simplicity of style, are best help for self-instruction. Also in Can. Machy., vol. 20, no. 23, Dec. 5, 1918, pp. 655 and 657.

Training Factory. Lens Grinding in a Training Factory, Erik Oberg. Machy., vol. 25, no. 4, Dec. 1918, pp. 330-332, 3 figs. Means for meeting war emergencies devised by U. S. Government.

Vocational Schools. Need for vocational Schools in Mining Communities, J. C. Wright. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 91-94. Kinds of vocational schools which may be organized under the terms of the Federal Vocational Education Act.

Welders. The Training of Eectric Welders, H. A. Horner. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 876-881, 9 figs. Development of ingenuity and manipulating skill necessitated by welding operators said to be principalaim of course given by instructors of Emergency Fleet Corporation.

Women. Service for Women in the Gisholt Shop, J. V. Hunter. Am. Mach., vol. 50, no. 1, Jan. 2, 1919, pp. 6-10, 17 figs. Methods used in training women workers in a Wisconsin shop.

Preliminary Training for Women Workers, Fred. H. Colvin. Am. Mach., vol. 49, no. 24, Dec. 12, 1918, pp. 1067-1070, 9 figs. Account of methods employed in school of Packard Motor Car Co.

Motor Company's Shop Training for Women, F. L. Prentiss. Iron Age, vol. 102, no. 24, Dec. 12, 1918, pp. 1453-1455, 1 fig. Intensive work at Lincoln plant done in threshold school; women employees are protected by enforcement of rigid rules.

Work Schools. New Developments in Industrial Organization. Modern Methods of Port Sunlight (Ill.), W. G. Cass. Cassier's Eng. Monthly, vol. 54, no. 5, No. 1918, pp. 248-256. Work schools at Port Sunlight works.

FACTORY MANAGEMENT

Employment Managers. Aids to Employment Managers and Interviewers on Shipyard Occupations with Description of Such Occupations. Special Bul. U. S. Shipping Board Emergency Fleet Corporation, 1918, 147 pp. List of fundamental trades and occupations with most commonly accepted names used as standard. Specifications describe occupation from shipyard standpoint.

Duties of the Employment Manager, Charles W. Moon. Machy., vol. 25, no. 5, Jan. 1919, pp. 443-447, 9 figs. Fundamental principles involved and methods used successfully by R. K. Le Blond Machine Tool Co.

Employment Managers Graduate at the University of California, A. T. Parsons. Metal Trades, vol. 9, no. 11, Nov. 1918, pp. 450-152. Historical account of development of industrial activity involved in occupation of employment managers.

Handbook on Employment Management in the Shipyard. Organizing the Employment Department—. U. S. Shipping Board Emergency Fleet Corporation 1918, 17 pp. Methods and processes of handling employment problems which have been found successful in some of largest shipyards and corporations in U. S.

The Employment Manager a New Factor in the Industrial Relationship, Edward P. Jones. Wis. Engr., vol. 23, no. 2, Nov. 1918, pp. 48-53. Considerations on necessity for and meaning of formanizing labor as developed in new profession. Also in Metal Trades, vol. 9, no. 12, Dec. 1918, pp. 500-501.

Employment Methods. Installing Employment Methods, William Alfred Sawyer. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 7-11, 16 figs. Record of first year's work of employment and health department of American Pulley Co.

Interviewing and Selecting, Mark M. Jones. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 66-67. From address before Am. Assn. of Public Employment Officers.

Environment. Influence of Environment on Production, Lewis J. Brew. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 428-429. Suggestions in layout and details of forge plant.

Equipment. Equipment for Diversified Production, A. B. Shuart. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 429-430. Features of forge-plant design contributing to eliminate manual labor to large extent.

Ford Shipbuilding Methods. Ford Methods in Ship Manufacture—I, Fred E. Rogers. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 1-6, 12 figs. Basic features that made possible the production of Eagle submarine chasers. (To be continued.)

Foundry. Organizing a Foundry to Obtain Top Production, Paul R. Ramp, Foundry, vol. 47, no. 317, Jan. 1919, pp. 8-13, 5 figs. Systematic method of following up work of foremen in each department essential. From paper before Am. Foundrymen's Assn., Milwaukee.

Inter-Departmental Communications. Shooting the Shop Orders to Their Targets, Robert I. Clegg. Iron Age, vol. 103, no. 1, Jan. 2, 1919, pp. 53-55, 4 figs. Simple scheme of Geometric Tool Co. to rush instructions to departments the instant they are required.

Localization of Industry. The Localization of Industry, Malcolm Keir. Sci. Monthly, vol. 8, no. 1, Jan. 1919, pp. 32-48. Localization traceable as response to resources either in raw materials and power, or in unskilled labor; chance and monopoly as contributing factors: requirements of factories utilizing waste products; dependence of localized industries on skilled labor; influence of localization in formation of labor unions; deterrent features of localization.

Material Handling. Saving Tool Materials in Winchester Shop, W. E. Freeland. Iron Age, vol. 102, no. 26, Dec. 26, 1918, pp. 1574-1575, 2 figs. Work of central material planning division. Files are kept on steel basis. Tenth article dealing with methods at Winchester plant.

ORGANIZATION. What Should Organization Achieve? Harry Tipper. Automotive Indus., vol. 40, no. 1, Jan. 2, 1919, pp. 17-18. Its effect on (1) providing incentive to work, (2) settling individual grievances and general disagreements, (3) improving the working force, (4) decreasing labor turnover, and (5) reducing friction between departments.

PRODUCTION CONTROL. Graphic Production Control—V The Control of Equipment and Labor, C. E. Knoeppel, Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 56, 61, 22 figs. Features of control said to improve efficiency of workmen, do away with idleness of equipment and improve faulty shop practice. (To be concluded.)

PUBLIC-UTILITY PLANTS. Practical Measures for Securing Greatest Economy in Public Utility Plant Operation, Charles Brossman. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 206-208. Proper use of recording and indicating instruments; bonus system; examples of plant neglect.

PURCHASING. Principles of Purchasing and Storing, Dwight T. Farnham, Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 33-38, 6 figs. Instructions concerning storing of materials and supplies, their withdrawal from stock preparing purchasing requisitions, obtaining bids and quotations, placing purchase orders, following up delayed purchase materials, and reporting receipt of materials. From U. S. Employment Service Bulletin.

RATES AND RATE SETTING. Time Studies for Rate Setting on Gisholt Boring Mills (111), Dwight V. Merrick, Cassier's Eng Monthly, vol. 54, no. 5, Nov. 1918, pp. 271-275, 4 figs. Time required in actual manipulation of machine for cuts.

Establishing Basic Rates Saves Time Study Work, Carle M. Bigelow. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 17-22, 5 figs. Using as examples the determination of basic rate for a machine and finding basic rate for manual labor, writer points out how their use gradually increases usefulness of time-study men by simplifying vexatious problems of determining allowed times and repeated studies due to variation of product for single operation.

SHOP EFFICIENCY. The Cultivation of Shop Efficiency, H. J. MacMillan. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 446-447, 9 figs. Contrasts present with past conditions in industrial relationship between employees. In illustration quotes work accomplished by Mueller Mfg. Co.

TOOL SYSTEM. A Simple Tool System, B. L. Van Schaick. Indus. Management, vol. 57, no. 1, Jan. 1919, p. 32, 1 fig. Plan based on actual inventory and formation of central crib where all grinding, dressing and repairing is done.

FINANCE AND COST

COST ACCOUNTING. Cost Accounting to Aid Production—IV. The Principles or Burden Distribution, G. Charter Harrison. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 49-55, 2 figs. Details of method of obtaining machine rates, bringing in use of punched cards and sorting and tabulating machines. (To be continued.)

COST FINDING. True Cost Finding—What It Can Do for the Railroads. Morris Llewellyn Cooke. Indus. Management, vol. 57, no. 1. Jan. 1919, pp. 40-42. States that since main purpose in collecting cost nata is to measure efficiency, its scientific application in railroad operation will provide gage for efficiency of each performance; and that initiative in scheming out an adequate cost finding system should be taken by U. S. Railroad Administration.

COST SYSTEMS AT FACTORIES. Costing at National Factories, W. Webster Jenkinson. Iron and Coal Trades Rev., vol. 47, no. 2645, Nov. 8, 1918, pp. 513-516. Forms of progress records and cost returns; desirability of introducing cost system in a business (Concluded.)

COST SYSTEMS, CONSTRUCTION. How to Figure Construction Costs, Stanley D. Moore. Cement & Eng. News, vol. 30, no. 12, Dec. 1918, pp. 30-32. Note son calculation of sewer system costs. Address at annual meeting of Iowa Eng. Soc.

INSPECTION

FUEL SUPERVISION. Supervision and Fuel Economy. Robert Collett. Official Proc. N. Y. R. R. Club, vol. 29, no. 1, Dec. 1918, pp. 5452-5455. Recommends supervision by friendly counsel and encouragement.

LABOR

BONUSES. Day Labor, Force Account Work and Bonuses, Charles M. Upham. Good Roads, vol. 16, no. 25, Dec. 21, 1918, pp. 239-241. Discusses advantages and disadvantages. Paper presented at meeting of Am. Assn. State Highway Officials, Chicago.

Piece Work and Bonus System (Le travail aux pièces et la prime), M Crémieux. Génie Civil, vol. 73, no. 17, Oct. 26, 1918, pp. 329-333, 8 figs. Established fundamental equations for comparison of these two systems of remunerating workers.

COMPENSATION. Workmen's Compensation, Health Insurance and Hospitals, Thomas Howell. Modern Hospital, vol. 11, no. 5, Nov. 1918, pp. 414-416. Discussion of future relations of charitable hopitals to industry, indicating probable vast changes.

CRIPPLES. An Experimental Employment Bureau for Cripples, Eleanor Adler. Modern Hospital, vol. 11, no. 5, Nov. 1918, pp. 402-405. Brief historical account of efforts to find employment for disabled with reference to establishment of bureau under control of Federation of Assns. for Cripples and the Hudson Guild.

Opportunities for Crippled Soldiers in the Metal Industries, Elsie Plant. Metal Trades, vol. 9, no. 11, Nov. 1918, pp. 448-449, 3 figs. Some of the things disabled men can do, as found by Red Cross Inst. for Crippled and Disabled Men.

DEMOBILZATION. When Labor Comes to Market, Walton H. Hamilton. Survey. vol. 41, no. 14, Jan. 4, 1919, pp. 425-428. Explanation and comment on demobilization chart of U. S. Labor Policies Board showing importance of rate at which demobilization is to be effected, analysis of problem and contingencies upon which solution depends.

Status of the Unproductive Worker, Harry Tipper. Automotive Indus., vol. 39, no. 25, Dec. 1918, pp. 1045-1046. Right of salaried workers to representation in organization with skilled and unskilled employees.

EMPLOYMENT DEPARTMENT. Employment Department. Hog Island Shipyard, Am. Mach., vol. 49, no. 23, Dec. 12, 1918, pp. 1971-1075, 11 figs. Shows forms used and describes process of employing men.

A Definition of "Penny-Wise, Pound Foolish," Applied to the Picking and Developing of Men for Big Jobs, Christian Girl. Monthly Jl., Utah Soc. Engrs., vol. 4, no. 9, Sept. 1918, pp. 169-175. Analysis of characteristics in personnel which contribute to stability of organization. Experience of writer in picking out men. From System.

Selecting Employees. Gas Industry, vol. 18, no. 12, Dec. 1918, pp. 359-362. Forms used by company covering appearance, mentality, and ability of applicants, who are examined on each by different person.

HOUSING. Instances of Industrial Housing. Stone & Webster Jl., vol. 23, no. 6, Dec. 1918, pp. 408-413, 11 figs. General appearance and finish of industrial housing at Mills of Carnegie Steel Co., and Buckeye Coal Co. Developments include building of houses, grading of streets, installation of water and sewer lines, etc

The New E. F. C. Hotel at Hog Island, W. H. Blood. Stone & Webster Jl., vol. 23, no. 5, Nov. 1918, pp. 344-346, 4 figs. Views; rules; conveniences available. Hotel accommodates 2176 men.

INDUSTRIAL COURTS. New Basis for Industrial Relations, Harry P. Kendall. Am. Contractor, vol. 39, no. 52, Dec. 28, 1918, p. 17. Discusses establishment of set of federal industrial courts as in Australia, and formation of boards set by by workmen and their employees with equal representation on each side to determine standards of wages, hours and conditions of employment. Address before Nat. Councillors of Chamber of Commerce of U. S.

LABOR REPRESENTATION. How Labor Representation Operates. Iron Trade Rev., vol. 63, no. 24, Dec. 12, 1918, pp. 1349-1351. Presents plan adopted by Youngstown Sheet & Tube Co., in which the company commits itself to whatever may be declared to be just and equitable.

Political Plan of Organization Satisfactery for Relatively Small Establishments, Harry Tipper. Automotive Indus., vol. 39, no. 26, Dec. 26, 1918, pp. 1083-1084 and 1088. Combined work of employees' representatives and supervisors' committee.

Real Labor Representation, Harry Tipper. Automotive Indus., vol. 39, no. 24, Dec. 12, 1918, pp. 1006-1007 and 1010, 1 fig. Analysis of Midvale Steel & Ordnance Co.'s plan. Organization constituted of legislative and judicial committees elected by employees in the various plants.

LABOR SITUATION. What About Labor? Business Digest & Investment Weekly, vol. 22, no. 12, Dec. 17, 1918, pp. 421-423 and 429. Reasons why, despite resumption of normal business activity, there is hesitancy due to possibilities in labor situation.

MINE LABOR. Employment of Mine Labor, Herbert M. Wilson. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. 83-85. Important aspects of securing and retaining workmen; purpose of Federal Board for Vocational Education.

PIECE-RATE CARD SYSTEM. Layout and Piece-Rate Card Syste n, John J. Borkenhagen. Machy., vol. 25, no. 4, Dec. 1918, pp. 327-329, 13 figs. Forms that assist in efficiency shop management.

RELATIONS BETWEEN EMPLOYEES. A Unique Method of Handling Employees. Jl. Elec., vol. 41, no. 10, Nov. 15, 1918, pp. 443-444. Promoting activities which will foster social relationship between them.

The Human Touch in Supervision, E. C. Clarke. Elec. Ry. Jl., vol. 52, no. 24, Dec. 14, 1918, 1048-1050, 3 figs. Object of management should be to instill spirit of cooperation among employees; how it may be done.

WAGES. The Relation of Wages to Public Health, B. S. Warren and Edgar Sydenstricker. Am. Jl. Public Health, vol. 8, no. 12, Dec. 1918, pp. 883-887. Points out the necessity of providing families with suitable money value commensurate with local necessities and capable of eliminating undesirable factors which may bring about unhealthy conditions. Based on statistics for period 1907-1912.

Standardization and Administration of Wages, H. P. Kendall and E. D. Howard. Jl. Am. Soc. Mech. Engrs., vol. 41, no. 1, Jan. 1919, pp. 35-37. Consequences of system of contractual relations between employers and employees; work of the War Labor Policies Board; post-war labor problems; advisability of establishing system of organized labor participation in management.

WELFARE. Welfare or Manpower Engineering? Frances A. Kellor. Nat. Efficiency Quarterly, vol. 1, no. 3, Nov. 1918, pp. 123-139. Contends that welfare work does not touch basic structure of plant management and that industrial relationship must be built in terms of engineering—impersonal, accurate, just and coordinated.

WOMEN. Wartime Experience With Women Metal Workers. Foundry, vol. 47, no. 317, Jan. 1919, pp. 6-7. Their efficiency has been demonstrated in core shops, foundries and metal-working plants generally and in some respects they have been found superior to men.

Women Workers and Labor Turnover, Ida May Wilson. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 67-68. Temperamental and psychological factors determining complacency and permanency of women employees.

Women in Industry. Travelers Standard, vol. 6, no. 12, Dec. 1918, pp. 237-256, 9 figs. Present and future need for women; their limitations; selecting and training them; supervision and discipline; special aspects of safety problem; hours of labor; sanitation and general welfare; reference to American and European practices.

Woman's Place in Scientific Industry. Cassier's Eng. Montly, vol. 54, no. 5, Nov. 1918, pp. 263-264. Women's labor after demobilization.

The Women in Our Industries. Jl. Elec., vol. 41, no. 11, Dec. 1, 1918, pp. 499-500. Record of situation in U. S. with special reference to conditions in the West.

Developing Latent Labor Forces, John E. Otterson. Nat. Efficiency Quarterly, vol. 1, no. 3, Nov. 1918, pp. 168-178. Women as laborers.

Let the Women Do the Work, D. C. Fessenden. Metal Trades, vol. 9, no. 11, Nov. 1918, pp. 435-438, 4 figs. Experience of several western companies.

LEGAL

Boiler Making. Legal Decisions Affecting Boiler Makers, John Simpson. Boiler Maker, vol. 18, no. 12, Dec. 1918, pp. 339-340. Employer responsible for condition of tools; employers' liability in America and England; employee's risk when precaution is disregarded; decision covering steam-pipe fitting; liability under federal boiler inspection act.

Change of Appliances. Change of Appliances, Chesla C. Sherlock. Power, vol. 48, no. 25, Dec. 17, 1918, p. 887. Some legal decisions.

Engineering License Laws. Engineering License Laws. Can. Engr., vol. 35, no. 25, Dec. 19, 1918, pp. 530 and 535. Report of committee appointed by Am. Assn. Engrs. to gather information concerning state engineering license laws, either proposed or in operation, and to draw up a standard license law.

Labor Legislation. Coordination of Legislative and Operative Functions in Labor Essential to Success, Harry Tipper. Automotive Indus., vol. 39, no. 23, Dec. 5, 1918, pp. 958-959 and 986. Organizatio- fundamentals and changes; experiments in organization and their advantages. (Second series.)

Power Plants. Some Recent Legal Decisions. Power, vol. 48, no. 27, Dec. 31, 1918, pp. 970, 971. Brief reports of some cases involving power plants.

LIGHTING

Chicago Factories. Productive Intensities, Wm. A. Durgin. Trans. Illum. Eng. Soc., vol. 13, no. 8, Nov. 20, 1918, pp. 417-424, and (discussion), pp. 424-428, 6 figs. Illumination survey of Chicago factories having connected load of 100 kw. or more.

Electrical Manufacturing Plants. Improved Lighting of Electrical Manufacturing Plants, F. H. Bernhard. Elec. Rev., vol. 73, no. 24, Dec. 14, 1918, pp 917-922, 7 figs. Last of series of twelve articles on electric lighting in industries.

Inspection. Light, Electricity and the Shop, C. E. Clewell. Am. Mach., vol. 49, no. no. 25, Dec. 19, 1918, pp. 1117-1122, 11 figs. Description of educational plan for state factory inspectors in New Jersey and Pennsylvania and some results accomplished in these states.

Machine Tools. The Lighting of Machine Tools, Cassier's Eng. Monthly, vol. 54, no. 5, Nov. 1918, pp. 276-279, 4 figs. Schemes for lighting punching machine, bench vises, turret lathe and drilling machine.

War Effects. Lighting Units for Commercial, Office and Home Illumination. Elec. Rec., vol. 24, no. 6, Dec. 1918, pp. 45-53, 37 figs. Discussion of present practice with illustrations of the various types; emphasis laid on effect of war.
Wartime Lighting Economies. Trans. Illum. Eng. Soc., vol. 13, no. 8, No. 20, 1918, pp. 387-400 and (discussion) pp. 400-410. Rules limiting use of artificial light to minimum necessary numbers of hours per day, and promoting efficient use of artificial light during those hours. Prepared by Committee on War Service of Illum, Eng. Soc.
See also MARINE ENGINEERING, Yards (Illumination).

PUBLIC REGULATION

Federal Control of Labor. Effect of Federal Control on Railway Labor, W. S. Carter. Ry. Age, vol. 65, no. 24, Dec. 13, 1918, pp. 1031-1064. Outline of efforts to create improved relations between employer and employee.

Water Power Department. A Plan for Power Development, C. Edward Magnusson. Jl. Elec., vol. 41, no. 10, Nov. 15, 1918, pp. 549-460, 1 fig. Scheme permitting Government aid without doing away with private enterprise and its application to State of Washington.

RECONSTRUCTION

Automobile Industry. Some Probable Effects of the War on the Automobile Industry, A. A. Remington, Automobile Engr., vol.. 8, no. 120, Nov. 1918, pp. 306-311, 2 figs. Presidential address before Instn. Automobile Engrs.

British Export Trade. Quantity or Quality, W. Slater, Cassier's Eng. Monthly, vol. 54, no. 5, Nov. 1918, pp. 284-286. Remarks on British export trade.

Canada. Reconstruction in Canada and the Social and Economic Forces Which Will Condition It, J. A. Stevenson. Survey, vol. 41, no. 14, Jan. 4, 1919, pp. 441-446. Problem of repatriation of troops as being worked out by committee of cabinet.
Canada Readjusting from War to Peace, Carroll E. Williams. Mfrs. Rec., vol. 75, no. 1, Jan. 2, 1919, pp. 159-160. Plans of industrial and agricultural work for returning soldiers.

Dumping. The Truth About German Steel Dumping, E. T. Good. Cassier's Eng. Monthly, vol. 54, no. 5, Nov. 1918, pp. 286-288. Warning against introduction into England of German products; former German policy.

Exports. World Markets for American Manufacturers, Lynn W. Meekins. Sci. Am., vol. 120, no. 1, Jan. 4, 1919, p. 12. Factors limiting market in France; how Germany obtained East Indian business; possibilities in Dutch East Indies.
Cultivating Japanese Automotive Field (V), Tom O. Jones, Automotive Indus., vol. 39, no. 25, Dec. 19, 1918, pp. 1059-1061. Opportunities for American tire makers; suggestions to American manufacturers.
Cultivating the Chinese Automotive Field, Tom O. Jones. Automotive Indus., vol. 39, no. 26, Dec 26, 1918, pp. 1106-1107 and 1122, 5 figs. Conditions of Chinese roads as a factor in automotive development; types of cars for China.

Latin-American Exports. Entering the Export Markets of Latin America. IV The Value of Insurance, Percy F. Martin. Cassier's Eng. Monthly, vol. 54, no. 5, Nov. 1918, pp. 280-283. Advisability of insuring shipments against loss or damage.

Post-War Trade. Obstacles to Post-War Trade, Richard Cooper. Soc. of Engrs. Jl. & Trans., vol. 9, no. 11, Nov. 1918, pp. 169-179 and (discussion) pp. 179-187. Sets forth problems of reorganization of industry to peace work. Possible profit from a system of high wages indicated from author's experience in engineering and chemical industry.

Readjustment Problems. Readjustment Problems Confronting America, Harry A. Wheeler. Gas Age, vol. 42, no. 12, Dec. 16, 1918, pp. 511-514. Presidential address before Chamber of Commerce of United States, Atlantic City. Also in Am. Fertilizer, vol. 49, no. 12, Dec. 7, 1918, pp. 38-39.
Reconstruction Problems, M. F. Chase. Bul Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. IX-XI. Parallel between European and American reconstruction problems; cancellation of contracts for war materials.
Petroleum and Reconstruction Problems, Chester Naramore. Bul. Am. Inst. Min. Engrs., no. 145, Jan. 1919, pp. XIV-XVIII. Erroneousness of conception that petroleum demands will decrease after signing of peace. Present leading position of U. S. in industry and means to perpetuate it.
Reconstruction of American Business, Edwin L. Seabrook. Boiler Maker, vol. 18, no. 12, Dec. 1918, pp. 338 and 352. Advisability of Government control during tansitional period; adjustment of wages and prices; special legislation.
Organizing the National for Peace, L. W. Alwyn-Schmidt. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 45-48. Survey of general plans of England, France and Germany for redistributing labor, repatriating army, invalid labor, reestablishing artisans and industrial housing. Also points out difficulties to be faced by United States in meeting world-wide competition.
See also MECHANICAL ENGINEER, Motor-Car Engineering (Exports).

SAFETY ENGINEERING

California State Commission. Accident Prevention, John R. Brownell. Proc. Pacific Ry. Club, vol. 2, no. 8, Nov. 1918, pp. 12-13. Work being done by commission which administers State Compensation Fund created by California legislature in Workmen's Compensation Insurance and Safety Act.

Causes of Industrial Accidents. Factors Concerned in the Causation of Industrial Accidents. Automotive Indus., vol. 39, no. 22, Nov. 28, 1918, pp. 916-918. Comparison of report of Health of Munition Workers Committee of British Ministry of Munitions with U. S. Labor Bureau statistics.
Reduction of Accident Hazard, R. L. Gould, Cassier's Eng. Monthly, vol. 54, no. 5, Nov. 1918, pp. 265-270, 1 fig. Discussion of questions confronting safety engineer in his endeavor to minimize risk of accident to limb and life in industrial plants and suggestions for promoting work.

Cranes. Safety First for Crane and Operator. Jl. Elec., vol. 41, no. 11, Dec. 1, 1918, pp. 524-525, 2 figs. Special protection panel for cranes having three polyphase motors. Panel provides two inverse time-element overload relays for each motor.

Diseases. Diseases and Infections, Chesla C. Sherlock. Am. Mach., vol. 50, no. 1, Jan. 2, 1919, pp. 18-30. Some legal interpretations of liability.

Dust Inhalation. Effects of Dust Inhalation, J. S. Haldane. Queensland Government Min. Jl., vol. 19, no. 222, Nov. 15, 1918, pp. 515-517. Analysis of dust and result of experiments on its reported destructive effects. Paper submitted to Chem. Metallurgical & Min. Soc. of South Africa and to Instn. Min. Engrs.

Eye Protection. Eye Protection in Iron Welding Operations, W. S. Andrews. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 961-966, 7 figs. Charts illustrating spectra of commercially available glasses and their combinations, for use in selecting best protection against radiations of welding arc.

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See also MINING ENGINEERING, Mines and Mining (Fire Protection; Safety).

SALVAGE

Waste Reduction. Conservation of Materials in Our Plants, Francis G. Hall. Am. Drop Forger, vol. 4, no. 11, Nov. 1918, pp. 440-441. Reducing waste by careful handling. (Second of Series.)
Salvaging Miscellaneous Wastes, W. Rockwood Conover. Indus. Management, vol. 57, no. 1, Jan. 1919, pp. 12-16, 3 figs. Methods for salvaging rubber, leather, fibre, rope, string, muslin rags, cloth trimmings, burlap sacks, old belting, asbestos, sheeting, mica, insulation papers, wire, waste paper, boxes, barrels, cans, containers, emery cloth, cotton waste brooms, brushes, oil and fuel gas.
See also MECHANICAL ENGINEERING, Foundries (Salvage Work).

TRANSPORTATION

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MOTOR-TRUCK TRANSPORT. Cost and Charges of Motor Truck Service. Ry. Rev., vol. 63, no. 23, Dec. 7, 1918, pp. 805-810, 9 figs. Some motor truck cost figures.
Rural Motor Express, S. W. Fenn. Jl. Soc. Automotive Engrs., vol. 3, no. 6, Dec. 1918, pp. 383-384 and (discussion), pp. 384-388. Work accomplished in Iowa; moving crops by motor trucks in Idaho; organization of rural lines in Tennessee, Alabama and Georgia.

VARIA

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INDUSTRIAL TECHNOLOGY

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AMMONIUM NITRATE. Coke Makers Now Make Nitrate of Ammonia, Mark Meredith. Chem. Engr., vol. 26, no. 12, Nov. 1918, pp. 451-452. English research proves it is commercially possible to turn ammonia by-product of coke ovens into nitrate of ammonia.

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Recent Progress and Future Development of Chemical Industries in France (Les progrès récentes et l'avenir des industries chimiques en France), Paul Razous. Génie Civil, vol. 73, nos. 19, 20 and 21, Nov. 9, 19 and 23, 1918, pp. 368-371, 390-393 and 407-410. Nov. 19: Potassium and sodium bichmates; mineral colors and varnishes; electrochemical industries; oils, pastes; fermentation; sugars; Nov. 23: Tanning industry; resins distillation of tars; carbonization of wood; artificial coloring.
The Criteria in the Declaration of Chemical Independence in the United States, I. Newton Kugelmass. Science, vol. 48, no. 1251, Dec. 20, 1918, pp. 608-612. Address at meeting of Alabama Section, Am. Chem. Soc.

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Distillation Tar from Mond Gas Plant, A. Gatley Lyons. Chem. Eng. & Min. Rev., vol. 10, no. 121, Oct. 5, 1918, pp. 19-20, 1 fig. Description of installation at Sulphide Corporation Works, New South Wales. Paper before Aust. Inst. Min. Engrs.
The Manufacture of Retort Coal-Gas in the Central States Using Low-Sulphur Coal from Illinois, Indiana and Western Kentucky, W. A. Dunkley and W. W. Odell. State of Ill., Div. Geol. Survey, bul. 21, 24 pp., 3 figs. Present use of central district coals; problems in their use in coal-gas manufacture; results reported; economical advantage of using them.

DUST PRECIPITATION. Removing Foundry Dust by Electric Precipitation, H. D. Egbert. Foundry, vol. 47, no. 317, Jan. 1919, pp. 43-45, 6 figs. Two sets of elecrodes used in Cottrell process, dust being charged with static electricity and attracted to collecting electrodes
Cleaning Blast Furnace Gases by Electrical Precipitation, N. H. Gellert. Mfrs. Rec., vol. 74, no. 24, Dec. 12, 1918, p. 58. Tests on furnace operating on spiegeleisen and having a rated capacity of 200 tons of pig iron per day.

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Preparation and Application of Enamels for Cast Iron, Homer F. Staley. Jl. Am. Ceramic Soc., vol. 1, no. 8, Aug. 1918, pp. 534-555, 3 figs. Details and arrangement of machinery in storing, weighing and mixing raw materials, melting enamel, drying grinding and screening; operations followed in enamelling process; enameling-room equipment.
How High-Grade Enameling is Done, E. C. Kreutzberg. Iron Trade Rev., vol. 63, no. 23, Dec. 5, 1918, pp. 1290-1291, 4 figs. Practice followed in a New York plant.

FILTRATION. Filtration in the Laboratory, Robt. T. Smith. Color Trade Jl., vol. 4, no. 1, Jan. 1919, pp. 21-24. Modern methods; natural suction and under hydraulic head. Suggestions in regard to selection of papers and adaptation of accessory apparatus.

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PICKLING. The Chemistry of Pickling Baths. Automotive Indus., vol. 39, no. 23, Dec. 5, 1918, pp. 960-961. Action of acid on metal below scale; effect of variations in strength of bath and in temperature; modifying action of bath by organic and inorganic materials.
Niter Cake Substitute for Pickling Steel, E. E. Corbett. Blast Furnace, vol. 6, no. 12, Dec. 1918, pp. 497-501. Investigation conducted by U. S. Bureau of Mines chiefly for purpose of conserving sulphuric acid.

PICRIC ACID. The Manufacture of Picric Acid, Alexander Murray. Color Trade Jl., vol. 4, no. 1, Jan. 1919, pp. 5-8, 2 figs. General features of nitrating pots; nitrating operation; description of large installation; crystallization of picric acid.

SILICA PRODUCTS. Study of Silica Products, A. Bigot. Iron & Coal Trades Rev., vol. 47, no. 2645, Nov. 8, 1918, pp. 521-522. Recommendations in regard to grinding rocks and burning products. Abstract of paper before Refractories Section of Ceramic Soc. of Swansea.

SUGAR INDUSTRY. On the Manufacture of Polariscopes in the United States, C. A. Browne. Louisiana Planter, vol. 62, no. 1, Jan. 4, 1919, pp. 12-14. Reasons for and against proposed change in manufacture of saccharimeters and getting away from German sugar scale and starting anew upon international scale proposed by Sidersky and Pellet. Opinions from 14 leading American chemists quoted.

ULTRA-VIOLET LIGHT. Ultra Violet Light (XIX), Carleton Ellis and A. A. Wells. Chem. Engr., vol. 26, no. 12, Nov. 1918, pp. 453-454 and 473. Its application in chemical arts.

YTTRIUM. The Preparation and Properties of Yttrium Mixed Metal, J. F. G. Hicks. Jl. Am. Chem. Soc., vol. 40, no. 11, Nov. 1918, pp. 1619-1625, 1 fig. Preparation in powder form by decomposing anhydrous chlorides with sodium in vacuo and by electrolysis of these chlorides infused condition; study of solution of yttrium earth metals in fused cryolite and of loss of yttrium chloride by volatilization.

WATER GAS. Water-Gas Manufacture with Central Bituminous Coals as Generator Fuel, W. W. Odell and W. A. Dunkley. State of Ill., Div. Geol. Survey, bul. 22, 24 pp., 3 figs. Data gathered by writers during inspection of 20 water-gas plants in Illinois and surrounding states, in which bituminous coal from central mining district of Illinois, Indiana and western Kentucky is being used as generator fuel.

WOOD WASTE. Some Uses of Wood Waste, Armin Elmendorf. Wis. Engr., vol. 23, no. 2, Nov. 1918, pp. 33-39, 2 figs. Methods for converting waste material into products valuable for use in industries.

See also ELECTRICAL ENGINEERING, Power Applications (Electrochemical Processes).

RAILROAD ENGINEERING

ELECTRIC RAILWAYS

ARGENTINA. Electric Traction on the Central Argentine Railway. Ry. Gaz., vol. 29, no. 20, Nov. 15, 1918, pp. 518-524, 8 figs. Rolling stock. (Continuation of serial.)

REGENERATIVE BRAKING. Braking System Permitting Recovery of Energy in Vehicles Operated by Single-Phase Commutator Motors (Système de freinage avec récupération d'énergie pour véhicles actionnés par moteurs monophasés à collecteur), Behn-Eschenburg. Génie Civil, vol. 75, no. 18, Nov. 2, 1918, pp. 347-350, 5 figs. Theoretical aspect of question as suggested from new developments permitting recovery of braking energy at all speeds and with any charge.

ROLLING STOCK. The New Rolling Material of the Dutch Electric Railways Co. (Het nieuwe rollend materieel der E. S. M.), H. F. Adams. De Ingenieur, year 33, no. 46, Nov. 16, 1918, pp. 893-904, 13 figs. Description of new electric cars.

ELECTRIFICATION

CALIFORNIA. Railway Electrification Recommended. Jl. Elec., vol. 41, no. 10, Nov. 15, 1918, pp. 465-466. Report of investigations made preliminary to recommending electrification of mountain divisions of Cal. railroads to Director General of Railroads.

MONTREAL TUNNEL. Electrification of the Montreal Tunnel Zone, William G. Gordon. Proc. Am. Inst. Elec. Engrs., vol. 37, no. 12, Dec. 1918, pp. 1235-1296, 7 figs. Method of constructing tunnel 3.1 miles long; details of equipment of substation and dimensions of locomotives and motor cars; features of catenary system due to local conditions and prevailing extremely low temperatures. Also Elec. News, vol. 27, no. 23, Dec. 1, 1918, pp. 29-30.

LABOR.

WOMEN. Women in the Service of the Railways, Pauline Goldmark. Ry. Age, vol. 65, no. 23, Dec. 6, 1918, pp. 1015-1018. Address before Labor Reconstruction Conference, Academy of Political Science, New York, Dec. 6, 1918.

LOCOMOTIVES

BOILERS. Report of Inspection of Locomotive Boilers, Ry. Rev., vol. 63, no. 26, Dec. 28, 1918, pp. 907-909, 1 fig. Department of Locomotive Inspection shows favorable results notwithstanding handicap of war.

DESIGN. Modern Locomotive Engine Design and Construction (XLIII). Ry. Engr., vol. 39, no. 467, Dec. 1918, pp. 222-227, 4 figs. Different types of superheaters for any desired working pressure; design calculations and formulae.

FEEDWATER HEATING. Locomotive Feed Water Heating, H. S. Vincent. Ry. Mech. Engr., vol. 92, no. 12, Dec. 1918, pp. 645-649, 8 figs. Discussion of exhaust-steam and waste-gas methods of preheating for locomotive boilers.

FIREBOXES. Radiant Heat and Firebox Design, J. T. Anthony, Ry. Mech., Engr. vol. 92, no. 12, Dec. 1918, pp. 658-660, 3 figs. Combustion chambers increase furnace efficiency and radiation; long tubes are of little value. From paper before Central Railway Club, May 1918.

INDIVIDUAL TYPES. 4-6-0 Passenger Engine and Double Bogie Tender: London and South-Western Railway. Ry. Engr., vol. 39, no. 467, Dec. 1918, pp. 228-229 and insert, 3 figs. Working drawings of engine and tender built at Eastleigh, Supplement to illustrations and particulars given in Oct. issue, pp. 184-186.

2-10-2 Type Locomotive for the Rock Island Lines. Ry. Age, vol. 65, no. 23, Dec. 6, 1918, pp. 992-994, 5 figs. Description with drawings and principal data.

A. T. & S. F. 4-8-2 Type Locomotives. Ry. Mech. Engr., vol. 92, no. 12, Dec. 1918, pp. 649-652. 2 figs. Drawings, description and principal data.

STANDARD LOCOMOTIVES. Standard 4-8-2 and Light 2-10-2 Locomotives. Ry. Age, vol. 65, no. 24, Dec. 13, 1918, pp. 1057-1073, 12 figs. Drawings, descriptions and principal data.

STOKERS. Mechanical Stoking of Locomotives, W. S. Bartholomew. Southern & Southwestern Ry. Club, vol. 14, no. 11, Sept. 1918, pp. 10-70 and (discussion), pp. 71-76, 62 figs. General arrangement of various types of stokers and their application to large freight and passenger locomotives; development of duplex stoker; result obtained in different types of locomotives.

SUPERHEATERS. Locomotive Superheater Maintenance. Ry. Mech. Eng., vol. 92, no. 11, Nov. 1918, pp. 621-623, 5 figs. From Bulletin No. 4, Locomotive Superheater Company.

Superheater Locomotive Performance. Ry. Mech. Eng., vol. 92, no. 12, Dec. 1918, pp. 652-655, 1 fig. From committee report presented at 1918 convention of Travelling Engrs' Assn.

THREE-CYLINDER LOCOMOTIVES. Three-Cylinder Locomotives, H. Holcroft. Ry. News, vol. 110, no. 2862, Nov. 9, 1918, pp. 331-332. Outline of British practice and study of problems involved in operating three valves by means of two gears. Paper before Instn. Locomotive Engrs.

TIRES. Falling Weight Test on Railway Tyres, J. H. G. Monypenny. Engineering, vol. 106, no. 2759, Nov. 15, 1918. pp. 545-547, 8 figs. General discussion of this method of testing; suggestions in regard to changes in method.

NEW CONSTRUCTION

HETCH-HETCHY PROJECT. San Francisco's Venture in Railroad Construction, A. J. Cleary. Ry. Age, vol. 65, no. 24, Dec. 13, 1918, pp. 1047-1050, 8 figs. Account of completion of 68-mile line as facility for Hetch-Hetchy project.

OPERATION AND MANAGEMENT

BRITISH. British Railways Under War Conditions. Engineer, vol. 126, no. 3281, Nov. 15, 1918, pp. 410-412. Early events after outbreak of hostilities. (Ninth article.)

British Railway Engineering and Operation—Some Immediate Problems to Be Faced, John A. F. Aspinall. Ry. News, vol. 110, no. 2862, Nov. 9, 1918, pp. 326-330. Presidential address before Instn. Civil Engrs.

FOREMAN. Mission of Railway General Foreman, Robert Quayle. Ry. Jl. vol. 25,, no. 1, Jan. 1919, pp. 28-29. Possible ways in which foremen can approach their men and develop in them loyalty to organization.

FUEL CONSERVATION. Cooperation in Fuel Conservation, D. R. MacBrain. Official Proc. N. Y. R. R. Club, vol. 29, no. 1 Dec. 1918, pp. 5447-5452. Necessity to secure interest in fuel conservation of every one in a railroad operating organization; influence of general condition of locomotive on fuel economy; time and experience required by an engineer to become master of locomotive engineering; education of firemen.

The Responsibility of General Officers for Fuel Economy, R. J. Pearson. Official Proc. N. Y. R. R. Club, vol. 29, no. 1, Dec. 1918. pp. 5445-5447. Importance of establishing system of supervision which will enable officers to ascertain consumption of fuel.

Address of Mr. Eugene McAuliffe. Official Proc. N. Y. R.R. Club, vol. 29, no. 1, Dec. 1918, pp. 5437-5445. Railway fuel, and railway fuel conservation. Working details of Fuel Conservation Section.

RECLAMATION. Reclamation on Chicago, Milwaukee & St. Paul. Ry. Rev., vol. 63, no. 26, Dec. 28, 1918, pp. 903-905. Adapted from report of special committee (H. S. Sackett, chairman) investigating status of reclamation with view to formation of future policy.

TONNAGE RATING. Train Resistance and Tonnage Rating. Ry. Jl., vol. 25, no. 1, Jan. 1919, pp. 29-31. Reports received by Committee of Master Mechanics' Convention from 25 roads, dealing with experience, tests conducted, regulations adopted and methods of supervision.

PERMANENT WAY AND BUILDINGS

BALLASTING. Modern Track Needs Good Ballast, R. C. Cram. Elec. Ry. Jl., vol. 52, no. 25, Dec. 21, 1918, pp. 1080-1085, 14 figs. Why well-ballasted track is economical to maintain; types of construction; properties and materials necessary for ideal ballast; ballast and ballasting from standpoint of best engineering practice.

BASE TRACK. Concrete Base Track Gives Good Results on Northern Pacific Railway. Eng. News-Rec., vol. 81, no. 24, Dec. 12, 1918, pp. 1071-1074, 13 figs. New type of construction four years in actual service; concrete slabs built on gravel roadbed have wood supports for rails; no ballast used; maintenance work not continuous but intermittent.

GRADE CROSSINGS. The Proper Engineering Treatment of Necessary Railroad Grade Crossings. Rodman Wiley. Good Reads, vol. 16, no. 26, Dec. 21, 1918, pp. 241-243. Claims no engineering advice has dictated present policy of establishing crossings in railroads. Paper before Am. Assn. of State Highway Officials, Chicago.

STRESSES IN TRACK. Stresses in Permanent Way. Ry. Engr., vol. 39, nos. 464, 465 and 466, Sept., Oct. and Nov. 1918, pp. 179-181, 191-194 and 211-213, 13 figs. Report of joint committee of Am. Soc. Civil Engrs. and Am. Ry. Eng., Assn., appointed to investigate stresses in railway track.

TIES. A New Concrete Railroad Tie. Mun. & County Eng., vol. 55, no. 6, Dec. 1918, pp. 212-213, 3 figs. Details of tie satisfactorily used for several years on municipal railroad of San Francisco, Cal.

Service Tests of Cross-Tie, P. R. Hicks. Bul. Am. Ry. Eng. Assn., vol. 20, no. 210, Oct. 1918, pp. 21-71. Tables comprising 350 service test records on 28 different species of ties, including 30 completed records submitted by 22 railroads.

Resilient Chairs and Reinforced Concrete Ties for Railway Track. Contract Rec., vol. 32, no. 47, Nov. 20, 1918, pp. 921-922, 2 figs. Details of sleeper said to have given satisfactory service on East Indian Ry.

TRACK IMPROVEMENT. Making the Old Track Last a Little Longer, P. Ney Wilson, Elec. Ry. Jl., vol. 52, no. 24, Dec. 14, 1918, pp. 1053-1054, 5 figs. What Connecticut Co. did to extend life of stretch of track in New Haven, with particular reference to arc welding.

See also CIVIL ENGINEER, Bridges (Railway Bridges).

RAILS

TRANSVERSE FISSURES. Transverse Fissures Cause Rail Failures, Ry. Age, vol. 65, no. 23, Dec. 6, 1918, pp. 1007-1009. Suggests that rails are being stressed beyond service limit. (From report by W. P. Borland, chief of Bureau of Safety of Interstate Commerce Commission of an investigation made by James E. Howard, engineer-physicist of Commission.) Also Ry. Rev., vol. 63, no. 24, Dec. 14, 1918, pp. 843-847, 11 figs.

Reheating as Cure for Rail Fissure, G. F. Comstock. Iron Trade Rev., vol. 63, no. 26, Dec. 26, 1918, pp. 1457-1462, 17 figs. Metallographic investigations of transverse fissures, using a special etching reagent; results apparently support theory that transverse failures are due to defect in steel and that reheating of blooms will diffuse bands of phosphorus. From paper to be presented at Feb. meeting of Am. Inst. Min Engrs.

ROLLING STOCK

CLEANING. Rotary Brushes for Cleaning Cars, C. H. Shaffer. Ry. Jl., vol. 25, no. 1, Jan. 1919, pp. 26-27, 2 figs. Brush operated at about 900 r.p.m. through special flexible shaft used in conjunction with air drill.

REFRIGERATOR CAR, STANDARD. Government Standard Refrigerator Car, Ry. Rev., vol. 63, no. 25, Dec. 21, 1918, pp. 865-868, 5 figs. Data and further description of Government's new design. Detail drawings. Also Ry. Mech. Eng., vol. 92, no. 12, Dec. 1918, pp. 633-668, 6 figs. and Ry. Age, vol. 65, no. 25, Dec. 20, 1918, pp. 1115-1117.

WELDED FREIGHT CAR. Electrically Welded Gondola Car. Ry. Rev., vol. 63, no. 24, Dec. 14, 1918, pp. 833-835, 5 figs. Car constructed for C., B. & Q. R.R. pioneer attempt at fabricating steel freight-car structure by process of electric welding. Also Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 913-915, 8 figs.

SAFETY AND SIGNALING SYSTEMS

ACCIDENT PREVENTION. The Conservation of Man-Power, H. A. Adams. Proc. Pacific Ry. Club, vol. 2, no. 8, Nov. 1918, pp. 7-11. Brief record of work done by Government, Congress and private agencies to prevent accidents in railroad operation, including present endeavors of U. S. Railroad Administration.

SHOPS

A. E. F. REPAIR SHOPS. Railroad Repair Shops in France Equipped and Operated by American Forces, Robert K. Tomlin, Jr. Eng. News-Rec., vol. 81, no. 26, Dec. 26, 1918, pp. 1178-1182, 6 figs. Features of shops; individual electric drive for all machine tools.

ROUNDHOUSE DESIGN. Locomotive Round-House at San Bernardo, Chile (La maestranza de San Bernardo, Chile), C. V. Cruchaga. Boletin de la Societdad de Fomento Fabril, year 35, no. 9, Sept. 1918, pp. 609-614. Details of American design built of concrete and is said to be largest of its kind in the world.

ROUNDHOUSE METHODS. Mileage of Engines—Its Relation to Cost of Shop and Running Repairs, George H. Logan. Ry. Jl., vol. 25, no. 1, Jan. 1919, pp. 24-26. Remarks on shop practice based on experiences in roundhouses.

Accuracy in Locomotive Repairs, M. H. Williams. Ry. Mech. Eng., vol. 92, no. 12, Dec. 1918, pp. 673-677, 8 figs. Methods of making and of fitting new and repair parts for locomotives with gages and micrometers.

TOOLS, BRASS-WORKING. Brass-Working Tools in a Railroad Shop, Frank A. Stanley. Am. Mach., vol. 49, no. 23, Dec. 12, 1918, pp. 1081-1084, 8 figs. Describes tools for making blow-off valves and their fittings.

WELDING. Arc Welding in Railroad Shops, B. C. Tracy. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 887-898, 20 figs. Based on its success in locomotive repair work, writer believes arc welding must be given serious consideration by railroads, not only from an economic viewpoint, but also to increase transportation facilities.

TERMINALS

South Boston. New Haven Improvements at South Boston Terminal. Ry. Age. vol. 65, no. 26, Dec. 27, 1918, pp. 1149-1152, 7 figs. Involve construction of two additional tracks and depressing old line. All done under heavy traffic.

MUNITIONS AND MILITARY ENGINEERING

Ambulance Trains. Ambulance Train of the American Army (Train-Ambulance de l'armée américaine). Génie Civil, vol. 73, no. 18, Nov. 2, 1918, pp. 341-343, 15 figs. Disposition and arrangement of coaches (built in England) for transportation of wounded soldiers.

Automobile Transport. Organization of the French Army Automobile Service, W. F. Bradley. Automotive Indus., vol. 39, no. 26, Dec. 26, 1918, pp. 1093-1095. How repairs were handled. Equipment included 90,000 trucks and 150,000 men.

Military Transport Chassis. Part IX. Automobile Engr., vol. 8, no. 121, Dec. 1918, pp. 346-349, 4 figs. Their performance under war conditions. Details of Pierce-Arrow 5-ton model R. 8 truck.

Camp Holabird—Largest Truck Overhaul Depot. Automotive Indus., vol. 39, no. 25, Dec. 19, 1918, pp. 1053-1055, 8 figs. Data on plant with capacity for assembling 30 trucks a day and crating 22 an hour for shipment.

Construction Work. How Construction Met the Issue, R. C. Marshall. Am. Contractor, vol. 39, no. 51, Dec. 21, 1918, pp. 22-25. Accomplishments of construction Division of War Department. Functions, organizations and procedure; "cost-plus and sliding scale fee contract." Address delivered at meeting of Gen. Contractors' Assn.

Gun Erosion. Experts Discuss Big Gun Erosion, Hudson Maxim. Iron Trade Rev., vol. 63, no. 26, Dec. 26, 1918, pp. 1463-1464. Analysis of causes producing erosion and study of possibilities to overcome them, together with recommendations in regard to material and method of lining. Discussion of Henry M. Howe's paper before Am. Inst. Min. Engrs.

Hand Grenades. Making the American Hand Grenade, Edward K. Hammond. Machy., vol. 25, no. 5, Jan. 1919, pp. 448-453, 15 figs. First of two articles on methods of machining and loading bodies and assembling bouchons.

H. E. Shells. Manufacture of High Explosive Shells and Detonators, from the Metallurgist's View Point, C. B. Swander. Proc. Steel Treating Research Soc., vol. 1, no. 11, pp. 9-14, 5 figs. Outline of forging operations on an 8-in. American carbon-steel high-explosive shell; machining; nosing operation; heat treating; copper banding; placing detonator; British, French and Russian detonators.

Howitzers. How the 155-Mm. Howitzer Is Made, J. V. Hunter. Am. Mach., vol. 49, no. 25, Dec. 19, 1918, pp. 1123-1129, 28 figs. Third article.

Illuminating Shells. Rockets and Illuminating Shells as Used in the Present War, A. Bergman. Illum. Engr., vol. 11, no. 8, Aug. 1918, pp. 189-191. Composition and data on candlepower developed. From paper before Illum. Eng. Soc.

Military Roads. Some Phases of Military Road Work, Gordon F. Daggett. Wis. Engr., vol. 23, no. 3, Dec. 1918, pp. 79-88. Trend of construction during last two years. Difficulties encountered, organizations required and materials availabe in work undertaken at the front. Requirements of wearing surface for military purposes.

Railway Artillery. Railway Artillery, James B. Dillard. Jl. Am. Soc. Mech. Engrs., vol. 41, no. 1, Jan. 1919, pp. 44-49, 5 figs. Development of models; types of cannon used; problems of design: barbette motar carriages; foreign types; American types; auxiliary cars; tactical uses; value and economy of seacoast defence.

Long-Range Heavy Navy Guns with Railway Mount, D. C. Buell. Jl. Am. Soc. Mech. Engrs., vol. 41, no. 1, Jan. 1919, pp. 25-27, 5 figs. Work done in completing mobile battery of naval 11-in. 50-caliber guns originally built for use in battle cruisers.

The War Department Railway Artillery. Ry. Age. vol. 65, no. 25, Dec. 20, 1918, pp. 1113-1114, 5 figs. Brief descriptions of 8-in., 12-in. anh 14-in. railway mounts.

Semi-Steel Shells. How Semi-steel Shells Are Machined. Iron Trade Rev., vol. 63, no. 22, Nov. 28, 1918, pp. 1236-1237, 17 figs. From circular of Ordnance Department recommending standard practice for manufacture of this class of projectile.

Tanks. The Mark VIII Land Cruiser, J. Edward Schipper. Automotive Indus., vol. 40, no. 1, Jan. 2, 1919, pp. 6-9, 11 figs. Technical description of large-sized battle tank developed during latter period of war; equipped with an adaptation of Liberty aircraft engine and weighs 40 tons. Also Motor Age, vol. 35, no. 1, Jan. 2, 1919, pp. 18-21, 9 figs. Mechanical features of huge model that carries 11 men.

Tools for Shell Manufacture. Special Tools and Appliances for Shell Manufacture, George A. Neubauer and Erik Oberg. Machy., vol. 25, no. 5, Jan. 1919, pp. 416-421, 7 figs. Describes number of devices used by Buffalo Pitts Co. in making 4.7 high-explosive shells. (First article.)

Tools for Boring a Closed-Bottom Shell, M. H. Potter. Machy., vol. 25, no. 5, Jan. 1919, pp. 427-428, 6 figs. Types of blades used in boring heads and methods of grinding and setting blades.

See also MECHANICAL ENGINEERING, Foundries (War Demands) Forging (Gun Forgings).

GENERAL SCIENCE

CHEMISTRY

Analysis. Quantitative Analysis of Metals by Electrolytic Deposit Without Using External Source of Electrical Energy (Sur un procédé de dosage des métaux par dépôt électrolytique sans emploi d'une énergie électrique étrangère), Maurcie François. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 20, Nov. 11, 1918, pp. 725-727. From a conductor resting on borders of platinum crucible containing sulphuric acid or similar reagent and salt to be analyzed a zinc or aluminum hook is suspended. Electrolytic action deposits metal in salt at bottom of crucible.

Method of Chromic Oxide Determination, W. C. Kiddell and Esther Kitredge. Chem. Engr., vol. 26, no. 12, Nov. 1918, pp. 457-458. Government chemists claim new method permits rapid handling of ore samples submitted for analysis. (To be concluded.)

Catalytic Exerthermic Gas Reactions. Starting and Stability Phenomena of Ammonia Oxidation and Similar Reactions, F. G. Liljenroth. Gen. Elec. Rev., vol. 21, no. 11, Nov. 1918, pp. 807-815, 7 figs. Explains fundamental characteristics of catalytic exothermic gas reactions.

Methane. Methane, William Matisoff and Gustav Egloff. Jl. Phys. Chem., vol. 22, no. 8, Nov. 1918, pp. 529-575. Formulation of results of research up to date and their classification along physical (constants, specific properties, gas properties, industrial application) and chemical (combustion, explosion, solubility, occlusion, industrial reactions) characteristics; notes on possibilities of research on methane both theoretical and practical.

Occluded Gases in Glass. Gases and Vapors from Glass, R. G. Sherwood. Phys. Rev., vol. 12, no. 6, Dec. 1918, pp. 448-458, 8 figs. Author finds that under the influence of heat there are two distinct kinds of gaseous evolution products, namely, one associated with absorption—readily removable at 200 deg. cent., and other resulting from formation of new chemical equilibria. Also Jl. Am. Chem. Soc., vol. 40, no. 11, Nov. 1918, pp. 1645-1653, 9 figs.

Rare Earths. Observances on the Rare Earths (VIII). The Separation of Yttrium from Erbium: Edward Wichers, B. S. Hopkins and C. W. Balke. Jl. Am. Chem. Soc., vol. 40, no. 11, Nov. 1918, pp. 1615-1619. Comparison between cobalticyanide and nitrite precipitation methods; preparation of erbium material by nitrate fusion method; determination of ratio of erbium oxide to erbium chloride in seven analyses.

Structure of Matter. The Atomic Structure of Carborundum Determined by X-Rays, C. L. Burdick and E. A. Owen. Jl. Am. Chem. Soc. vol. 40, no. 12, Dec. 1918, pp. 1749-1759, 4 figs. Measurements of angles of reflection of palladium X-rays from principal planes of crystal of carborundum and interpretation of measurements of intensities of reflection of different orders. Writers conclude elementary tetrahedron of carborundum differs from that of diamond only in a slight shortening of vertical axis and slight difference in displacement of carbon atoms from centers of tetrahedron.

MATHEMATICS

Elliptic Functions. On the Coefficients in the Expansions of Certain Modular Functions, G. H. Hardy and S. Ramanujan. Proc. Roy. Soc., vol. 95, no. A667, Nov. 7, 1918, pp. 141-155, 2 figs.

Equations. On the Characteristics of Partial Derivative Equations of Second Order (Sur les caractéristiques des équations aux dérivées partielles du second ordre) E. Gau. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 19, Nov. 4, 1918, pp. 675-678. Invariant for characteristics of system by two quadratures.

Systems of Coordinates, G. H. Light, G. H. Light. Univ. of Colo. Jl. Eng., vol. 15, no. 1, Oct. 1918, pp. 23-27, 4 figs. Intrinsic equation of catenary and cycloid in system defined by length of arc and radius of curvature.

Heaviside Development Theory. Generalization of Heaviside Development Theorem (Généralisation du théorème du développement de Heaviside), Abraham Press. Revue Générale de l'Electricité, vol. 4, no. 19, Nov. 9, 1918, pp. 691-693. States that Carson (Phys. Rev. Sept. 1917, pp. 217-225) does not quite generalize theorem in question because the applied forces he considers have the exponential form; writer accordingly takes up case of any forced vibration by discussing general differential equation with constant cofficients.

Rectification of Arc. Notes on a Geometrical Construction for Rectifying Any Arc of a Circle, F. A. Lindemann. Lond., Edinburg & Dublin Phil. Mag., vol. 36, no. 216, Dec. 1918, pp. 472-474, 1 fig. Process involving successive bisections and based on rapidly converging trigonometric series.

Single-Sided Surfaces. A Surface Having Only a Single Side, Carl Hering. Jl. Franklin Inst., vol. 186, no. 5, Nov. 1918, pp. 627-630, 4 figs. Further variations and minor corrections in study of surface generated by line moving along circle, always remaining in planes passing through axis of circle and simultaneously revolving around circle as axis at half angular rate of its movement along circle. Addendum to article in Aug. issue.

PHYSICS

Calorimeters. Calorimetric Lag, Walter P. White. Jl. Am. Chem. Soc., vol. 40, no. 12, Dec. 1918, pp. 1858-1872. Mathematical treatment of elimination of three lag effects of bodies external to calorimeters: (1) change in heat capacity of calorimeter, (2) thermal leakage, (3) loss dependent on jacket temperature.

The Conditions of Calorimetric Precision, Walter P. White. Jl. Am. Chem. Soc., vol. 40, no. 12, Dec. 1918, pp. 1872-1886. Expressing leakage effect as a function of time, thermal head for experimental period and leakage modulus of calorimeter, the effects of diminishing each of these on the values of other two are analyzed and rules for calorimetric precision are derived.

Crystals. Experimental Study on the Growth of Crystals (Etude expérimentale sur le dévelopement des cristaux), René Marcelin. Annales de Physique, vol. 10. Sept.-Oct. 1918, pp. 185-188. Report of observations on paratoluidine. It appeared that these crystals grew not in depth but in surface by successive alluvions.

Formation and Optical Study of Sodium Chromate Crystals Having Four Water Molecules (Mode d'obtention et étude optique des critaux de chromate de soude à 4 molécules d'eau), Lucien Delhaye. Bulletin de la Société Française de Minéralogie, vol. 41, nos. 4-5-6, Apr.-June 1918, pp. 80-93, 4 figs. Experimental research; Variation of three principal indices in terms of wave length; variation of apparent and true angles in turns of wave length; variation of position of bisectors in crystal in terms of wave length.

Crystalloluminescence. Crystalloluminescence (11), Harry B. Weiser. Jl. Phys. Chem., vol. 22, no. 8, Nov. 1918, pp. 576-595, 1 fig. Survey of theories advanced by various investigators concerning nature of triboluminescence (property of many crystalline substances which emit phosphorescent light when rubbed or crushed); theory that it is the result of chemical action and is identical with crystalloluminescence so far as chemical reaction is concerned, differing only between themselves in physical process employed to bring about reaction; experiments with arsenic trioxide and with potassium sulphite.

Curie and Haüy Laws. Note on Curie and Haüy Laws (Sur les lois de Curie et de Haüy), C. Viola. Bulletin de la Société Française de Minéralogie, vol. 41, nos. 4-5-6, Apr.-June 1918, pp. 103-116. Demonstrates inter-connection of the two laws, Haüy's being developed analytically from Curie's differential fundamentals.

Curie Point in Iron. Curie's Point in Pure Iron and Ferrosilicon Alloys (Le point de Curie dans le fer pur et les ferro-silliciums), A. Sanfourche. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 19, Nov. 4, 1918, pp. 683-685. Experimental measurements of termal manifestation at Curie's point. Alloys experimented contained from 0.5 to 2.5 per cent sillicon.

Density of Gases, Determination. An Accurate Method for Measuring the Density of Gases, O. Maas and J. Russell. Jl. Am. Chem. Soc., vol. 40 no. 12, Dec. 1918, pp. 1847-1852, 1 fig. Applicable to gases which can be condensed by liquid air or some other freezing agent. Known volume at known pressure and temperature is liquefied in bulb attached to containing vessel; bulb is then sealed off and gas weighed at room temperature.

Double-Suspension Mirror. The Double Suspension Mirror, L. Southerns. Lond., Edinburgh and Dublin Phil. Mag., vol. 36, no. 216, Dec. 1918, pp. 477-486, 8 figs. Theory of a method of observing deflections in a delicate balance; method a modification of "double suspension mirror."

Drops. Sounds Produced by Drops Falling on Water, A. Mallock. Prlc. Roy. Soc., vol. 95, no. A667, Nov. 7, 1918, pp. 138-143, 6 figs. Theoretical determination of shape of cavity a falling sphere must make when it penetrates a fluid; experimental confirmation by instantaneous shadow photographs of falling shot.

Electromagnetic Vectors. The Electromagnetic Vectors, H. Bateman. Phys. Rev., vol. 12, no. 6, Dec. 1918, pp. 459-481. Geometrical study of an electromagnetic field in relation to a moving observer and location of vectors with aid of two cones which at each point limit directions of forces acting on electric and magnetic charges moving with velocities less than that of light; expression of electromagnetic laws in terms of forces on unit electric and magnetic charges in motion and deductions relating to lines of force, derived from Hargreaves' theorems for space-time integrals; discussion of energy in electromagnetic field; development of theory in regard to amount of concealed euergy in filed of moving electron.

Explosion, Effects of. On the Rupture of Mirrors and Window-Panes by Explosions (Sur la rupture des glaces et des vitres par les explosions). P. Gaubert. Bulletin de la Société Française de Minéralogie, vol. 41, nos. 4-5-6, Apr.-June 1918, pp. 65-67. Explanation for shapes commonly presented by pieces into which a large plate breaks as result of explosion.

Fluorescence. The Physical Characteristics of X-Ray Fluorescent Intensifying Screens, Millard B. Hodgson. Phys. Rev., vol. 12, no. 6, Dec. 1918, pp. 431-435, 2 figs. Fluorescence of various materials discussed from point of view of photographic efficiency; qualitative determination of spectral distribution of fluorescence from calcium tungstate; photographic efficiency of characteristic radiation from silver, tungsten, platinum and lead.

Fluorescence (La Fluorescence), Jean Perrin. Annals de Physique, vol. 10, Sept.-Oct. 1918, pp. 133-159. Destruction of fluorescent bodies by emission of fluorescence; influence of temperature on intensity of emission; molecular and atomic fluorescence; limiting power; fluorescence of concentrated solution; fragility of fluorescent molecules.

Gravitation. On a Peculiarity of the Normal Component of the Attraction Due to Certain Surface Distributions, Ganesh Prasad. Lond., Edinburgh and Dublin Phil. Mag., vol. 36, no. 216, Dec. 1918, pp. 475-476. Cases in which component N of Newtonian attraction at point P along normal through P meeting surface at O tends to no limit as P approaches O along normal.

Impact. The Photographic Study of Impact at Minimal Velocities, C. V. Roman. Phys. Rev., vol. 12, no. 6, Dec. 1918, pp. 442-447, 6 figs. Graphs showing relation between coefficient of restitution and velocity of impact for polished spheres of equal radius of brass, aluminum, hard bronze, whie marble, and lead.

Inflammability of Gaseous Mixtures. The Inflammation of Mixtures of Methane and Air in a Closed Vessel, Richard Vernon Wheeler. Jl. Chem. Soc., vols. 113 and 114, no. 673, Nov. 1919, pp. 840-859, 7 figs. Results of experiments in spherical vessels. Giving data on maximum pressures developed, rates of development of pressure, and speeds of propagation of flame.

Ionization. Ionization of Mercury, Sodium and Potassium Vapors and the Production of Low Voltage Arcs in These Vapors, T. C. Hebb. Phys. Rev., vol. 12, no. 6, Dec. 1918, pp. 482-490, 2 figs. Concludes from experiments that: Potassium vapor can be ionized at 1.6 volts; sodium vapor at 2.5 volts; D lines of sodium can be excited at less than 1.0 volt; sodium and potassium arcs in mercury vapor can operate below their resonance potentials and as low as 1.4 for sodium and 0.5 volts for potassium; mercury spectrum can be produced at 0.5 volt in atmosphere of mercury and potassium.

Latent Heat of Fusion. Latent Heat of Fusion as the Energy of Molecular Rotations, Kôtarô Honda. Phys. Rev., vol. 12, no. 6, Dec. 1918, pp. 425-430. Tables and calculations, based on Landolt and Bornstein's values, which lead writer to assert that latent heat of fusion consists of energy of rotation of molecules gained during fusion.

Light Emission. On the Light Emitted from a Random Distribution of Luminous Sources, Lord Rayleigh. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 216, Dec. 1918, pp. 429-449, 3 figs. Mathematical treatment of probable expectation of intensity in any direction. By "expectation" is meant the mean of a large number of independent trials, or combinations, in each of which the phases are redistributed at random. Sonorous vibrations are considered but the results are shown to be applicable to electric vibrations.

Light Polarization. The Light Scattered by Gases: Its Polarization and Intensity, R. J. Strutt. Proc. Roy. Soc., vol. 95, no. A667, Nov. 7, 1918, pp. 155-176, 5 figs. Measurements of intensity of vibrations parallel to existing beam of light scattered at right angles by gases and vapors; particular study of behavior of helium; evaluation of intensity of scattering by different gases in terms of refractivity; photographs of polarizations of ether, vapor and nitrous oxide.

Liquid Films. The Stratification of Liquid Films. (La stratification des lames liquides), Jean Perrin. Annales de Physique, vol. 10, Sept.-Oct. 1918, pp. 160-184. Result of Johonnott's microscopical examination of soap bubbles; superficial tension of soap solutions; law of multiple thicknesses; chemical separation by simple extension of free surfaces.

Pitched Baseball. A Pitched Baseball, Willard W. Griffin. Sci. Am. Supp., vol. 87, no. 2244, Jan. 4, 1919, pp. 12-14, 3 figs. Mechanical analysis of a "floater" and other curved ball paths.

Radioactivity. The Problem of Radioactive Lead, Theodore W. Richards. Science, vol. 49, no. 1253, Jan. 3, 1919, pp. 1-11. Account of experimental researches; hypothesis concerning disintegration of uranium; hypothetical calculation of atomic weight of uranium-lead; solubility of two kinds of lead nitrate; comparison of properties of different kinds of lead. Presidential address before Am. Assn. for Advancement of Science.

Sound, Standard of. A Possible Standard of Sound, Chas. T. Knipp. Phys. Rev., vol. 12, no. 6, Dec. 1918, pp. 491-492, 1 fig. Adjustment of mercury vapor trap of pyrex glass to furnish sound of desired pitch. From paper presented at meeting of Am. Phys. Soc.

Specific Heat. Specific Heat Determination at Higher Temperatures, Walter P. White. Am. Jl. Sci., vol. 47, no. 277, Jan. 1919, pp. 44-59, 4 figs. Experimental technique at temperatures up to 1400 deg. cent. by method of mixtures; modifications in furnaces and in methods of transferring to calorimeter; variability of heat losses attending dropping of hot bodies into water; use of aneroid calorimeters.

Silicate Specific Heats, Walter P. White. Am. Jl. Sci., vol. 47, no. 277, Jan. 1919, pp. 1-43, 4 figs. Experimental determination for temperatures from 100 to 1400 deg. cent. by dropping from furnaces into calorimeters; checks and precautions employed; two methods for determining true or atomic heats from interval heats. Paper extends scope of writer's previous communications.

The Specific Heat of Platinum at High Temperatures, Walter P. White. Phys. Rev., vol. 12, no. 6, Dec. 1918, pp. 436-441. Redetermination of specific heat from 100 to 1300 deg. cent. with precision of 0.3 per mile. Results agree with those of Gaede, Plato, Corbino, Magnus and Fabaro.

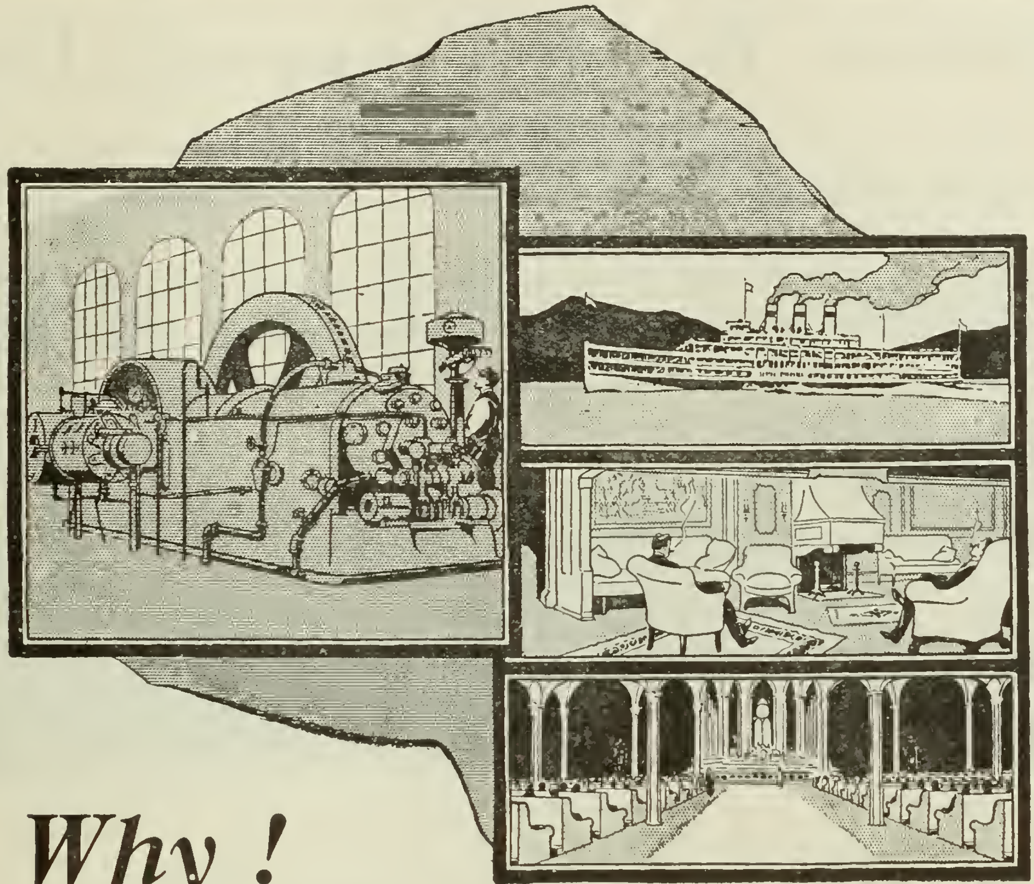
Spectra. The Origin of Spectra, J. C. McLennan. Proc. Phys. Soc. Lond., vol. 31, no. 176, Dec. 15, 1918, pp. 1-29, 14 figs. Outline of investigations undertaken since Frank and Hertz' measurements of mercury-vapor ionization potential and further experimental researches including also vapors of zinc, cadmium and magnesium. Ultraviolet region investigated with a fluorite spectograph and extreme ultraviolet region with a vacuum grating spectrograph. General discussion of results obtained by writer and other investigators.

On the Ultraviolet Spectra of Magnesium and Selenium, J. C. McLennan. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 216, Dec. 1918, pp. 450-460, 2 figs.

On Fundamental Frequencies in the Spectra of Various Elements, J. C. McLennan. Lond., Edinburgh & Dublin Phil. Mag., vol. 36, no. 216, Dec. 1918, pp. 461-471, 7 figs. Extensive experimental research with photographic records. It is concluded that when zinc and cadmium vapors respectively are bombarded by electrons whose kinetic energy is gradually increased, monochromatic radiation is suddenly emitted by vapor when impact voltage reaches certain value, beyond which no additional relation is produced.

Welsbach Mantle. A Physical Study of the Welsbach Mantle, Herbert E. Ives, E. F. Kingsbury and E. Karrer. Jl. Franklin Inst., vol. 186, no. 5, Nov. 1918, pp. 585-625, 21 figs. Extension of Ruben's work on thoria-ceria mixtures to large family of such combinations; from investigation of conditions under which visible absorption bands of ceria and other materials appear and disappear, an explanation is offered of different behavior of mantle in flame and cathode-discharge heating; attempt to fix possible attainable efficiencies of gas-light production by present methods (Concluded from p. 438, Oct. 1918.)

See also ELECTRICAL ENGINEERING, Electrophysics (Vapor Arms).

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THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

"TO FACILITATE THE ACQUIREMENT AND INTERCHANGE OF PROFESSIONAL KNOWLEDGE AMONG ITS MEMBERS, TO PROMOTE THEIR PROFESSIONAL INTERESTS, TO ENCOURAGE ORIGINAL RESEARCH, TO DEVELOP AND MAINTAIN HIGH STANDARDS IN THE ENGINEERING PROFESSION AND TO ENHANCE THE USEFULNESS OF THE PROFESSION TO THE PUBLIC."

REPORT OF
ANNUAL GENERAL MEETING AND PROFESSIONAL MEETING

OTTAWA, FEBRUARY 11th, 12th, 13th.

MARCH 1919

PUBLISHED MONTHLY BY THE ENGINEERING INSTITUTE OF CANADA,

AT 176 MANSFIELD STREET, MONTREAL

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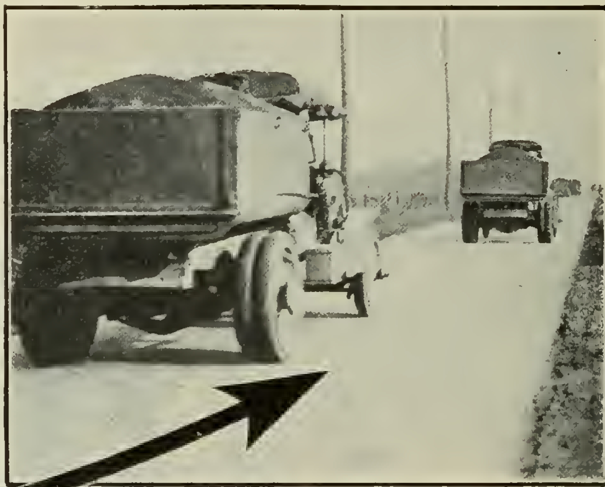

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VOLUME II — MONTREAL, MARCH 1919 — NUMBER 3

REPORT OF THIRTY-THIRD ANNUAL MEETING

The Annual General Meeting and a General Professional Meeting were held at Ottawa, February 11th, 12th and 13th at the Chateau Laurier.

Morning Session, February 11th.

The meeting was called to order at ten o'clock a.m. President H. H. Vaughan in the chair.

The Secretary read the minutes of the regular Annual Meeting held in Montreal on January 28th, which adjourned to meet in Ottawa this date, as follows:

Minutes of the Thirty-Third Annual Meeting of *The Engineering Institute of Canada*, held at 176 Mansfield Street, on Tuesday, January 28th.

The meeting was called to order at 10.30 a.m. by President H. H. Vaughan.

Reading of Minutes: The President announced that the first order of business was the reading of the minutes of the last Annual Meeting. On motion by J. A. Burnett, seconded by O. Lefebvre and carried, the minutes of the last Annual Meeting were taken as read.

Appointment of Auditors: It was moved by W. F. Tye, seconded by J. M. R. Fairbairn, that Messrs. Riddell, Stead, Graham & Hutchison be appointed auditors. Carried.

Appointment of Scrutineers: It was explained by the President that it has been the custom for the auditors to count the ballot and report to the scrutineers appointed at the meeting, who in turn report back to the meeting. It was moved by S. F. Rutherford and seconded by L. G. Papineau, that Messrs. Chace Thomson and O. Lefebvre act as scrutineers. Carried.

Adjournment: The President stated that there was no other business on the agenda. It was moved by A. W. Robinson, seconded by P. B. Motley, and carried, that this Annual Meeting be adjourned to meet in Ottawa on February 11th at 10.30 a.m.

The President declared the meeting adjourned and thanked the members for their attendance.

Report of Council for 1918

The Secretary read the first portion of the Report of Council for the year 1918, as set out on pages fifty-nine and sixty of *The Journal of The Institute*, issue of February 1919.

It was moved by Geo. A. Mountain, seconded by W. F. Tye, that the balance of the report be taken as read, and that the report be adopted. Carried.

Report of Finance Committee

In the absence of R. A. Ross, Chairman of Finance Committee, the Secretary read the report as appearing on page sixty-nine of the February issue of *The Journal of The Institute*. Lieut.-Col. R. W. Leonard moved the adoption of the report, seconded by A. W. Robinson. In speaking on the motion Mr. Robinson congratulated *The Institute* and the Secretary for being able to show that *The Journal* is self sustaining. By expanding its usefulness it will be a potent factor in the success of *The Institute*. He called for support for *The Journal* to make it an efficient medium of discussion and a means for the publication of timely articles contributed by the members. President Vaughan in confirming the statement that *The Journal* was now self sustaining, felt that the members should know of the difficulty experienced in obtaining the consent of the postal authorities to grant statutory privileges to *The Journal*. It had been necessary to pay full postage, resulting in an expenditure of eight or nine hundred dollars more than would have been necessary. Opposition from existing technical papers he was convinced, was the cause of this. It had put us to a lot of trouble and inconvience. Continuing, he said, " We are receiving good support from the business firms and every member should realize that the more support he gives *The Journal* the stronger it will be. We want *The Journal* to be something like the Journal of the American Society of Mechanical Engineers, which is an index of the Manufacturing concerns in United States. Incidentally, advertising is not a good thing for a Journal of this kind if the people do not use it as an index. Once we get above a certain point—and we can bring it above that point if we try—we will have a Journal that will really be an index to the manufacturing concerns in the country and then our *Journal* will be on the safe side.

In response to a question by Mr. Mountain, regarding reduced postage on the transactions, the Secretary stated that this privilege had been discontinued years ago and would not be renewed. He referred to a report of the special meeting of the Executive Committee which had been ratified by Council and published in the February *Journal*. It is intended that in addition to publishing *The Journal*, proceedings will be issued each year and to overtake those not issued in 1918 steps have been taken to have them printed and issued to the members in two volumns, one dealing with the Quebec Bridge and the other containing the general papers of *The Institute*. Transactions will be issued as in the past.

Mr. Francis: " May I take the liberty of suggesting to the meeting that *The Institute* is probably in a much better financial condition than the report itself would indicate. I understand that later reference will be made to that great and glorious number of members of *The Institute* who are in Service; the point I wish to make at the moment is that while over one-third of our men are in military service and our exchequer is short to that extent because of their being relieved of the payment of dues, the Finance Committee has been able to produce a report on which I firmly believe that *The Institute* is to be soundly congratulated. We have been going ahead under the greatest sort of handicap, yet we have a very respectable financial report, and in addition to that we have a going *Journal*."

The motion for the adoption of the report was duly carried.

Report of the Library and House Committee

It was moved by Geo. A. Mountain, seconded by Arthur Surveyer that the report of the Library and House Committee set out on page sixty-five of the February issue of *The Journal* be taken as read and adopted. Carried.

Report of Papers Committee

Walter J. Francis, Chairman of the Papers Committee read the report as follows:

The Papers Committee for the year 1918-1919, the first to be appointed under the new by-laws, duly commenced its work of advising and assisting the Branches in obtaining papers and in co-operating for the General Professional Meetings of *The Institute*. The personnel of the Committee consists of the Chairman of each of the Branches of *The Institute*. The number of members is limited to ten by the by-laws. The new Branches formed during the year have had representation on the Committee, each Chairman being invited to co-operate. A recommendation has been made to amend the by-laws so as to fix the personnel of the Committee as one for each Branch, and eliminate the number ten now given in the by-laws. In Montreal the conditions have changed during the year as a result of the formation of the Montreal Branch, and the Papers Committee has exercised itself by co-operating with the Montreal Branch until it was in a position to carry out its own programme independently of the old headquarters arrangements.

It has been difficult to procure a large number of meritorious papers during the year owing to the continuation of war conditions, nevertheless, the Committee has been most fortunate in securing many very worthy papers, some of which have already been read or have been definitely arranged for. Apart from the Quebec Bridge series which has been continued from last year, and to which reference is made in the succeeding paragraph, the following papers are worthy of special reference:— " Frazil Ice," by R. M. Wilson, M.E.I.C., a paper containing much research work of great interest to hydro-electric power engineers as well as to the profession generally; " Reinforced Concrete Covered Reservoirs," by R. deL. French, M.E.I.C., probably the most complete paper on this new branch of engineering art which has yet been written; "A Description of the Reinforced Concrete Viaducts of the C. P. R., near North Toronto," by B. O. Eriksen, A.M.E.I.C., and S. H. Deubelbeiss, A.M.E.I.C., a brief but very comprehensive and valuable description of a unique and highly advanced type of bridgework; " The Mount Royal Tunnel," by J. L. Busfield, A.M.E.I.C., a most comprehensive description of the complete tunnel under Mount Royal for the C. N. R.; " Kettle Rapids Bridge," by W. Chase Thomson, M.E.I.C., a complete description of an unusual bridge problem; " Nicu Steel," by Lt.-Col. R. W. Leonard, M.E.I.C., the presentation of an entirely new metallurgical product; " Champlain Dry Dock," by U. Valiquet, M.E.I.C., a full description of this new structure; " Fuels," by B. F. Haanel, M.E.I.C., a clear-cut statement of the situation in connection with this important Canadian problem; " Progress in Metallurgy," by Dr. A. Stansfield, Assoc. E.I.C. It would be very much in the interest of *The Institute* if more papers were obtainable from points other than Montreal.

The Quebec Bridge series was continued into the present year and following the papers and addresses already given by Lt.-Col. C. N. Monsarrat, M.E.I.C., George F. Porter, M.E.I.C., and Phelps Johnson, M.E.I.C., an exhaustive paper on the original designs of the bridge was presented by G. H. Duggan, M.E.I.C. The series is being concluded by a complete description of the superstructure under the joint authorship of Phelps Johnson, M.E.I.C., G. H. Duggan, M.E.I.C., and George F. Porter, M.E.I.C.

It is felt that a very great service was rendered to *The Institute* in general by the kindness of St. Lawrence Bridge Company and the interest of George F. Porter, M.E.I.C., in enabling him to visit all the Branches of *The Institute* and deliver illustrated addresses on the bridge. The enthusiasm with which this illustrated lecture was received was very marked and your Committee feels that the Branches probably received more value by way of public recognition through the presentation of this address than by any other single effort. The itinerary was arranged through the Papers Committee.

A marked innovation resulting from the new by-laws was the holding of General Professional Meetings during the year, one at Toronto, one at Saskatoon and one at Halifax. The programme for each of these meetings was thoroughly worked out by the local committees co-operating with the Papers Committee, and in each case was intended to be of special interest to the district.

This report should not close without reference to the publication of *The Journal*, which it is believed is proving of great value to *The Institute* as a whole and to every one of its members. The issuing of *The Journal* has rendered it necessary to revise the old system of publishing advance proofs. Your Committee in completing the work of its period, which, although nominally now at an end, actually continues until the close of the season in May, has found great difficulty in arranging for matter for *The Journal* which comes out only once a month, whereas the meetings of the Branches of *The Institute* and the Professional Meetings are held very much more frequently than once a month. The Committee is co-operating with the Council and the other Committees in an effort to bring about the most advantageous use of *The Journal* and all other available means of communication with the members.

On behalf of the Papers Committee,
WALTER J. FRANCIS,
Chairman.

Montreal, January 21st, 1919.

In moving the adoption of the report, Mr. Francis stated that the list of papers submitted reflected great credit on *The Institute*. The motion was seconded by Arthur Surveyer.

Mr. Vaughan: " You will notice that in *The Journal* we have been printing, as referred to in the annual report, an engineering index containing abstracts from eleven hundred publications. This was obtained largely through the kindness and co-operative spirit of the American Society of Mechanical Engineers. It is of very great value to us and greatly improves *The Journal*. It would be entirely in order for us to pass a vote of thanks to the American Society of Mechanical Engineers for their kindly co-operation and their generosity in permitting us to print this engineering index monthly.

Motion for the adoption of the report carried.

Professor H. E. T. Haultain moved, seconded by O. Lefebvre, that the thanks of this *Institute* be tendered to the American Society of Mechanical Engineers for the kindness, generosity and the co-operative spirit that they have shown in permitting *The Engineering Institute of Canada* to print the Engineering index in their *Journal*. Carried.

Report of Publications Committee

W. F. Tye moved, seconded by Col. Harkom that the report of the Publications Committee as set out on page sixty-six of the February *Journal* be taken as read and adopted.

Carried.

Report of Engineering Standards Committee

The report of the Engineering Standards Committee was presented by Mr. Vaughan as follows:—

The Engineering Standards Committee was organized at the request of the Institution of Civil Engineers transmitted to the members of that Institution resident in Canada, of which, as you probably know, a small committee is in existence acting as an advisory committee to the Council of the Institute of Civil Engineers. The request was also transmitted from the Board of Trade through the Canadian Government. As a result of this request a committee was organized having representation from the members of the Institution of Civil Engineers resident in Canada, *The Engineering Institute*, the Mining Institute, the Honourary Advisory Council, the Manufacturers' Association and the various departments of the Dominion Government. That committee appointed a sub-committee on aeroplane parts and another sub-committee on the standardization of screw threads. The matter having been taken up directly through the British and the American Governments, our action was unnecessary, but the committee on aeroplane parts held several meetings and sent delegates to the meeting of the International Aircraft Standard Board held in London, on which are representatives of France, Italy, United States, Great Britain and Canada, Canada having been honored by recognition as a separate nation on that Board. The Committee of the Canadian Engineering Standards Committee was recognized as the Canadian Committee on aircraft matters. Since that time the Canadian Engineering Standards Committee has been incorporated as the Canadian Engineering Standards Association and its organization has been changed to include these members from the Institution of Civil Engineers, three nominations from *The Engineering Institute of Canada*, three from the Mining Institute, three from the Manufacturers' Association, three from McGill, three from Toronto University and three from Laval, with three honourary or advisory members from the departments of the Government. That is the situation to-day. They have applied to the Government for a grant to enable them to carry on their work during the coming year, and while that Association may in some ways be considered as of comparatively little value in Canada, there is quite a prospect as we look into the matter that we shall find an important and useful work to do. This *Institute* is represented on that Committee to-day by G. H. Duggan, Dr. Herdt and H. H. Vaughan. The membership will retire annually and have to be renominated or three members elected from time to time.

Mr. Mountain moved, seconded by Mr. Tye, that the report be received. Carried.

Report of Electro-Technical Committee

Mr. Francis moved, seconded by Mr. Tye, that the report of the Electro-Technical Committee, as printed on page sixty-six of the February *Journal* be taken as read.

Report of Board of Examiners and Education

Mr. Tye moved, seconded by Mr. Kennedy, that the report of the Board of Examiners and Education as set out on page sixty-six of the February *Journal*, be taken as read. Carried.

Board of Examiners—Quebec Act

No report.

Gzowski Medal

The Secretary reported for the Committee on the Gzowski Medal, awarding the medal for the year 1918 to B. F. C. Haanel, member of *The Institute*, for his paper on " Fuels of Canada, " read at the last annual Meeting.

Students Prize

The Secretary announced that heretofore the Students Prize had been awarded by the Gzowski Medal Committee. This year Council requested a Committee of which Professor Mackay of McGill University is the Chairman, to make the award. This Committee finds only one paper of those submitted to be of sufficient merit to award the prize and recommends that for that paper " Scientific Management and Efficiency," by Donald DeC Ross-Ross be awarded the prize.

Plummer Medal

It was announced by the Secretary that the Plummer Medal Committee had been appointed by Council towards the end of the year and had drawn up regulations which had not yet been approved by Council. This Committee desires that the award be made next year on papers presented on a metallurgical subject during 1918 and 1919.

Leonard Medal

Regulations for this medal were drawn up only during the past year and are published in *The Journal.* No award has been made, but it is intended that an award be made in 1919.

Report of Honour Roll Committee

The Secretary read the report of the Honour Roll Committee as follows:

The records of *The Institute* show that nine hundred and sixty of our members have been engaged in active service in connection with the war. It is believed that this will be increased to at least one thousand from the list of the members whose addresses have not been known for several years.

The members known to be engaged in active service represent thirty-six percent of our total membership eligible for military service. The balance of our members were largely engaged in war work in Canada—the manufacture of munitions and other necessary war material. Those not so engaged were contributing to the absolute essentials such as the railroads, municipal works and the engineering and technical departments of the Provincial and Federal Governments.

Of the nine hundred and sixty on the Honour Roll, nine hundred and forty-three are known to be officers. These are:—

Brigadier-Generals	9
Colonels	9
Lieutenant-Colonels	35
Majors	114
Captains	110
Lieutenants	329
Non commissioned officers, etc	377

We have lost of our number, either by being killed in action or having died of wounds, a total of seventy-five.

Within the past three months most of the information regarding decorations given our members has been received, showing that our knowledge at present is limited as to the extent to which our men have been decorated for distinguished services. Even the incomplete information shows that we have reason to be proud of the record they have achieved. Of the known awards there are:—

Victoria Cross	2
K.B.E.	1
C.M.G	9
C.B.	1
D.S.O.	29
M.C.	55
M.M.	2
D.C.M.	2
Croix de Guerre	5
Croix de Légion d'honneur	3
Order of Ste. Anne	1

In addition one of our members Col. C. H. Mitchell, who has been awarded nearly every known decoration has been honoured by the Kings of Belgium and Italy.

History records no more heroic action than that for which one of our Associate Members, Captain Coulson Norman Mitchell, M.C., of Winnipeg, received the Victoria Cross. The bare official citation, giving the account of his heroic triumph is thrilling. It reads:—

" Capt. Coulson Norman Mitchell, M.C., Fourth Battalion, Canadian Engineers, for most conspicious bravery and devotion to duty on the night of October 8th-9th, 1918. At Canal Lescault northeast of Cambrai, he led a small party ahead of the first wave of infantry, in order to examine various bridges on the line of approach, and, if possible, to prevent their demolition. On reaching the canal he found the bridge already blown up. Under a heavy barrage he crossed to the next bridge where he cut a number of lead wires. Then, in total darkness, unaware of the position and strength of the enemy bridgehead, he dashed across the main bridge over the canal bridge. This he found to be heavily charged for demolition. Whilst Capt. Mitchell assisted by his non-com., was cutting the wires, the enemy attempted to rush the bridge in order to blow up the charges, whereupon he at once dashed to the assistance of his sentry who had been wounded. He killed three of the enemy, captured twelve, and maintained the bridgehead until reinforced. Then under a heavy fire he continued the task of cutting the wire, removing charges which he well knew might at any moment have been fired by the enemy. It was entirely due to his valor and decisive action that this important bridge across the canal was saved from destruction."

C. N. Monsarrat,
Fraser S. Keith.

D. B. Dowling, President, Canadian Mining Institute, expressed his keen appreciation of the services which *The Engineering Institute* rendered during the war.

General Specification for Steel Railway Bridges

The Chairman announced that the report of the Committee on Steel Bridges Specifications had been printed in December issue of *The Journal.* It was moved by Geo. A. Mountain and seconded by H. P. Borden, that the report be received and referred to the Council for further action. Carried.

Roads and Pavements Committee

Geo. Hogarth read the report of the Roads and Pavements Committee and moved, seconded by G. H. Bryson that the report be received and referred to Council. Carried.

Steam Boilers Specifications Committee

The Secretary read the report of the Committee on Uniform Boiler Specifications for the Dominion of Canada, consisting of R. J. Durley, W. G. Chace, F. G. Clark, D. N. Robb, Logan Waterous, H. H. Vaughan and L. M. Arkley, Chairman, as follows:

At a meeting of the above committee a sub-committee, consisting of Messrs. F. G. Clark, Chief Engineer, Toronto Power Co.; James Laing, Designing Engineer of the John Inglis Co.; J. O. B. Latour, Chief Engineer, General Accident Assurance Co.; D. M. Metcalf, Chief Boiler Inspector for Ontario, and the writer, were appointed to compare the present Ontario Boiler Rules with those of the Western Provinces and the American Society of Mechanical Engineers, and formulate a set suitable for the whole Dominion.

This sub-committee did a lot of work along the lines suggested, but suspended operations on learning that the Chief Boiler Inspectors for Ontario and the Western Provinces were compiling a similar set of rules. It was felt that by continuing there would be a duplication of effort, and that we might help defeat the object for which the committee was formed.

The Chief Inspectors, together with representatives from Quebec and Nova Scotia, held a conference in Winnipeg last September and the rules formulated are now being put in shape for distribution. They have agreed to furnish your committee with a copy of these for constructive criticism before sending them on to their respective Provincial Legislatures for adoption.

We believe that by co-operating in this way with the Chief Inspectors we can best further the ends for which the committee was appointed, and that in the near future there will be a uniform set of Boiler Rules for the whole Dominion of Canada.

We would, therefore, ask that the committee be continued to carry on the work as outlined above.

Respectfully submitted,
L. M. Arkley,
Chairman.

Reports of Branches

Report of Calgary Branch

The Secretary read the report of the Calgary Branch, which is printed on page seventy-two of the February *Journal*. In the published report the names of the Officers who signed the report were omitted; G. W. Craig, Chairman, and C. M. Arnold, Secretary-Treasurer.

It was moved by the Secretary and seconded by Brigadier-General Sir Alexander Bertram, that the report of the Calgary Branch be adopted. Carried.

Report of the Montreal Branch

Moved by Mr. Francis, seconded by Mr. Surveyer, that the report of the Montreal Branch, as printed on page seventy-three and following pages of the February *Journal* be adopted.

Mr. Vaughan: " I wish to call the attention of the membership to the splendid work that has been done by Mr. Francis and his Committee in the organization of the Montreal Branch this year. As you know it was decided at the last meeting to do away with what we might call Headquarters activity as far as meetings were concerned, this function being carried on by the Montreal Branch, which has set an example that other Branches might follow. You will see from the list of their papers that they have organized civil, electrical, mechanical and industrial sections and they are having papers of interest to every class of engineer. They are holding a meeting practically every week. One week the mechanical section, next week the civil, next week the electrical and the next week the industrial, so that every engineer living in Montreal can become interested in the work of the Branch. The Chairmen of the sections have been appointed and have taken a great interest in working up the papers and the attendance at their respective sections. The attendance at their meetings has been excellent, and I feel that if we are to contine to be successful as *The Engineering Institute of Canada* and to take in all branches of engineers we have to do in each of our large branches just what the men in Montreal Branch have done—that is, develop the section work and get all branches of engineers interested in it. The Montreal Branch has done splendid work this year under very difficult circumstances. They have taken hold of an entirely new proposition, with a large number of members; they have got them organized and held meetings —and this has been done only by an enormous amount of work on the part of the executive. I draw your attention to this not only because *The Institute* owes a debt of gratitude to the officers of the Montreal Branch for the work they have done, but also because what they have done is a model of what might be accomplished in the other large branches of *The Institute.*

Motion for the adoption of the Report carried.

Report of the Quebec Branch

The report of the Quebec Branch was printed on page seventy-six of the February *Journal.*

The President pointed out that in this report of the Quebec Branch attention is drawn to a resolution forwarded by them in December last, to the effect that our profession is not having proper representation on various commissions which have been undertaken in connection with engineering and requesting that the Executive Council bring its influence to bear on the Government for commissions for the apointment of corporate members of *The Engineering Institute* or graduates from recognized engineering universities to fill all engineering positions, thus protecting the public and raising the standing of *The Institute* and the profession. A memorial is now being drawn up requesting the Government to consider the appointment of more engineers on Government positions.

It was moved by Mr. Harkness, seconded by Mr. Dunn, that the report be adopted. Carried.

Report of Hamilton Branch

The Secretary in moving the adoption of the report as published on page seventy-six of *The Journal* of February, stated that it was a very satisfactory report of a new Branch. It was established on July 26th, having held several meetings where important papers were read, the financial statement showing a balance in the bank of seventy-eight dollars and twenty-six cents. The Hamilton Branch has co-operated with the Board of Trade in Hamilton in the matter of public service and has taken an interest in municipal and other matters relating to the general welfare of the public. Such activity deserves special commendation on the part of *The Institute*, the Hamilton Branch having done remarkably for the length of time it has been in existance. Mr. Mountain seconded the motion, stating that he had the pleasure of attending the meeting of the Hamilton Branch the other evening at which there were about one hundred and fifty present. Mr. Vaughan called attention to the fact that the financial statement shows forty-five dollars as having been received by way of fees from affiliates. He wished to direct particular attention to the good work done by the Hamilton Branch in securing affiliates as he had to the Montreal Branch in establishing sections. One of the very large questions before us in trying to carry out our program in building up an engineering society to represent general engineering activities in Canada, is to get every one in who should be interested in the work. There are in Canada, "said Mr. Vaughan," a large number of engineers, who are members of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers; we cannot expect these men to give up membership in their respective societies. But we can get them interested in our work and bring them into the branches as affiliates, and I am very sure that if our branches carried out the idea of interesting engineers who are residing in their districts in the work of *The Engineering Institute of Canada*, it will not be long before they join us as corporate members and become actively interested in our work.

Motion for the adoption of the report carried.

Report of Victoria Branch

The Secretary read the report of the Victoria Branch, as printed in the February *Journal*, page seventy-seven and moved, seconded by E. Brydone-Jack, that it be adopted. Carried.

Report of Saskatchewan Branch

The Secretary read the report of the Saskatchewan Branch, as printed on page seventy-eight of the February *Journal* and moved, seconded by R. F. Uniacke, that the report be adopted. Carried.

Report of St. John Branch

C. C. Kirby moved the adoption of the report of the St. John Branch, as published on page seventy-nine of the February *Journal*, seconded by Brigadier-General Sir Alexander Bertram. Mr. Kirby drew attention to a new feature in connection with engineering affairs in the Maritime Provinces, resulting from the establishment of Branches at St. John and Halifax, and the holding of a joint Professional Meeting at Halifax. This feature was the interest displayed by the municipalities of St. John and Halifax in our affairs. At the invitation of the Chairman of the St. John Branch the Mayor of St. John and the President of the St. John Board of Trade accompanied the St. John delegation to Halifax and attended the meeting there. We were entertained by the Halifax Commercial Club, and the Halifax Board of Trade arranged a trip around the harbour for us. As a result of that meeting the Mayor of St. John and the President of the Board of Trade have invited *The Institute* to hold the Maritime Professional Meeting this year in St. John. It is very promising indeed for the activities of *The Institute* that such interest should be displayed in our affairs by the municipality.

Motion for the adoption of the report was carried.

Report of Edmonton Branch

The Secretary read the report of the Edmonton Branch as follows:

We beg to submit the 1918 Annual Report of the Edmonton Branch.

The Branch Membership is as follows:—

Members	10
Associate Members	31
Junior Members	7
Student Members	8
	56

Of the above number, 27 are on active service, and the usefulness of the Branch in submission and discussion of engineering papers and problems is much impaired on account of the reduced number of resident members. It is hoped that this condition will improve at an early date, now that the war is over. The Branch lost a very active member through the death of Professor Muir Edwards of the University of Alberta.

Meanwhile the organization has been kept going, and indeed has been quite active with the Calgary Branch in furthering the matter of legislation for engineers. A draft bill was prepared ready for early presentation to the local Legislature, but action has just been postponed largely out of deference to the evident desire of many members of our Branch, and of the Local Branch of the Canadian Mining Institute to proceed along common lines and to the request of the Parent Institute for fuller discussion. The work done to date, and the experience gained thereby, should prove very useful in any general debate.

No papers were read during the season by local members, though the fuel situation in Alberta was discussed at length at a general meeting held on February 27, 1918.

At a general meeting held on May 28th, G. F. Porter gave his lecture on the Quebec Bridge. This was very much appreciated and the Branch wishes to place on record its thanks to Mr. Porter and the St. Lawrence Bridge Company. In all, ten general meetings and twenty executive meetings were held, besides two joint meetings with the Northern Alberta Branch of the Canadian Mining Institute.

The Branch has a cash balance of $29.02 at date, but a special levy which was authorized is not yet fully collected.

The Officers of the Branch previous to date were:—

Chairman, N. M. Thornton; Vice Chairman, J. L. Coté; Secretary-Treasurer, R. J. Gibb.

Executive, A. W. Haddow, A. T. Fraser, D. J. Carter, R. Cunningham.

Owing to the resignation of N. M. Thornton and A. T. Fraser, the following additional officers were elected on February 3rd: R. P. Graves, R. W. Jones, D. Donaldson.

The filling of the chairmanship was left to the Executive.

Yours truly,

J. L. Cote, Vice Chairman.

Robert J. Gibb, Secretary-Treasurer.

Moved by the Secretary, seconded by Mr. Leamy, that the report of the Edmonton Branch be adopted.

Report of Ottawa Branch

G. Gordon Gale retiring Chairman of the Branch read the report of the Ottawa Branch, as follows:—

To the President and Members of
The Engineering Institute of Canada:

Gentlemen:

On behalf of the Managing Committee of the Ottawa Branch, we beg to submit the following report for the calendar year 1918. The precedent of former years has been followed, and a programme of monthly luncheons, addresses and evening papers has been carried out with great success, due to the enthusiastic attendance of members. Under war conditions the strictest economy has been practiced and the Branch is still without permanent quarters.

Membership

We have found it exceedingly difficult to keep in close and constant touch with the Members of *The Institute* residing temporarily in Ottawa. One of the greatest helps in this connection has been the Year Book, issued annually by the Branch, giving the name, occupation, office and house address of every Corporate, Junior and Student Member, and Branch Affiliate. It is hoped that in due time some method will be evolved whereby a more accurate and constant record may be available of the movements of all members of *The Institute*, in order that the privilege of active participation in the activities of the various branches may be enjoyed to the fullest possible extent. The figures for the membership of this Branch for the years 1914, 1915, 1916, 1917 and 1918, are given hereunder:

	1914	1915	1916	1917	1918
Honorary Members	3	1	1	1	1
Members	46	51	60	60	68
Associate Members	113	124	124	113	123
Associates	1	1	1	2	2
Juniors	28	33	36	38	33
Students	16	27	28	25	24
Ottawa Associates	21	17	23	27	28
	228	254	273	266	279

Proceedings

There has been an unusually satisfactory and representative attendance of the members at all of the following regular meetings of the Branch:—

Feb. 7th. H. H. Vaughan, President, E.I.C., Problems Confronting the Society.

Feb. 21st.—F. H. Peters, M.E.I.C. : Ways and Means for Improving and Defining the Status of the Engineer.

Feb. 28th.—J. Blizard, A.M.E.I.C.: Availability of Energy as a Source of Power and Heat.

March 7th.—Hon. F. B. Carvell, K.C., Minister of Public Works : Value of Engineers to the Government and to the Nation.

April 11th.—E. A. Jamieson, A.M.E.I.C. : The Manufacture of Ordnance.

April 25th.—U. Valiquet, M.E.I.C. : Quebec Harbour Dry Dock.

May 18th.—J. B. McRae, M.E.I.C.: Visit to the New Pumphouse, Lemieux Island.

Nov. 15th.—Capt. Baker : Vocational Training.

Nov. 28th.—Jos. Keele, B.A.Sc.: Clay Products in Canada.

Dec. 7th.—Luncheon and Inspection Parliament Buildings.

Library

During 1917, M. F. Cochrane was appointed Librarian, to be responsible for the books and records. There are now about 750 volumes in the library, of which about 100 have been added during the past year. The entire collection has been indexed and classified according to the system devised by the librarians of the United Engineering Society of New York. Special effort is being made to secure an absolute, complete collection of all Government publications issued at Ottawa of interest to the engineering profession. A specially interesting feature of the librarian's efforts during the last year has been the collection of photographs of prominent members of *The Institute* who have resided at Ottawa, especially those who held office either with Council or with the Branch.

Financial

The finances of the Branch are fully set out in the attached statement of assets and liabilities and of revenue and expenditure. The Branch possesses a five hundred dollar Victory Bond, and has a cash balance in the bank of $446.56.

Officers for 1919

The Annual Meeting of the Branch was held on the 9th day of January. The following officers and members of the Managing Committee were elected for the year 1919:—

Chairman, R. deB. Corriveau; Secretary-Treasurer, J. B. Challies; Managing Committee, A. F. Macallum, Col. C. N. Monsarrat, J. Blizard, G. B. Dodge, E. B. Jost.

The Managing Committee of the Ottawa Branch desire to record with appreciation the successful accomplishment of three main achievements of *The Institute* during the past year. First, the change in name; second, the organization of General Professional Meetings; third, the establishment of *The Journal.*

The change of name undoubtedly broadens the scope and field of usefulness of our organization. The General Professional Meetings have afforded the various Branches a long needed opportunity for joint effort under local auspices and to meet particular conditions. *The Journal* going regularly to every member of *The Institute* throughout the world, affords an ideal connection between the members, the Branches and Council. These activities represent a tremendous amount of work, and we respectfully tender the President, the Council, and especially the General Secretary, the congratulations of the Ottawa Branch upon the excellent results already obtained.

G. Gordon Gale, Chairman.
J. B. Challies, Secretary.

Statement of Assets and Liabilities as at December 31st, 1918:—

Assets

Furniture (cost $200)	$ 90.00
Library:	
Book Case (cost $60)	43.20
Bound Magazines (cost $65)	1.00
Books (600) volumes	25.00
Rebates still due from Institute on Account 1918 fees	57.28
Unexpired Insurance	1.00
Stationery and equipment	25.00
Victory Bond	500.00
Cash in Bank	446.56
	$1,189.04

Liabilities

Collections Account Main *Institute* Tobacco Fund	$ 6.00
Printing Account, 1918	25.00
Surplus	1,158.04
	$1,189.04

Revenue and Expenditure for the year ending December 31st, 1918:—

Receipts

Balance on hand Jan. 1st, 1918		$ 587.58
Subscriptions to Tobacco Fund		15.50
Rebates from Main *Institute*, Montreal, Dec. 31st, 1917		48.75
Refund of unexpended balance of amount advanced to H. L. Seymour of Publicity Committee		12.60
Interest on $500 Victory Bond		27.50
Rebates from Main *Institute*, Montreal, January to August 31st, 1918		292.20
Branch Affiliate Fees, A. Anrep, 1918	$2.00	
" " E. Viens, 1918 and 1919	4.00	
		6.00
		$ 990.13

Expenditure

Advertising	$ 8.25
Expenses representative of Branch at Prof. McLeod's funeral	10.00
Wreath for Prof. McLeod's funeral	10.00
Printing F. S. Keith's address (Awakening Recognition of Engineer)	90.15
Insurance on Branch property	4.00
F. S. Keith, balance of subscriptions to Tobacco Fund	30.75
Library sundry expenses	13.77
H. L. Seymour, Publicity Committee	25.00
Stenographic and Clerical Services, Secretary's Office	70.00
Expenses in connection with Branch contribution of exhibit Beavers to Main *Institute* rooms, Montreal	116.00
Postage, Secretary's Office	35.15
Payments to janitors, Carnegie Library and Normal School for attendance at evening meetings	8.00
Printing (Year Book $55.00)	76.10
Sundries (including $14.20 difference between attendance and number guaranteed for luncheon in Daly tea room)	21.40
Advance to Special Committee in connection with meeting of *Institute* to be held in Ottawa in February	25.00
Balance in Bank, Dec. 31st, 1918	446.56
	$ 990.13

It was moved by Mr. Gale, seconded by Mr. Tye, that the report be adopted. In seconding the motion, Mr. Tye commended the Ottawa Branch for their very fine report, showing a large membership and a very satisfactory financial condition. To-day's meeting shows how well the Ottawa Branch is doing. Motion carried.

Report of Toronto Branch

W. S. Harvey, Secretary Treasurer read the report of the Toronto Branch as follows:

To the President and Council:

During the year the Toronto Branch of *The Engineering Institute of Canada* held six regular meetings The list is as follows:—

February 12th.—An address on The Quebec Bridge, by Lt.-Col. C. N. Monsarrat.

March 5th.—Addresses by H. H. Vaughan and Fraser S. Keith, President and Secretary of *The Institute*, respectively. Mr. Vaughan spoke on the wider views of *The Institute*, and Mr. Keith on the status of the engineer in the community.

April 25th.—A meeting to receive and discuss the report of the Committee on Prestige and Influence.

December 3rd.—An address by H. K. Wicksteed on The Montreal Tunnel from an Economic Point of View.

December 10th.—An address by C. H. Rust on The Water Supply of The City of Victoria, B.C.

December 17th.—A meeting to canvas the ballot for the election of officers for 1919.

In addition, the first General Professional Meeting, as provided for in the new by-laws, was held in Toronto on March 26th and 27th, and was devoted to a discussion of the fuel and power situation in Canada.

During its term of office, the Executive held twenty meetings in all.

The Executive regrets to report that owing to the world war and the epidemic of Spanish influenza, the activities of the Branch during the year were adversely influenced. Notwithstanding this, efforts have been made, and with some promise of success, to enlist the co-operation of the Toronto Section of the American Institute of Electrical Engineers, and the Ontario Section of the American Society of Mechanical Engineers to the end that a national and non-sectional Association of Engineers may be built up in this country.

The retiring Executive is gratified to report that the number of comparatively recent applications for membership indicates that new interest in *The Engineering Institute of Canada* has been awakened, as a result of the changes inaugurated a year ago.

In accordance with instructions received at the last Annual Meeting, this Branch, in co-operation with the Ottawa and Hamilton Branches, met the Provincial Secretary for Ontario on December 18th, and discussed with him the modifications in the existing Public Health Act suggested in the report of the Committee on Sewage Disposal for 1917. The Hon. Mr. McPherson received the delegation courteously and promised the sympathetic consideration of himself and his colleagues in respect of the questions contained in the report.

A comparison of the membership of the Branch according to classes for the current year is as follows:—

Members	66
Associate Members	144
Juniors	34
Students	69
Associates	5

During the year, in addition to carrying the unusual expenditures incurred by the General Professional Meeting and paying the house rental for 1917, as well as for 1918, the Executive finds itself with a surplus of $550.96, distributed as follows:—

Victory Loan Bond	$500.00
Cash in Bank	50.96
Total	$550.96

During its term of office the Branch has met all current expenses and leaves the Treasury substantially as it was a year ago.

During the past month the Executive of the new Ontario Provincial Division has been named, and steps have been taken to elect officers at a meeting to be held in Toronto on January 31st, 1919.

The following were elected to office for 1919 by the ballot just received: Chairman, A. H. Harkness; Secretary W. S. Harvey; Committee men, H. G. Acres, Willis Chipman and W. A. Bucke. The members of the Committee elected in 1918 for a two-year term, and, therefore, members of the 1919 Executive are Professor H. E. T. Haultain, J. R. W. Ambrose and R. O. Wynne-Roberts. The retiring Chairman, Professor Gillespie, is also a member of the Executive. Members of Council at Montreal are also members of the Executive of the Toronto Branch.

PETER GILLESPIE,
Chairman.

Toronto, January the 22nd, 1919.

Report of Halifax Branch

The Secretary read the report of the Halifax Branch as follows:—

To the President and Council:—

The chief object of the Halifax branch during that part of the past year in which it has been in existence has been merely to become organized. Under the local conditions which existed, members of the Branch would have been well satisfied with such an accomplishment.

In the first place, the absorption of the former Nova Scotia Society of Engineers extended over a considerable time and involved a large amount of work and attention. In the second place, the enormous disruption of all social and business relations by the Halifax explosion gave local members little opportunity for any interests outside of their immediate personal or business needs.

In the face of all this, the carrying out of the Halifax Professional Meeting is considered a notable achievement. Full accounts of this meeting were given in *The Journal*. So far as the engineering profession in the Maritime Provinces is concerned, such a meeting was unique and represented in a most substantial way, the results of having a local branch of the national society rather than an independent society.

The Halifax Branch was officially organized at a meeting held April 19, 1918. Including the organization meeting, five general meetings were held. As everywhere, regular meetings during the latter part of the year were not possible on account of the Influenza epidemic.

The Branch now has a total enrollment of 66, made up of 23 members, 35 associate members, 6 juniors and 2 branch affiliates. A number of applications are pending and several in immediate prospect.

K. H. SMITH, Branch Secretary.

The Secretary moved the adoption of this report, which was seconded by W. Chase Thomson. President Vaughan pointed out that the formation of the Halifax Branch was more than the mere establishment of a branch, as it involved the absorption of the Nova Scotia Society of Engineers. The latter was an old organization and the willingness of the men in Nova Scotia to give up their local Society and joing forces and interests with *The Engineering Institute* is a notable occurrence of the past year. The motion carried.

Discussion on Branch Reports

Professor Haultain drew attention to the very satisfactory financial condition of all the Branches where the financial condition was given, three of the Branches having over five hundred dollars to their credit. Mr. Robinson stated that one could not fail to be impressed in listening to these reports with the multifarious activities of *The Institute* showing that we are covering a great deal of ground and an immense output of matter of every description. He thought the Publications Committee one of the most important Committees we have as upon that Committee rests the responsibility of all sifting out of the vast array of output and determining what would be retained in our permanent transactions. In the increase of quantity we should not lose sight of quality. He pointed out the importance of *The Journal* in raising the quality of paper at local branches by the author knowing that his paper would get national attention. Mr. Challies stated that at the last annual meeting it was distinctly understood that all Branches should submit a clear financial statement and asked if such had been done. In reply the Secretary stated that there were but two exceptions and these Branches were being asked for same. Mr. Vaughan thought that before closing the subject of Branches it would be well to point out the advances made during the past year in the organization of new branches and the benefit that it is going to be to *The Institute.* Last year four new Branches were established and since the report of the Council has been made up another Branch has been authorized and established at Sault Ste. Marie with several others in immediate contemplation and this is solving the question of getting the membership at large in close touch with the *Institute.* Soon nearly all of the members will be branch members and thus in close touch with Headquarters. He considered that the reports were very satisfactory and that the thanks of *The Institute* as a whole are due to the men who have given so much of their time and done so much hard work—and hard work it is to conduct a Branch properly—during the past year.

At this point Dr. Martin Murphy, one of the early Presidents entered the meeting room and was greeted with hearty applause.

Reports of Divisions

The Chairman announced that there were three divisions now in existence, British Columbia, Alberta and Ontario just formed, with Quebec in process of formation. Both the Saskatchewan and Manitoba Branches, although not divisions take in a large share of the membership in the Provinces. It is hoped that very shortly a branch will be organized in every Province to take up any matters that may be of interest as between the Engineering Profession and the Provincial Government.

At a meeting of the Executive of the Ontario division held concurrently with the annual meeting at the call of the Chairman, pro-tem, Professor Gillespie, at which were present representatives from various parts of Ontario, the following officers were elected: Chairman, J. B. Challies, Ottawa; Secretary-Treasurer, Geo. Hogarth, Toronto.

Communications

A cable from Lieut-Col. Chas. H. Mitchell, M.E.I.C., C.M.G., D.S.O., Croix de Guerre, etc., extending his greetings to the Annual Meeting and expressing his regret at his inability to be present was read by the Secretary. Also a telegram from H. R. Safford, M.E.I.C., Chairman of the Library and House Committee expressing his regret at not being able to be present.

The following telegram of greetings was read by the Secretary from Calvin W. Rice, Secretary of the American Society of Mechanical Engineers and received with enthusiasm.

> "Peace earned at such sacrifice has raised all ideals, none more than those of the engineering profession. The American Society of Mechanical Engineers sends greetings on the occasion of your anniversary, renews its pledges jointly with you to devote supreme efforts to the advancement of the engineering profession through service for the common good."

Report of Emblem Committee

The Chairman announced that at the last meeting of Council the report of the Emblem Committee had been adopted and referred to the annual meeting for any suggestions which the members might have to make. He called upon Mr. Francis, Chairman of the Committee, which consisted of in addition H. R. Safford, Frederick B. Brown and Arthur Surveyer.

Mr. Francis: "Following the suggestion which I had the honor to make at the last Annual Meeting, and what I believe was understood as representing the approval of the Annual Meeting, Council appointed a Committee to study the question of the designing of a suitable emblem for *The Institute.* The committee met a considerable number of times, invited designs, considered suggestions, and finally made a slight modification of the design submitted at the last meeting. The recommendation of the committee which was tentative, being adopted by the Council and passed on for reference to this Annual Meeting—was that the design of the emblem should be in the form of the shield which has been in use by *The Society* for something like fifteen or twenty years; that the shield should bear the design of a working beaver, and that, in order to make the emblem distinctive it should be of fine quality, the die work to be as for coins, without the usual enamel, and that the metal for members should be gold, for the associate members, silver, and for juniors and students bronze. That is the report tentatively adopted by Council, I now submit on behalf of the committee for the approval of the Annual Meeting.

Changes in By-Laws

The Chairman: Our present By-laws make the following provisions with regard to amending or repealing existing By-laws or introducing new ones:

"Section 73.—Proposals to introduce new By-laws or to amend or repeal existing By-laws shall be presented in writing to the Council, signed by at least twenty Corporate Members; and shall reach the Secretary not later than the first day of October. The Council shall consider the proposals and the proposers shall be notified of the opinion of the Council in regard thereto not later than the seventh day of November. The proposers may then withdraw their proposals, accept any changes suggested, or insist on the original form, sending their decision to the Secretary not later than the fifteenth day of December. The proposals, as accepted by the proposers, shall be mailed to Corporate Members not less than twenty-one days before the Annual General Meeting. Proposals to introduce new By-laws or to amend or repeal existing By-laws may also be suggested by the Council and shall be mailed to Corporate Members not less than twenty-one days before the Annual General Meeting.

"All proposals shall be submitted for discussion at the Annual General Meeting and shall then be voted upon by letter ballot by the membership at large. The Secretary shall issue the letter-ballot not later than two months after the Annual General Meeting. The reasons advanced for and against the proposals edited by a Committee appointed by the Chairman consisting of an equal number of members favouring and members opposing the proposals shall accompany the letter ballot. The letter ballot shall be returnable to the Secretary not later than three months after the Annual General Meeting. Scrutineers appointed by the Council shall immediately thereafter count the ballots and report the result to the Council.

"An affirmative vote of two-thirds of all valid ballots shall be necessary to the adoption of any amendment.

"Amendments so adopted shall take effect forthwith, except that Officers of *The Institute*, at the time any amendments may be adopted, shall continue in office until the next Annual Election."

The By-laws were set out in the December number of *The Journal* and have, therefore, been mailed to all the members. A great number of the changes are purely changes in grammar and English. The present By-laws were largely run out by myself and Mr. Dodge after the Committee on Society Affairs got through last year, and they were done in a hurry. When we had Professor Ernest Brown criticize them and analyze our English, we were amazed at what we had done. Professor Brown has spent a great deal of time on the by-laws and has succeeded, I think, in putting them into very much better shape. Some of the amendments are purely changes in the wording and do not in any way change the effect of the existing by-laws, while some of the other revisions are more or less important and should be understood by the general meeting in order to enable the members to discuss them intelligently.

The first change of any importance is in section 18, in which the provision regarding the Papers Committee is changed to agree with section 21 which provides that the Papers Committee shall be composed of the Chairmen of the various Branches.

The amendment to section 24 straightens out a difficulty which arose through last year's by-laws not having been drafted in accordance with what was intended. The important clause is that the Annual General Meeting may recommend to the Council the appointment of special committees and that such recommendations shall be considered by the Council at the first meeting following the Annual General Meeting. That was the intention of the original by-law, but it was not properly drafted. The idea was that committees should not be appointed at an annual meeting, but that the annual meeting should recommend to the Council the appointment of committees and that the committees should operate under the direction of Council and not be appointed by an annual meeting and report to the succeeding annual meeting. The new by-law provides that special committees shall perform their duties under the supervision of the Council and shall report to the Council.

We have a new clause regarding the adoption of specifications. We have been free and easy about the adoption of specifications; the committee could bring in a report and some one could make a motion at the annual meeting that the report be adopted as a standard of *The Institute* and it might go through with the vote of a very small percentage of the membership. We felt that the *Institute* should not lend its name to specifications unless the membership at large is desirous of adopting them. The proposed by-law is as follows:

"Reports of Special Committees on Specifications shall be issued to the membership after presentation to the Council, and shall be open for discussion by all members for a sufficient period. All discussion thereon shall be forwarded to the Special Committee by a date fixed by the Council, and the Committee shall then present a final report to the Council, which report shall be issued to the membership, and the Council shall determine whether it shall be voted upon for adoption by *The Institute*. If the report be submitted for adoption, the Secretary shall issue a letter-ballot to Corporate Members in a form prescribed by the Council, and an affirmative vote of two-thirds of all valid ballots shall be necessary for adoption. The ballot shall be canvassed by scrutineers appointed by the Council, and the result of the voting shall be announced to the membership."

The next important amendment is with regard to the annual fees, section 34, which have been changed on account of the new by-law, section 73, providing that all members shall subscribe for *The Journal of The Institute*. That had to be done in order to make our position clear to the Post Office Department, and the fees have been reduced from $15 to $13. In other words, the fees have been reduced $2 right through, except in the case of non-resident students, who have paid only $2, and whose fee has been reduced to $1.

Then, we have the following new clause in section 38:

" The Council, upon written request and at its discretion may exempt from further payment of annual fees, any Corporate Member who has reached the age of sixty-five or who has been a Corporate Members for thiry years. The names of such members shall be placed on a 'Retired List.' "

Then, under section 57, it is provided that the Secretary of *The Institute* shall each year transmit to each branch, except the Montreal Branch, twenty-five per cent of the annual fees, instead of twenty per cent. This is on account of the change with regard to the subscription and the $2 having been transferred to *The Journal.* It comes out almost exactly the same as it was before.

A new clause, number 73, is introduced, as follows:

" Members of all classes shall subscribe for *The Journal* of *The Institute,* and the subscription shall be payable on the first day of January each year.

" The annual subscription for *The Journal,* for members of *The Institute,* shall be Two Dollars."

In accordance with our existing by-laws these proposals are submitted by the By-law Committee for discussion at the Annual General Meeting and constitute the report of the Committee appointed by the Council on the Revision of By-laws.

The discussion which followed showed that the present report was a compliment to the men who drew up the revised By-Laws recommended by the Committee on Society Affairs. It was moved by Mr. Francis, seconded by Professor Haultain, that the revised By-Laws as submitted be endorsed by the Annual Meeting and referred to the Council for proper action in accordance with existing By-Laws.

The President announced that we were to be honored by the presence of His Excellency The Governor General of Canada at luncheon, and requested that all members be seated by one o'clock except those who were to sit at the head table.

Luncheon

The noon luncheon was held in the main dining hall of the Chateau, there being about two hundred and twenty-five present, at which it had been planned to have addresses from His Excellency the Duke of Devonshire, Hon. M.E.I.C., who had graciously consented to be present and Alfred D. Flinn, Secretary of the Engineering Council of New York, who had kindly come to speak on international co-operation.

With the completion of the meal President Vaughan, on rising voiced the pleasure of the members in the fact that our most distinguished Honourary Member, His Excellency the Governor General of Canada, representing our King, the Head of the Empire for which the overseas Dominion had done such splendid work in the past had honored *The Institute* with his presence. He referred briefly to the part which our members had taken in the War and quoted some of the figures from the report of the Honor Roll Committee, read at the morning Session, and pointed out that we, as engineers, had every reason to be proud of the part Canadian Engineers had taken in the War.

His Excellency the Duke of Devonshire, K.G., G.C.M.G., G.C.V.O., Governor General of Canada:—

"Mr. Chairman and Gentlemen: I know that you are going to be disappointed if you expect from me anything in the nature of a technical speech. After a period approaching thirty years of political parliamentary life, I think I have safely learned the lesson that when one is in the presence of experts it is far better to keep one's ears open and one's tongue silent. But I do wish on this occasion to offer my cordial congratulation to this great *Institute* on the splendid record that we have just heard from the Chair, of the magnificent contribution which you have made to the personnel which is really responsible for the splendid victory which we are now celebrating—to those who when the moment came gave up everything and placed themselves at the service of their King and their country. And in what has been accomplished we have to consider not only the personnel, not only the men who took their places in the fighting line, but also the magnificent work which has been done throughout the length and breadth of Canada; and here you are still deserving of the highest possible praise and congratulation.

I should not like to say that I have seen more of the munition factories in this country than anybody else, but certainly I have, during the two years and three months in which I have had the privilege of holding the great office of Governor General of Canada, had opportunities of seeing something of that tremendous work which has been going on from the Atlantic to the Pacific. Wherever I went I could not help being profoundly impressed not only with the work which was being done, but also with the splendid spirit which was behind it. But quite apart from the results which have been obtained, we have learned what can be done by unity, by co-operation and by capacity for production.

The annual production which you are so largely responsible for has, unfortunately, during the last four years of war, been mainly directed to the purposes of destruction. It is now for us to appreciate to the full the real meaning of all that work. We have seen the very best brains, the very best knowledge, applied solely for the purpose of creating something capable of greater horror and greater destruction than anything of which we had known before. But now we have to turn our attention in another direction, and let us hope that never again in our lifetime or in the lifetime of our children's children for many generations will skill, capacity and intelligence be directed to the purposes of destruction rather than those of construction. Certainly in Canada there is wonderful opportunity for applying these forces now to the purposes of construction. Many of you who are intimately acquainted with engineering developments in this great Dominion are able to look back upon the time—only a very few years ago, indeed—when tasks which are now accomplished would have been considered quite impossible. By skill and by intelligence well applied, these wonderful results have been obtained.

And yet, after all, it is but a commonplace truism to say that Canada is only at its beginning; that what has been accomplished in the past is but an indication, an earnest, of what can be accomplished in the future. We shall have many difficulties to face, but by bringing to bear upon them the same spirit which was so splendidly manifested during the period of the war, we can, I think, look forward with confidence to the future.

At this moment the world is going through critical times. After the vast upheaval which has shaken society to its very foundations, it is inevitable that only after some time can equilibrium be regained. But we have learned in the bitter experience of war what can be accomplished, and you, gentlemen, in your individual capacity, in your capacity as a great Institute, are able to help— I do not mean to use the word " reconstruction," but to help in rebuilding these great industries and in opening fresh fields and pursuing paths of further constructive endeavour.

You have a record of service rendered during these years of war of which any Institute would have reason to be proud. You will pass that position down to future generations. And just as we have achieved this wonderful victory in time of war, so I think you can look forward with the greatest confidence to obtaining even greater victories in the happier times of peace which are to come."

With the conclusion of the Governor General's address President Vaughan introduced Mayor Harold Fisher, of Ottawa, who, on behalf of the City of Ottawa, tendered a welcome to the Engineers of Canada assembled in annual convention. He trusted that the stay in Ottawa would be be profitable and pleasant, and if he could be of any service he would be glad to do so.

Alfred D. Flinn, Secretary, United Engineering Council was then introduced by Mr. Vaughan, who stated that engineers were striving for greater recognition and that they would get it. In United States the great engineering bodies had joined forming a united engineering Council to discuss and take action on matters affecting the interests of engineers throughout the country. The Engineering Council has a membership of thirty eight thousand. In this country, we have embraced the various branches of engineers in one body. It was a pleasure to have Mr. Flinn with us and to call upon him for an address.

International Affiliation

In opening his remarks Mr. Flinn stated that it gave him much pleasure to stand before an audience with such a record and to give expression to his respect and admiration which the members of the organization which he represented felt for their brother engineers in Canada.

Continuing, Mr. Flinn said: "Affiliation across national boundaries, like close association within any nation, and of engineers, like affiliation among other kinds of men, demands intercourse and mutual service. Engineers from the Dominion have singly and in groups made many visits to various places in the States and have thus engendered among American engineers respect and fondness. Your President and Secretary have come among us and we like them. Engineers from the States have gone into the Dominion and have received such warm hospitality that they have been tempted to purchase northbound transportation more frequently. Let this pleasant intercourse continue. Be assured that engineering headquarters in all parts of the States, and especially " grand headquarters " in New York are ever open to our Canadian brothers.

But there are other means of intercourse. We cannot all travel, nor can any of us travel as frequently as we might like. Instead, we have an interchange of messages through our publications. We look forward to receiving the successive issues of *The Journal* of *The Engineering Institute of Canada* as to the coming of letters from friends. Always there is some cordial message, always interesting news of society progress and professional work. You are to be complimented upon your *Journal.*

Exchanges of services are possible between us in many ways large and small, and there are services to our great profession and the world in which we can join. Engineering Societies Library in New York, with its 160,000 titles, is already becoming your library also, and may be yours to the extent to which you will use it. The Engineering Index published in your *Journal* is one way in which the Library is serving you; searches and translations are others. Its doors are always open to visitors. It is only at the beginning of the services its Board hopes to be able to give engineers.

You are concerned with British and American engineering standards and so are we; therefore, both whould work together for the establishment of standards which because of their rightness will be generally honored. On no other authority can any standard really become established. Both of us are interested in international engineering standards and should have a large share in fixing them. There is an American Engineering Standards Committee. Why should it not collaborate with the corresponding organization in Canada?

There are international engineering problems in which both you and we have an interest. Our countries have many industrial interests in common also, with their problems. Personal acquaintance among engineers on both sides of the border will aid the wise and fair solution of all such problems.

Scientific research and its engineering application concern us all. Many fields of research are common to both sides of the invisible boundary which separates us politically. Need this imaginary line prevent co-operation in research between your organizations and our Engineering Foundation and National Research Council? We believe not.

There is another group of interests—those which affect all engineers as residents in a community, citizens of a country and members of a profession—the non-technical relations among engineering societies and between engineers and government, local and national. To deal with these matters there has been established in the States, to represent engineers in all branches of the profession, Engineering Council. Many of its activities are of common concern to all engineers on this continent. There is nothing in its constitution to prevent engineering organizations across the border being represented upon it and sharing in its work and benefits. Are not Canadian engineers interested in the work of such committees as these: Public Affairs, Water Conservation, Fuel Conservation, Reconstruction, Engineering Societies Employment Bureau and on Licensing of Engineers? Even committees whose spheres are national in the immediate application of their efforts, indirectly may be internationally helpful. Is not this true of our Patents Committee, National Service Committee and even our Americanization Committee?

Engineering Council is an organization of national technical societies of America, created to provide for consideration of matters of common concern to engineers, as well as those of public welfare in which the profession is interested in order that united action may be made possible. Engineering Council now has as its member societies the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers and American Society for Testing Materials, having an aggregate membership of 38,000. Other national technical societies are eligible.

Now, as to international affiliation, it seems to us quite possible that *The Engineering Institute of Canada* should be in some way associated or connected with the Engineering Council. It may not be convenient or practicable that you should become a member of the Council on the same basis as the American societies which have been named, for reasons which will occur to you. But it seems to us quite feasible that *The Engineering Institute of Canada* and the Engineering Council should have an international co-operative committee—a committee on which both bodies may have members; a committee of interchange of good fellowship, of information and of mutual helpfulness. At least, it occurs to us that would be a good tentative step with which to begin our active and formal co-operation. Then, if as time goes on it develops that further services may be performed in common, further steps in the development of mutual organization may be undertaken as may be suggested by you or by us. I assure you that there is in our midst the heartiest feeling of good fellowship towards you and a desire for closer co-operation between the Engineers of Canada and the Engineers of the United States.

I wish to thank you for the very pleasant hours that I have spent with you, the splendid reception which has been accorded to me, and for the honour of an invitation to be with you at your successful annual meeting. Let me assure you again that my appreciation of being here is none the less hearty because I must leave within a few minutes to continue my journey, and that my good wishes for the successful continuation of your meetings are very genuine."

The proceedings closed with the singing of God Save the King.

Afternoon Session. Tuesday February 11th

Emblem of the Institute

Continuing the business of the afternoon session President Vaughan asked Mr. Francis to enlighten the meeting regarding the emblem—and in response Mr. Francis announced that the Committee had made a unanimous report after having considered a great number of suggestions and after considerable discussion in Council. The Committee recommended the adoption of a badge in the form of a shield so long in use and suggested that the badge should be of metal without enamel, gold for members silver for associate members, and bronze for students and juniors, the badge to be issued only by the Secretary. The back of the badge would be plain and numbered, the number to be registered and the front to bear the legend that was approved of at the last Annual Meeting. "*The Engineering Institute of Canada*, founded 1887." It was further suggested that the die work should be of the best quality obtainable corresponding to the last issue of American coins, and the recommended design illustrating a beaver and containing the recommended legend was passed around for the inspection of the members. Mr. Francis moved the adoption of the design submitted with the reservation that should it be found that the beaver shown on the design should be looking in the opposite direction the Committee was quite agreeable to have it so. The motion was seconded by Mr. Surveyer, after some discussion regarding heraldry. In the discussion that followed it was stated that the magnificient specimen of beaver presented to *The Institute* by S. J. Chapleau, M.E.I.C., formed the basis of the designs ubmitted. A somewhat lengthy discussion ensued and the motion was enlarged to include the carrying out of the details of the design by the Council. The motion was carried.

The President then announced that the meeting would adjourn until four o'clock when the President's address would be given. In the morning the program of the business meeting would be continued receiving the report of the Legislation Committee, the report of the Scrutineers and the nominations to the Nominating Committee made by the various Branches.

President's Address

The session was resumed at four o'clock with Vice-President Haultain in the chair. The President then delivered a remarkable address on the Manufacture of Munitions in Canada " telling in intimate detail for the first time the part played by this country in the production of munitions for the Allies, commencing with the conditions in existence prior to the formation of the original Shell Committee and leading on through successive steps, with details of the products manufactured; the establishment of the Board of Munitions and the growth of the industry to a stage where the output represented fifteen percent of the disbursements of the British Ministry of Munitions.

This address with many illustrations will be produced shortly in the form of a volume of transactions of *The Institute.*

At the conclusion of the address there was thrown upon the screen a highly interesting series of views illustrating the different phases of the subject so exhaustively dealt with by Mr. Vaughan during the course of his address, including different types of shells, fuzes, plants, and processes, and bringing vividly before the meeting the initial difficulties that had to be overcome, the method by which problems were solved and the enormous proportion to which the shell industry attained before the signing of the Armistice. The illustrations also dealt with the manufacture of primers, cordite, nitro-cellulose, T.N.T., fuzes and aeroplanes.

The Chairman stated that all had listened to this remarkable address with the greatest degree of interest and pleasure and that an expression of appreciation would be in order. Col. Leonard moved a hearty vote of thanks to Mr. Vaughan for his magnificient paper, which will form a valuable record for all time to come of one of Canada's great achievements in the war. In seconding the motion, Mr. Tye stated that Mr. Vaughan during his occupancy of the office of President had established a new high water mark in relation to the amount of work he had done and the efficiency with which he had done it. The motion was adopted unanimously.

The session concluded at six o'clock.

Morning Session, Wednesday, February 12th.

The meeting was called to order at ten a.m., the President Mr. Vaughan in the Chair. The Chairman asked for the report of the special Legislation Committee appointed by the various Branches which had met with a view to making recommendations to the Annual Meeting.

The report of the special Legislation Committee was in the form of a motion moved by J. M. Leamy, who represented the Manitoba Branch, seconded by C. C. Kirby, representing St. John Branch.

Whereas it seems that the wishes of the majoirty of the members and of the Branches of *The Engineering Institute of Canada* are that provincial legislation should be obtained to define the status of the engineers throughout Canada.

Whereas the members of this annual meeting are of the opinion that this legislation should be as uniform as possible throughout the provinces.

Be it resolved:

That a special Committee be formed, composed of one delegate appointed by each branch to meet at headquarters before the 15th of April, 1919, to draw up such sample legislation as it may deem necessary and advisable in order that the members of *The Institute* throughout the different provinces may ask for legislation on the same uniform basis.

That the Secretary be instructed to call the first meeting of this Committee.

That this Committee be authorized to obtain the necessary legal advice on the matter.

That this Committee shall submit the proposed legislation to the Council before the 1st of May, 1919.

That the Council shall then ask by letter ballot, before the 1st of June, 1919, the opinion of all the members of *The Institute* regarding the adoption of the proposed legislation prepared by the said special Committee of *The Institute*.

That the Council be authorized to pay all the expenses of this Committee and of each delegate.

That the Council of *The Institute* shall report the result of the ballot to the Branches, and if the vote is favorable to legislation the Council of *The Institute* shall immediately take the necessary measures, in co-operation with the Branches, to have such legislation enacted.

This resolution evoked the most prolonged discussion of any subject introduced at the annual meeting, the discussion hinging principally on the point raised by the Chairman that in passing this motion the power of veto was taken out of the hands of Council entirely. The following participated in the discussion, some of whom spoke at considerable length, Messrs. Leamy, Kirby, Decary, Lambe, Pearce, Surveyer, Dodwell, Francis, Stead, Haultain, Mountain, and Col. Leonard.

It was pointed out that the position of this Committee would be somewhat similar to that of the Committee on Society Affairs, and that it would no doubt be advised by Council individually if not officially in its work. The opinion was unanimous that legislation was advisable and should be sought at the earliest possible moment. The resolution contained in the motion before the meeting provided early action. It also involved committing *The Institute* to an expenditure of several thousand dollars

The discussion brought out the fact that with one or two exceptions the subject has not yet been discussed, every branch has gone on record as favoring legislation. Strong support to the motion was given by a number of members of Council and special representatives from the various branches. On the motion being put to the meeting it was carried.

Scrutineers Report

The Secretary read the Scrutineers Report as follows: We beg to report that the following have been elected to office for the current year: President, Lieut.-Col. R. W. Leonard; Vice-Presidents, Walter J. Francis and D. O. Lewis; Members of Council: District No. 1, Sir Alexander Bertram, and Arthur Surveyer; District No. 2, J. E. Gibault; District No. 3, Alexander Gray; District No. 4, G. Gordon Gale; District No. 5, W. A. McLean; District No. 6, W. P. Brereton; District No. 7, G. D. Mackie (for three year term); A. R. Greig (for one year term); District No. 8, L. B. Elliot (for three year term), F. H. Peters (for one year term); District No. 9, R. W. MacIntyre.

Respectfully submitted by
W. Chase Thomson,
O. Lefebvre,
Scrutineers.

P.S.—The Auditors report is returned herewith.

The report of the Scrutineers was adopted.

New President Introduced

In introducing Lieut.-Col. R. W. Leonard, Mr. Vaughan stated that he needed no introduction as his long experience and his reputation both as a civil and a mining engineer were well known. It gave him very great pleasure to escort the newly elected President Lieut.-Col. R. W. Leonard to the chair. Col. Leonard said: Gentlemen, I wish to thank you for the honor which has been conferred upon me, the highest honor in the gift of the engineering profession in Canada. I realize that the work of my predecessors, the excellent results that have been accomplished in this part of the Dominion, including Montreal, and the magnificient work the Ottawa Branch has done has set up a high mark of efficiency, which it is going to be very difficult for me to follow. However, we, in Ontario, shall try to emulate in some degree the work that has been done here and shall try to hold our own anyway. I thank you very heartily.

Nominating Committee

The Secretary announced the Nominating Committee as appointed by the various branches which constitutes the Nominating Committee for the year nineteen nineteen.

District No. 1, Montreal, headquarters of *The Institute*, and all members resident outside of Canada, H. M. MacKay, A. E. Doucet.

District No. 2, Province of Quebec, Alex. Fraser.

District No. 3, Nova Scotia, New Brunswick, Prince Edward Island, J. L. Allan.

District No. 4, Province of Ontario, east of Lindsay, A. A. Dion.

District No. 5, Province of Ontario, west of Lindsay, G. Hogarth, H. U. Hart.

District No. 6, Manitoba, Guy C. Dunn.

District No. 7, Saskatchewan, O. W. Smith.

District No. 8, Alberta, A. W. Haddow, S. G. Porter.

District No. 9, British Columbia, Newton J. Ker, E. G. Marriott.

The Secretary moved, seconded by Geo. A. Mountain, that the above named constitute the Nominating Committee for the coming year, with H. M. MacKay as Chairman. Carried.

This concluded the business of the Annual General Meeting and the Chairman announced that the meeting would immediately proceed with the general professional meeting and called upon Capt. R. J. Durley, M.E.I.C., Chief of the Division of Gauges and Standards, Imperial Ministry of Munitions, who read his paper: "Standards in Engineering."

Standards in Engineering

1. *Standardization.*

At the present time Canada is passing through a period of industrial readjustment, and many of our manufacturers are endeavouring to change over from the war conditions under which they have been operating, to a state of affairs under which it is anticipated that competition will be extremely keen, while the economic situation for some time to come will hardly lessen the difficulties under which they are working.

It is, therefore, felt that this is an appropriate time for the proceedings of *The Engineering Institute of Canada* to contain a communication drawing attention to the increasing importance of Engineering Standardization, which has proved, both in England, and in the United States, to be one of the most powerful influences in limiting costs of manufacture and facilitating production, not only by reducing the number of kinds of material, or patterns of any given article, which have to be manufactured and kept in stock, but also by rendering available standard specifications and methods of construction.

Mr. Vaughan in his Presidential address has just given a very complete and authoritative account of the phenomenal way in which the munitions industry of this country was developed during the past four years, and has made it clear that success in the production of enormous quantities of such highly complex and accurately made articles as Shell, Fuzes and the like, could never have been achieved in such a short period without making the most complete possible use of the aids afforded by standard types and dimensions and standard specifications for material. While it is true that in ordinary commercial work there are few products whose manufacture is necessary in such gigantic quantities or with such close limits of accuracy as in the case of munitions of war, it must be admitted that similar conditions will apply in many cases during peace time, and that the country which first and most completely seizes and utilizes in its industries the advantages conferred by Engineering Standardization will have a corresponding advantage in the industrial race which has now to be run. It is proposed to give here a brief account of the work which has been accomplished in England and the United States, and the commencement which has been made in Canada.

2. *Work in England.*

In many respects standardization in engineering work has reached its fullest development in England, where for the past seventeen years the voluntary efforts of an influential body, the British Engineering Standards Committee (now the British Engineering Standards Association) have been unceasingly directed towards its establishment. The origin and activities of the British Engineering Standards Association have been described in many publications, among which may be mentioned The "James Forrest" Lecture of the Institution of Civil Engineers, delivered in 1917 by the late Sir John Wolfe Barry; and recently a brief but excellent paper by Mr. LeMaistre, the Secretary of the British Engineering Standards Association, presented to the American Society of Mechanical Engineers at its New York meeting in December, 1918.

It need only be stated here that the British Engineering Standards Association is a semi-official body composed of members prominent in engineering and industrial work, nominated by such bodies as the great Technical Societies of Great Britain, together with some representatives of the large purchasing departments of the British Government and certain scientific members. It is supported by voluntary subscriptions from firms and individuals interested in the engineering industry of the country, and to a smaller degree by a Government grant.

It is important to note that the British Engineering Standards Committee, from which the British Engineering Standards Association has developed, was founded in 1901, at which time an urgent need was felt in England for the replacement of the many existing lists of sections of structural steel by a single standard set, as up to that time every manufacturer had to cut rolls in accordance with the ideas of the individual purchaser or engineer for whom he was working. The same situation had arisen in the case of tramway and railway rails, and the matter was, therefore, placed in the hands of a Committee appointed at the instance of the Institution of Civil Engineers, and having as its members persons nominated not only by that Institution, but also by the Institution of Mechanical Engineers, the Institution of Naval Architects, and the Iron and Steel Institute. These bodies, with the Institution of Electrical Engineers which came in later, were the five Institutions which have supported the Engineering Standards Committee. From its very inception the work of the Committee continued to develop as demand arose, and it rapidly attained greater and greater industrial importance, with the result that in 1918 on the receipt of an assurance of more extended Government support, it was decided to incorporate it under the name of the British Engineering Standards Association, and establish relations with branch or cognate Committees to be formed in various parts of the world.

Inasmuch as some misapprehension exists among engineers as to the way in which engineering standards arise and are formulated, it will be well here to outline the system adopted by the British Engineering Standards Association, which has gradually grown along the lines which experience has proved to be sound. It is obvious that if some official body, without fully consulting the industry concerned, takes upon itself to promulgate a set of rules for standardizing a certain product, and if their enforcement is attempted by employing Governmental or other action, thus endeavouring to compel manufacturers to work to them, failure is inevitable. To ensure success and general acceptance, rules for standardization must be developed with the desire and assistance of the persons concerned in the manufacture and purchase of the articles for which it is needed, and the standards must be good and practical. Standardization in fact is primarily a commercial rather than a scientific question.

The guiding principles which have been adopted by the British Engineering Standards Association since the beginning of its work provide fully for the aspect of the case, and they are so definite and reasonable that no excuse is needed for quoting them here. They may be summarized as follows:—

(*a*) The different interests of producers and purchasers must be fully considered. This result is accomplished by the appointment of a special sectional committee to deal with each subject brought up, the members of such a Sectional Committee comprising engineers who are familiar with the subject, manufacturers actually engaged in production, and representatives of the chief users of the article under consideration, the whole under the chairmanship of a member of the main committee of the Association. It should be particularly noted that members of such a sectional committee, while appointed with the approval of the main committee, are not necessarily members of it, It is arranged in each particular case to secure the services of the men having the best possible qualifications, whether technical, scientific or commercial.

(*b*) As the movement is purely a voluntary one and in the interests of producers and consumers alike, all are asked to give their services gratuitously.

(*c*) The Association only undertakes to deal with any subject when a demand for its services is received. Thus the Association does not take up subjects of its own initiation, but in order to meet recognized wants.

(*d*) The Association is not a testing authority, its work being to set up and formulate the standards desired, leaving it to the purchaser to satisfy himself as to whether or not the material supplied to him complies with the standard requirements. Any experimental or scientific investigation necessary in connection with the Association's work is carried out by the National Physical Laboratory.

(*e*) It is important to provide for the effect of changing industrial or scientific conditions. Thus all standards formulated are subject to periodical revision, so that improvements can be incorporated at any time as experience dictates.

The British Engineering Standards Association since its formation in 1901 has expended approximately £51,000 sterling, and its list of published standards and specifications covers upwards of sixty subjects, a list of some of which is attached as Appendix I. The Association now has some 160 Committees, Sub-Committees and Panels, dealing under its central authority with standards relating to practically the whole field of engineering; and as Mr. LeMaistre says, " for many years past, the British Engineering Standards Association, as it is now called, has provided the neutral ground upon which the producer and the consumer, including the technical officers of the large spending departments of the Government and the great Classification Societies, have met and considered this subject of such vital interest to the well-being of the engineering industry of the country."

It is interesting to note that a very large increase in the Association's activities took place during the war, one of the most conspicuous instances being its work in connection with the recent immense development of the aircraft industry in England. During the first two years of the war, when every effort was being made in England to obtain a supply of serviceable aircraft, it was impossible to pay much regard to uniformity of specification, for the industry was in such a fluid condition that only the beginnings of standardization could be dealt with; but later when a much larger programme was being embarked upon, and when the Department of Aircraft Production had been fully organized, the Ministry of Munitions placed in the hands of the British Engineering Standards Association the whole duty of preparing standard specifications for aircraft materials. We have here an example of the fact that standardization, if properly carried out, does not cramp or limit the efforts of the designer. No attempt, for instance, was made in this case to impose upon aircraft builders any limitation of their freedom in design or in individual methods of construction; but it is safe to say that had each of these manufacturers been allowed to work to his own ideas as regards the particular qualities of the materials to be employed by him, production would have been much delayed by reason of the difficulty of obtaining such materials, many varieties of which would have differed only in unimportant details.

As another example of the special war activity of the Association, it may be mentioned that its services were called for in connection with the building of standard ships, the total number of standard sections of rolled steel used in ship-building by the Mercantile Section of the Admiralty having been reduced to eight, selected from the British Standard list, and important work having also been done in unifying the testing requirements of the three great Marine Classification Societies and of the Board of Trade, so as to facilitate classification.

It is understood that the Association's Sectional Committee dealing with this subject is now taking up many points in greater detail, especially as regards marine machinery, and it is expected that considerable progress will be made along these lines, especially in connection with auxiliary machinery, accessories and fittings. It is thus hoped that in England much of the experience gained during the war in the construction of standard ships and their machinery will be applied with advantage in reducing the cost of marine work done on a post-war basis, by making it possible to produce in quantity many of the items in ship and engine construction which in the past have been designed and made individually by each shipbuilder and marine engineer.

Many other examples might be given, but those mentioned will suffice to give an idea of the wide scope and effective results which have characterized the work of the Association.

Its publications, which are of great technical value, are accessible to the public, as they can be purchased at a nominal price. Arrangements are being made for the maintenance of a stock of these documents in Canada, so that their data will be readily available here.

3. Engineering Standardization in the United States.

In the United States the development of engineering standardization has taken place along quite different lines from those which have obtained in England, and much progress has been made, although a central standardizing body, the American Engineering Standards Committee, has only been formed within the last few months. While the formulation of engineering standards in the United States has hitherto been the more or less independent work of the various technical societies, many of the resulting standards have attained nation-wide acceptance.

The work in standardization done by the American Institute of Electrical Engineers is perhaps the best known and far-reaching in its effects. The American Institute of Electrical Engineers commenced work in 1898 and now has thirty-four Sub-Committees dealing with all phases of electrical work. In March, 1915, representatives from this Committee visited England, and the result of this Anglo-American co-operation has been that certain standardization rules for electrical work in both countries are identical in a number of essential points.

In 1902 the American Society of Mechanical Engineers appointed a Committee to deal with the standard proportions desirable for machine screws, and in later years Committees have been appointed by that Society to deal with such questions as engine tests, standard specifications for the construction of steam boilers, and various points in connection with the testing of materials.

The latter subject, has, however, been more completely dealt with by the American Society for Testing Materials, which has a total membership of about one thousand, and has thirty-eight standing Committees dealing with tests and standard specifications for iron, steel, copper, bronze, cement, road materials, coal and many other items.

A fourth and younger body which has been very active is the Society of Automotive Engineers, whose Standardization Committees have very largely dealt with Automobile work. They originated the well known and widely accepted S. A. E. System of fine screw threads, and their work has recently undergone considerable development in connection with Aircraft and Aero Engine Standardization. The S. A. E. issue not only standard specifications and dimensions, but also documents embodying their "recommended practice."

Finally, attention should be drawn to the very active part which has been taken by the United States Government in connection with Engineering Standardization. The Bureau of Standards at Washington is organized along lines somewhat different from those of the National Physical Laboratory in England, and has been very liberally supported by the United States Government. The Bureau was established in 1901, at first as a development of the then Bureau of Weights and Measures, but its activities have so widened and increased that in 1916 nearly two million dollars were expended, and it deals with a great variety of matters. Besides carrying on through its many departments a vast amount of Industrial and Scientific Research, the Bureau of Standards has within the last few years dealt with many questions of industrial Standardization, particularly in matters having regard to public safety; for example, in formulating safety codes for various kinds of structural work. It has prepared and issued standard cement specifications, and has prescribed standard definitions and methods of test for a number of other important products, such as gasoline.

Quite recently the United States Government has itself entered more definitely upon the field of Engineering Standardization, the Senate having appointed a Screw Threads Commission, with instructions to report on a revised system of screw threads for the United States, the Senate having directed that the findings of this Commission should be adopted by all departments of the United States Government.

It will thus be seen that while in Great Britain Engineering Standardization has been from the first in the hands of one central voluntary Association operating with the support of the Technical Societies, the various industrial interests and the British Government, the corresponding work in the United States has been done through the more or less independent activities of the various Technical Societies, the Bureau of Standards and the Government itself. It is understood that the American Engineering Standards Committee which has just been formed, has as its primary object the co-ordination of all these efforts so as to avoid overlapping, and to make the results of the work of various bodies available as truly national standards.

4. Standardization in Canada.

One purpose of this paper is to inform the engineering profession in Canada regarding the promising commencement which has been made in connection with Engineering Standardization here. The movement was actually initiated in November, 1917, by a communication from the then British Engineering Standards Committee, which was transmitted to the Canadian Government through the British Government, which pointed out the desirability of the formation of a Standards Committee in Canada, and which naturally had regard primarily to the advantages of establishing close relations between such a body and the corresponding body in England. As a result the nomination of a Canadian Engineering Standards Committee was placed by Sir Joseph Pope in the hands of the Administrative Chairman of the Honorary Advisory Council for Industrial and Scientific Research, with the co-operation of a number of prominent members of the engineering profession. The Committee thus formed included twenty-five members under the Chairmanship of Sir John Kennedy. Of this number, eight members may be regarded as in a sense representing the Manufacturers' Association of Canada, two the Canadian Mining Institute, and four *The Engineering Institute of Canada*, while the remainder represent the various Departments of the Canadian Government, including those of Inland Revenue, Interior, Marine, Militia, Public Works, and the Advisory Research Council. A list of the original members of the Canadian Engineering Standards Committee is attached as Appendix II, and it will be seen that approximately two thirds of the number were members of *The Engineering Institute of Canada*.

At the very commencement of the work of the Committee it was felt that its activities should be chiefly directed to the consideration of those questions of Engineering Standardization which particularly affect Canada, while at the same time maintaining close relations with the British Engineering Standards Association. It was agreed that the guiding principles to be adopted in the Committee's work should be those which have proved so satisfactory in dealing with similar problems in Great Britain, and that, further, every effort should be made by the Committee, while acting as the body authorized to represent the British Engineering Standards Association in Canada, to make more widely known to Canadian engineers and manufacturers the excellent work which has been accomplished in England. The exceptional situation of Canadian industries, with their standards partly British and partly American, makes the co-operation of the Canadian Committee especially important in cases where agreement is sought between the standards of the British Empire and those of the United States.

In carrying out the work outlined above it will be the object of the Canadian Engineering Standards Committee, like that of the similar organization in Great Britain, not to attempt to impose standards upon manufacturers and others, but to meet industrial requirements by arranging for the selection of the best standard designs and dimensions and their modification whenever necessary, so as to insure their general adoption. At the urgent request of the British authorities, and in order that Canadian representatives might proceed to England to attend conferences on those subjects, the Canadian Engineering Standards Committee last spring appointed two Sectional Sub-Committees, the first on Screw Threads, and the second on Aeroplane Parts. These Sub-committees will, of course, include in their membership as may be found desirable, representatives of the industries concerned. The special problems arising in connection with Aircraft Standardization are dealt with later in this paper.

The bulk of the work accomplished by the Canadian Engineering Standards Committee during the past six months has thus been in connection with Screw Threads and Aircraft Parts, delegates having been sent to England to represent the Committee at the Conference held in London at the invitation of the Ministry of Munitions in April, 1918, on Screw Thread Standardization, and at the meeting of the International Aircraft Standards Commission held in London in October last. Considerable progress has also been made with the organization of the Committee in other directions. The formation of additional Sectional Committees so that meetings can at once be held whenever need arises, has been arranged for in connection with the following subjects: Cement, Bridges and Building Construction, Aircraft Parts and Materials, Pipe Flanges, Rope Pulley Grooves, Electrical Standards, Iron and Steel Sheets, Wire Ropes, Sections and Tests for Materials used in Ships, etc., Road Materials, Notched Bars, etc., Cast Iron Pipes, Vitirified Pipes, Rails, Automobile Parts, Locomotives, Machine Parts, Gauging, etc., and Railway Rolling Stock.

An application is now before the Government* asking for the incorporation of the Committee under the name of the Canadian Engineering Standards Association, this incorporation being desirable in order to define the status of the body, and to give it a clearly recognized position. It is proposed also to modify somewhat the consitution of the Main Committee, so as to widen the scope of the Association.

During the year 1918 the work of the Committee was brought to the attention of the Canadian Government, and a grant of $3,000 was made through the Advisory Council, on the condition that the sum named would be payable when and as equivalent contributions were received from Technical Societies and industrial bodies interested in the work of the Committee. It is gratifying to note that although during the first few months the Committee's activities have necessarily been confined largely to organization work and to the sending of delegates to the Conventions already mentioned, there is every prospect that the full amount of the Government grant for 1918 will be rendered available, by reason of the prompt response of the industrial interests to the appeal which has been made to them.

As regards the future of the Association, an application for a continuation of and increase in the Government grant under similar conditions has been made, and on receipt of the favourable reply which is anticipated, the services of a Secretary, giving his whole time to the work of the Association will be secured, and the Association will be prepared to deal with the various questions of Standardization which have already been suggested to it as now claiming attention. Under these circumstances experience will soon indicate whether the engineering industry in Canada under "post-war" conditions will be able to show such healthy development along modern lines as will enable the Canadian Engineering Standards Association to demonstrate more fully its usefulness and the necessity for its existence.

5. *International Standardization.*

This paper would be incomplete without some reference to International Engineering Standardization

*Since the time of writing, the incorporation has been accomplished.

and the principal bodies which have so far been concerned with it.

(*a*) Of these perhaps the earliest was the *International Association for Testing Materials*, which dealt, however, primarily with the unification of standard methods for physical tests of materials, and the comparison of results obtained by the divergent methods in use in different countries. The Commission was initiated in Germany in 1884, and a number of congresses have been held, the sixth of which took place in 1912 in New York. The congresses of this Association are open to all, but their findings are not binding upon anybody, and merely serve to express the opinion of the majority present. The work of this organization, however, has no doubt had considera-able influence in encouraging uniformity of testing methods.

(*b*) The *International Electro-Technical Commssion* was formed in 1906, and its establishment was originally due to the efforts of Col. Crompton, a member of the British Engineering Standards Committee. This Commission is composed of a number of national committees, each enjoying in greater or less degree the support of its own Government, and has performed valuable work in connection with the question of an international basis of comparison for the rating of electrical machinery. The work of this body, as well as that of the International Association for Testing Materials, has, of course, been greatly interrupted by the war.

(*c*) *International Standardization as Regards Aircraft Parts and Accessories.*

The Standardization of Aircraft Materials and Parts formed one of the earliest and most important pieces of war work undertaken by the British Engineering Standards Association, and was taken up when a request was received in June, 1917, from the Society of British Aircraft Constructors, asking for the formation of a Sectional Committee for Standardization in this matter. Such a Sectional Committee was at once appointed, and commenced work in August, 1917. Experience with military aircraft under the conditions obtaining in France, where the air forces of several countries were co-operating, soon indicated the need for a certain measure of International Standardization, not as regards the details of aircraft construction in general, but in connection with such points as affect the utilization, by the aircraft of one country, of spare parts, accessories and instruments belonging to the aircraft of another nationality. To take two examples only, the desirability of a standard series of dimensions for the size and spacing of the holes in the wooden hubs of propellers became evident; and it was further obvious that a great saving of time and expense would result if Allied agreement could be reached on the question of standard specifications for aircraft materials, so that materials purchased in one country to the Government specifications ruling there would be at once acceptable for a similar purpose in Government work in another country.

With objects of this kind in view, an invitation was forwarded by the British Engineering Standards Association to a number of representative authorities in the United States, including the U. S. Aircraft Board, the U. S. Bureau of Standards, the U. S. Navy Department, the U. S. War Department, the American Aircraft Manufacturers' Association, the Society of Automotive Engineers, the American Society of Mechanical Engineers, and the American Society for Testing Materials, asking that their delegates might proceed to England to attend an Aircraft Standardization Conference to be held early in 1918. This Conference took place in London in March, and was attended by fourteen American representatives. It considered briefly the differences in British and American Aircraft practice in rgard to a great number of topics, such as:—Nomenclature, Timber, Ply wood, Glue, Propellor Hubs, Electrical Parts, Instruments, Ball and Roller Bearings, Sparking Plugs, Magnetos, Wheels and Tires, Structural Tubing, Rigging, Rubber, Dope, Fabric, and Steels; and the American delegates left for the United States with the understanding that a further conference would be called together in a few months, and that in the meantime everything possible would be done to prepare the ground for an agreement.

As a result of the Anglo-American Conference just described, and at the wish of the Ministry of Munitions, it was decided that the various Allied Governments should be approached with a view to the constitution of an International Aircraft Standards Commission, primarily, of course, as a war measure, but looking also to the international questions which are bound to arise in connection with commercial aviation. An Organization Committee under the Chairmanship of Sir Henry Fowler, Assistant Director General of Aircraft Production, drew up a tentative constitution, under which it was suggested that this Commission should be composed of a number of separate National Committees, resembling in this respect the International Electro-Technical Commission. In the case of those countries having National Standards Committees it was felt that their respective Sectional Committees on Aircraft Parts would naturally be selected as the National Committees representing each country on the International Aircraft Standards Commission. The organization of the Commission proceeded on this basis, and its first plenary meetings were held in London in October, 1918, which the writer attended as one of the Canadian delegates. The countries represented were Great Britain, Canada, France, Italy and the United States, the scheme of organization was fully worked out, and a Constitution formally agreed upon (subject, of course, to ratification by the various Governments), after which the Commission proceeded to consider in detail a number of the points in connection with which the necessity for International Standardization had been suggested. International Advisory Committees were appointed to deal with these questions, and it was arranged that their reports should be considered at the next Plenary Meeting of the Commission, to be held in Paris some time in 1919.

It is, of course, possible that the changed conditions which have arisen since the Commission met will result in some temporary diminution of its activities, but its formation and organization is a very gratifying indication of the possibilities for future International co-operation in aircraft work.

(*d*) *International Screw Thread Standardization.*

During the war the problem of obtaining in large quantities a supply of interchangeable screws assumed considerable importance, and it soon became evident that if a system of screw threads could be obtained which would meet the requirements of two or more of the Allied countries, the supply of munitions would be greatly simplified. Much elaborate work in connection with Screw Thread Standardization had already been done in England, the British Engineering Standards Committee having issued as early as 1907 their report Number 38 on "Standard Systems of Limit Gauges for Screw Threads." In France the Société d'Encouragement pour l'Industrie Nationale appointed a Committee in 1891 for the Standardization of Screw Threads, as a result of which, and of an International Congress held at Zurich in 1898, the Metric "Système International" was decided upon. The Système International has, however, not as yet received very wide acceptance outside of France.

The French have also given considerable attention to the International Standardization of Pipe Threads, and some progress was made in the direction of an International system of pipe threads in 1914 at a Paris Congress, upon which France, the United States, Switzerland, Germany, Italy and Great Britain were represented. The work of this Congress was, however, not completed before the outbreak of the war.

It was felt in England that no agreement regarding the International Standardization of Screw Threads in the widest sense would be possible during the war, as no steps could be taken to that end without the consideration of the Système International and other metric thread systems, and this would widen too much the scope of the discussion. It was thought, however, that some working arrangement might be possible between Great Britain and the United States, which did not involve consideration of the metric system, and early in 1918, in response to an invitation from the British Engineering Standards Committee a preliminary meeting was held in London which was attended by delegates from the United States and Canada, and at which the subject was opened. This meeting was followed by a joint meeting of the various Sub-Committees of the British Engineering Standards Association on Screw Threads and Limit Gauges. From the various discussions it appeared that before any further International Conference on the subject could be held a good deal of preliminary work was necessary, as it was evident that the engineers and manufacturers of each country ought to be made fully acquainted with the work which had been done elsewhere in connection with Screw Thread Standardization. Steps have accordingly been taken by the British Engineering Standards Association to bring to the notice of the United States Government and the engineering profession in the United States the great amount of original work which has been done in England in connection with screw threads and their limit gauges. This work is very clearly set forth in a paper by Sir Richard Glazebrook presented at the New York meeting of the American Society of Mechanical Engineers in December, 1918.

The writer was one of the Canadian delegates present at the Conference in London in April, 1918, and at that meeting presented a memorandum (since published by the British Engineering Standards Association as (C.L. (M) 4537), in which attention was drawn to the very close relation existing between machine shop practice in Canada and that in the United States. This was emphasized by the replies to a questionnaire sent out to a large number of Canadian engineers and manufacturers, the consensus of opinion being that as regards screw thread work in Canada it would be natural to follow the standards of the United States, although the desirability of possible modification was recognized.

At the present time conditions do not seem quite ripe for the proposed Anglo-American Conference, and it is likely that before such a Conference takes place it will be necessary to await the report of the United States Senate Commission on screw threads and the results of other work which is at present going on in the United States.

The foregoing is a very brief and necessarily incomplete presentation of the outlines of an immensely important subject, in regard to which much work still remains to be done. Those interested will find a large amount of information in the various publications of the British Engineering Standards Association, the American Society of Mechanical Engineers, the Society of Automotive Engineers and other bodies already mentioned.

APPENDIX I

Published Standards and Specifications of the British Engineering Standards Association

Rolled Sections for Structural Purposes.
Tramway Rails and Fishplates.
Influence of Gauge Length and Section of Test Bar on the Percentage of Elongation.
Locomotives for Indian Railways.
Copper Conductors.
Tubular Tramway Poles.
Railway Rails.
Pipe Flanges.
Portland Cement.
Structural Steel for Shipbuilding.
Structural Steel for Marine Boilers.
Structural Steel for Bridges and General Building Construction.
Telegraph Material.
Electrical Machinery.
Tensile Test Pieces.
Temperature Experiments on Field Coils of Electrical Machines.
Screw Threads.
Pipe Threads for Iron or Steel Pipes and Tubes.
Trolley Groove and Wire.
Nuts, Bolt Heads and Spanners.
Ingot Steel Forgings for Marine Purposes.
Steel Castings for Marine Purposes.
Steel Conduits for Electrical Wiring.
Steel Bars for use in Automatic Machines.
Carbon Filament Glow Lamps.
Copper Alloy Bars for use in Automatic Machines.
Electricity Meters.
Limit Gauges for Screw Threads.
Cast Iron Low Pressure Heating Pipes.
Cast Iron Flue or Smoke Pipes.
Reciprocating Steam Engines for Electrical Purposes.
Boiler Tubes.
Cast Iron Pipes for Hydraulic Power.

Sparking Plugs for Internal Combustion Engines.
Keys and Keyways.
Steel Fishplates for Bull Head and Flat Bottom Railway Rails.
Wrought Iron of Smithing Quality for Shipbuilding (Grade D.)
Ammeters and Voltmeters.
Wrought Iron for use in Railway Rolling Stock.
Lampholders and Caps.
Cold Drawn Weldless Steel Boiler Tubes for Locomotive Boilers.
Screw Threads, Nuts and Bolt Heads for use in Automobile Construction.
Copper and Bronze Wire.
Heads for small screws.
Cast Iron Soil Pipes.
Cast Iron Waste and Ventilating Pipes.
Tungsten Filament Glow Lamps.
Copper Tubes and their Screw Threads.
Screwing for Marine Boiler Stays.
Broken Stone and Chippings.
Fishbolts and Nuts for Railway Rails.
Salt-Glazed Ware Pipes.
Copper-Alloy Three-Piece Unions.
Ceiling Roses.
Method of Specifying the Resistance of Steel Conductor Rails.
Tungsten Filament Glow Lamps for Automobiles.
Pneumatic Tyre Rims.
Wheel Rims and Tyre Bands for Solid Rubber Tyres for Automobiles.
Wall Plugs and Sockets.
Charging Plugs and Sockets.
Wrought Steels for Automobiles.
Tars, Pitches, Bitumens and Asphalts used for Road Purposes.
Electrical Pressures for New Systems and Installations.
Cast Iron Pipes and Special Castings for Water, Gas and Sewage.
Magnetos for Automobile and Aircraft Purposes.
Dope and Protective Covering for Aircraft.
Steel for Aircraft for Government Purchases in the United States.
Ball Journal Bearings.
French Metric Screw Threads for Aircraft Purposes.

APPENDIX II

Original Members of the Canadian Engineering Standards Committee

Chairman.—Sir John Kennedy, Consulting Engineer, Montreal Harbor Comm. and Chairman Advisory Comm. of Council, Institution of Civil Engineers.

Vice Chairman.—Capt. R. J. Durley, M.B.E., Officer, I/c Div. of Gauges and Standards, I.M.M., Ottawa; H. H. Vaughan, Vice-President and Chief Engineer, Dominion Bridge Co., Montreal.

Hon. Secretary.—Professor J. B. Porter, D.Sc., McGill University.

Lt.-Col. W. P. Anderson, C.M.G., Chief Eng., Dept. Marine, Ottawa.

M. J. Butler, C.M.G., G. M. Armstrong-Whitworth Co., Montreal.

K. M. Cameron, Supervisory Eng., Dept. Public Works, Ottawa.

E. Deville, L.L.D., Surveyor General, Dept. of Interior, Ottawa.

G. H. Duggan, Pres., Dominion Bridge Co., Montreal.

J. M. R. Fairbairn, Chief Eng., Canadian Pacific Ry. Co., Montreal.

L. A. Herdt, D.Sc., Chairman, Can. Electro-Technical Commission, Montreal.

R. Hobson, Pres., Steel Co. of Canada, Hamilton.

Wm. Inglis, Pres., John Inglis Co., Toronto.

Major W. J. Keightly, Chief Inspector, Military Stores, Ottawa.

A. B. Macallum, D.Sc., F.R.S., Chairman, Hon. Advisory Council, Ottawa.

D. H. McDougall, Pres., Nova Scotia Steel Co., New Glasgow.

J. C. McLennan, D.Sc., F.R.S., Professor of Physics, University of Toronto, Toronto.

P. L. Millar, G. M. Canadian Vickers Co., Montreal.

Lt.-Col. C. N. Monsarrat, Con. Eng., Dept. Rys. & Canals, Ottawa.

R. A. Ross, Con. Eng. and Member Hon. Advisory Council, Montreal.

R. F. Ruttan, M.D., Prof. Chemistry, McGill Univ. and Member Hon. Advisory Council, Montreal.

A. Surveyer, Con. Eng. and Member Hon. Advisory Council, Montreal.

A. Stansfield, D.Sc., Prof. Metallurgy, McGill Univ., Montreal.

W. F. Tye, Const. Engineer, Montreal.

E. O. Way, Chief Inspector, Weights and Measures, Ottawa, Ont.

With reference to the International Aircraft Standards Commission, the delegates to that body represented Great Britain, Canada, France, Italy and the United States. We were very gratified to feel that the activity and energy which has been shown in this country in the construction of aircraft during the war was recognized by an invitation to send delegates to this Commission. We hope and expect that the sectional committee of the Association dealing with aircraft parts will be recognized by the Canadian Government as the National Committee representative of Canada in connection with the deliberations of this International Commission.

I should like to add a few words in connection with some of the impressions that I gained during my visit to England to attend these committees.

The thing that impressed me most about the work which had been done in England was the extremely thorough and scientific way in which the Government, the industrial world, and the British Engineering Standards Association committees and sub-committees have gone into original investigations connected with standardization and war work. Take for instance the theory of screw thread measurement, which is really a very complicated and thorny subject. Even although the work was undertaken as a war measure they went about it in a most thorough manner and the amount of data and information accumulated with regard to that one subject is monumental. The whole thing was gone into, one might almost say, from first principles.

For example, when the question was raised in England as regards the desirability of having a thread angle of 55 degrees as in the Whitworth system, or 60 degrees, as in the United States standard form of thread, the matter was not handled by the simple expression of a number of individual opinions. They went into the thing very completely recognizing the necessity for example, that there should be a clearance between the crest and root of the male and female thread and that the fit should be on the working surface of the thread. Then the question of what these clearances should be was considered, what tolerances are possible in quantity production of screwed work, whether made in the lathe or by screwing tackle, or as the case may be. Then they considered the effect of varying the angle of the thread on these clearances. From that point of view a paper by James Taylor of Leicester points out that with very fine pitches it is permissible to employ a narrow thread angle, 45 degrees or something of that sort, whereas for coarser pitches it is desirable to have a wider thread angle which still permits a reasonable tolerance on the crest and root of the thread.

Then, the same question would be attacked by another investigator from the point of view of strength. In this connection research had to be carried out to form an idea of the actual distribution of stress in the body of the bolt, with threads of various forms. By an extremely ingenious method whereby a slice of celluloid was used, cut out into the form of the thread, the thread section was stressed by the action of what corresponded to a nut, and the distribution of stress was then investigated by passing polarized light through the celluloid, and by comparing the colored patterns produced. This example will give you an idea of the way in which such work has been carried on in England.

Similar activity was shown in connection with many other branches, the Aircraft Inspection Department, for instance. I do not think I am letting out a secret in saying that when I was in England they were investigating the possibility of using X-rays for the purpose of examining the structure of timber and much experimental work was in progress along every line of work. The Aircraft Inspection Department and the Aircraft Production Department of the Ministry have carried out a very large amount of original work, much of which, of course, has never been made public and will not be for some time. A great deal of research work in connection with the war has also been carried out at the National Physical Laboratory. Sir Richard Glazebrook was kind enough to show me something of the work which had been done in connection with aircraft design there. Further, in one of the big wind tunnels used for testing the resistance of aeroplane models they had started investigating the resistance of shells. For example, they had a number of model shells which were suspended on a very delicate measuring appliance in a current of air, in order to find out what effect stream lines applied to the shell base had upon its resistance. The same energy and earnestness of purpose characterized all these investigations, whatever branch of work one chanced to examine.

I would like particularly to point out the very great benefits that have accrued to industry from co-operation and through the pooling of information which took place during the war between different manufacturers. It is not too much to say, for instance, that the progress which has been made in the last three years in connection with aircraft design could not have been accomplished under ordinary conditions in much greater time; one estimate I heard gave at least one hundred years as the time during which an equal amount of progress would have been made under pre-war conditions. A great deal of that advance, in my opinion, was due to the fact that everybody was working to a common end. The information and experience obtained at each plant—the essential portion at all events—was communicated to the Aircraft Production Department of the Ministry of Munitions and it was then distributed where it would do the most good, and similar methods were adopted in the other departments of munitions work.

One of the things, sir, that we should guard against as far as possible is that of coming back to the old individualistic methods under which, as far as technical progress is concerned, every manufacturer or industrial concern works independently of the others. Perhaps I am touching on rather a thorny point there, but the progress which has been made, not only in England but in Canada as well, by the dissemination of information in the way that I have described has to me been a very striking circumstance.

I had the pleasure of visiting a large number of plants and engineering factories of different kinds and I should very much like to be able to tell you something of the things I saw. The impression left by a visit of that kind is, of course, very bewildering. For instance, one plant which I visited in Coventry, was turning out from one hundred to one hundred and fifty 300 horsepower aero-engines a week—an accomplishment which is really stupendous when you come to analyze what it means in the way of production I found the same amazing production in France—in every plant where I had the privilege of going, and I certainly came away with the feeling that the industrial development in England and France far exceeded anything that one could have thought to be possible."

H. H. Vaughan: I wish to say a few words in connection with Capt. Durley's most interesting paper. I think we should all thank Capt. Durley for what he has told us. While I have heard Capt. Durley on a previous occasion tell something about the things he saw on his trip, he has told us some things this morning that are really of very great interest. I wish, however, to refer more particularly to the work of the British Engineering Standards Association.

One of the most marvellous things about Britain's effort in this war has been not only the wonderful way in which all our population have entered into it, but—what most of us hardly expected—the deeply scientific manner in which she has tackled her war problems. On this side we are apt to think that English engineering is more a question of rule of thumb than is the case in connection with our Canadian and American work, but it is a fact that England has shown the most extraordinary energy in developing scientific research in connection with her war problems. Capt. Durley has told you some of it. It is amazing to realize what England has done in appointing competent, scientific men to investigate the problems she has come up against. That has not only had its effect on the war, but is going to have its effect in after times of peace. England has certainly revised her methods; she has taken a new lease of life in industrial work, and this country has a task before it not only to hold its export trade, but to hold its own home industries—unless we follow the English system.

The work of the Engineering Standards Association is only a very small item amongst the things that we should do, but I believe it is an item; I believe there are some things to be done here in connection with which this Association can be of value. As you know, I am one of the representatives of *The Institute* on that Committee, and I do not for a moment want to devote any effort to work that is not going to be of some value; I am sure that my associates feel that way too. We are willing to give time to a work if it is to be of any service, but we haven't the faintest desire to engage in a work which is not going to accomplish anything. We believe, however, that there is a field for this Association which will be of service to Canadian industry. We have applied to the Government for a grant. The Committee, as Capt. Durley told you, has been changed to an organized association, and that association has seen two of the Ministers, and the grant is now under consideration. I would much like to see this meeting endorse that application for the grant, and I have prepared a resolution which I move in the following terms:—

> "Resolved, that this meeting endorse the application of the Canadian Engineering Standards Association to the Dominion Government for a grant to partially defray its expenses during the ensuing year, and believe that this Association will be of great service in the industrial development of the Dominion."

The motion was seconded by Mr. Mountain and carried unanimously.

Mr. Francis proposed an expression of appreciation to Capt. Durley for his very excellent address, which, as the Chairman stated was seconded by everyone as the proposal was greeted with applause.

M. R. Riddell, Chief Engineer of Canadian Aeroplanes Limited then read his paper on: " The Development and Future of Aviation in Canada."

During the course of Mr. Riddell's paper the meeting adjourned for luncheon and on resuming for the afternoon session the paper was continued. The paper was illustrated by a series of slides showing the different types of aeroplanes and interesting processes of manufacture.

Discussion

In the discussion following the reading of this paper the author was congratulated on the comprehensive way in which he had covered the subject. It was pointed out that *The Institute* might give attention to two points in this connection, one was the necessity for the development of the technical or engineering side in addition to the practical, where much had already been accomplished by Canadians and the other point was the absolute necessity for the further study of meteorology in connection with flying, as flying depended so much upon weather conditions. *The Institute* should give consideration to both of these points if we are to share in the development of aviation.

Luncheon, Wednesday Noon

From the morning session adjournment was made to luncheon at which President Leonard presided. Hon. Arthur Meighen, Minister of the Interior, was the first speaker on the programme, who gave a brief but very effective address, delivered with the natural grace of a born orator. He felt it an honor to have the privilege of addressing *The Institute*, particularly because the department over which he presides has among its officers a very considerable number of the members of the engineering profession, some eight-six in all, all of whom with one exception are members of *The Engineering Institute of Canada*. In connection with the men in his department his greatest and most lasting impression has been the very high standard of efficiency and the almost universally high standard of devotion of whom he placed at the top the members of the engineering profession. In part, Mr. Meighen said: " Engineering as I understand it in all its phases, has to do with the collection of the energies of nature and their direction toward the uses of man; and if the use of man is in the military field, then the energies of nature come to bear a tremendous part in determining the issue of the conflict. We speak a truth known to all when we say that a great factor in the triumphant issue of the conflict through which we have passed is the part played by the engineering profession in making that success possible. One only has to visit the front in France; indeed, one only has to read what is at hand for all to read, concerning the various war activities, to comprehend how tremendous a part this profession has played in all its activities on both sides, and, fortunately, with greater success on ours." On behalf of the Government, Mr. Meighen extended a cordial welcome to the engineers of Canada.

Dr. Ira N. Hollis

The Chairman then introduced Dr. Ira N. Hollis, Dean of the Worcester Polytechnic Institute, who had kindly come from his home in Worcester as a representative of the American Society of Mechanical Engineers, of which he is a past president as well as one of the eminent engineers of the United States.

Dr. Hollis, who was warmly welcomed, on rising to speak, said:

Mr. Chairman and gentlemen: I want to assure you that for a number of reasons it is a real delight to me to come to Canada, one of them being that I promised two or three times, while I was President of the American Society of Mechanical Engineers to come to Ottawa, and every time I had to break my promise for some reason connected with our entering the war. This is, therefore, a redemption of my promise to friends in Ottawa and Toronto.

Another reason why I am glad to be here is that it affords me an opportunity of congratulating you on the statement of the aims of your *Institute* which appears on the cover of your *Journal*. We, as engineers often fail to understand the significance of our own profession. It is not necessary to shout from the housetops, but who has ever produced a better motto than the following for an *Institute* such as this:—

> "To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession, and to enhance the usefulness of the profession to the public."

Numerous committees of the American Society of Mechanical Engineers, the Society of Civil Engineers, and the Engineering Council, have endeavoured to state the aims and organization of our societies, but with all our attempts in the past we have not produced anything as good as this. I think in the American Society of Mechanical Engineers that the percentage of technical papers has decreased in proportion as the papers intended to be useful to the public have increased. I do not know whether that is the best thing for a technical society or not, but I do know that it bids fair to make our profession in the United States a profession of better citizenship. With regard to the technical papers, we must never forget that the purpose of any technical organization like ours or like this is mainly educational. That is what the association is for—to teach its members how to do their work better and how to serve and to build up their relations with the public in a better way.

Another reason for my coming here is deeper and broader than anything I could state in regard to our profession; it relates to your part in the war. Although much smaller in population than the United States, you, gentlemen, are our older brothers in arms. Upon your shoulders fell the first shock of the war as you rallied so splendidly to the defence of human liberty. I can state nothing better in this connection than two or three sentences contained in a letter from a relative on the other side, who went in at Chateau Thierry and ended up at Stenay. Every one of his letters contains some stronger statement of this sentiment. He said: "As the time goes on and I learn more about this war, I take my hat off to the British and Canadians who fought here in the beginning. We came in with our army as a large reserve, we fought in some important actions and we were getting more troops to the front, but we came in at a time when the Germans were putting forth their last great effort after time for ample preparation, whereas the British and Canadians had to prepare while they were fighting. I take my hat off to them." I cannot help feeling, gentlemen, that is the finest reason of all for my coming up here, to salute you.

I look upon our race as the inheritors of the liberties of this world. After all, we have the English ideals of government on this continent and we have to make all those who come to our shores from other countries English in ideals. South of the line we call ourselves Americans, and you Canadians, but we are all Americans in the freedom of the atmosphere in which we live. I come from that federation of states which split off from the mother country more than a century ago through a document, after all, gentlemen, written by Englishmen—one of the noblest statements in our language, next to the Magna Charta. We are all Americans, and we have here on this continent the best league of peace that I can imagine. No fortifications on our boundaries and war is unthinkable north of the Rio Grande. Our league is written in the hearts of two peoples who do not resort to bloodshed to settle their differences. As we meet here, the Peace Conference is sitting in Paris and is working toward definite action—for what? It will be the most important decision ever made in the world, and it will be framed into some kind of statute, where the cowardly bully who has bathed the soil of France in the blood of our sons and covered the ocean with ships and the bodies of the innocent is up for sentence and to be rendered impotent until the centuries shall have turned him into a Christian.

So far as our profession is concerned, I am glad to bring to you, gentlemen, the greetings of the American Society of Mechanical Engineers. We have the same warmth of feeling towards you that we have towards our members in the States, and we congratulate you on the formation of an *Institute* containing all the societies of engineers in the youth of those societies. We have a harder task ahead of us in the United States to make one great society of engineers, because each separate society has already crystalized into its own methods and its own policies, thus rendering difficult a union of all.

The world's history has been marked by three periods of progress. I like what Mr. Meighen said about the engineers being a warrior profession. Some creature in the remote past seized a club in his clutches or claws to defend himself against some other creature. He there crossed the border-line between the animal and the man. From that has grown the reasoning power which makes the difference between us and the other creatures that God has placed on this earth. From that period up to the time of a poor Scotchman, we went through the inventions necessary to maintain and sustain life on this earth, and that forms the first great period of recorded history, previous to about 1760. In the interval came the second stage in the development of man; it was that spiritual relation that began with the birth of Jesus Christ, making life worth living. And we have entered in this century, the third period, namely, that period where man makes use of power external to himself.

At the beginning of one of H. G. Wells' books you will find this sentence: "Civilization is advanced in proportion to a man's control over power outside of himself." Through what James Watt gave to mankind a little over a century ago, we have entered this third period of the twentieth and succeeding centuries, the possibilities of which are not even thought of, inasmuch as we can use the power and energy that God placed on this earth for the development of man into something higher and far better. Some day this century will seem but as the dark age to our descendants, and that mainly through the control of power entirely outside of man. I speak of this, gentlemen, because that gives you plainly and at once the function and the place of the engineer. Yet what does all his work amount to without the spirituality that makes life worth living?

I was speaking in New York, not very long ago, on the subject: " Is Science Safe for Mankind?" I dealt with the subject in all seriousness, for if science can be turned into a destructive agency to cover the earth with blood and to destroy all that has been previously produced it is not safe. How can it be made safe? It can be made safe through our profession, gentlemen, by approaching the discoveries of science and the application of science in that reverent attitude that will forever prevent its being used as a destructive agency. That, to me, is what our profession can do. What does it amount to if we produce another railroad, another dock, a finer type of bridge, or a better machine, if it but leads to a conspiracy for the control of the earth? What does efficiency amount to if that, after all, is the end? God deliver us from that kind of efficiency that places in the hands of the privileged few the control of the masses who are to be trained to service very much as the ox or the horse is trained.

Another feature of the engineering profession is its opportunity to teach that proper attitude of mind towards the patrimony that nature has handed down to us on this continent so that we may prevent its being used or wasted in the destruction of mankind by self indulgence or war.

May I add a word or two about what the engineer has learned from this war? I can speak, perhaps, for the United States as I saw it, before we entered the war. One thing I can say: we were the most wasteful people on the face of God's earth. We had found in our country immense resources, which we prided ourselves on exploiting for the luxury and the greed of a great many people. This war has brought to our profession a different vision, and we have certain things to think of. The first is found in the work, " conservation " which has grown up in the United States and which I have no doubt you have in Canada. What is the significance of it? It means the saving of everything that will help to perpetuate the influence of the Anglo-Saxon race; it means the saving of anything that will promote our ideals as a race; that our language and our efforts may civilize this whole world, the Germans as well as the others I cannot help feeling that there are two or three aspects of that to which we have given but little attention. My interest in the matter was aroused in Massachusetts, because during the past year or eighteen months I have assisted in the conservation of fuel for that state. Through propaganda, through speaking on the subject, through indicating to the New England conscience that they ought to save, and, besides, that they had to or they would not get the coal during the winter, we have managed to make a real reform. In Worcester, through an effective committee of manufacturers, where there are 200,000 people, during the past year we saved, not by cutting off any industries, but by actual scientific study of the problem of saving in our power stations and in our factories, 125,000 tons of coal—a million dollars saved for that city alone during the past year. In a state which takes 12,000,000 tons of bituminous coal in the course of a year, we saved at least ten percent, and we were rash enough to promise Mr. Garfield and the Fuel Administration that we would take two and a half million tons less during this year than we took the previous year. Gentlemen, we had just touched the fringe of this subject when the armistice was signed and the bottom dropped out of the whole movement. Are we going to permit this effort throughout the United States to break down? Not at all.

In my state—but it is not my state; I was born in Kentucky—when I went as a professor to Harvard College years ago, my picture was published in the Louisvile Courier Journal; and lest I should become vain on that account, my photograph was bracketed on the same page with a man who had been hanged in Louisville the day before. One of my friends saw that picture, an old farmer whom I had known in my youth, and who was living in Jefferson County, Kentucky. He said to me: " I see you have resigned from the Navy and are going to Harvard College as a professor." I said: " Yes." He said: "For God's sake don't do it; you are going amongst those d—— Yankees." The New England people do not like that story very much, but it shows that sometimes misunderstanding can exist among our states, the same as I have sometimes heard of between Canada and the United States. But whatever misunderstandings have occurred between those two countries, they do not approach some of the former bitterness between the North and the South; do not approach some of the misunderstandings between the different states. You see, that man who was talking to me about New England knew nothing of it; he did not know of the generous impulses that are to be found there, and of the generous attitude of the people towards everything that has a value to the public. Gentlemen, you will find in New England the same broad generosity to be found in Canada, if you look for it.

Coming back to the matter of the question of coal in Massachusetts; by organizing and by co-operation, the things that the war has taught us, we can save at least twenty-five per cent of the coal that has hitherto been used, cutting off three million tons, saving at least $20,000,000, and helping that state to hold its place in the manufacturing activities of my country.

The aspect of saving in connection with coal is only one corner of the picture. We have learned during the past year to effect saving in food, in order that we might supply our Allies on the other side, as well as our own soldiers. We have reduced the amount of transportation for unnecessary commodities and thus we have made our railroads more effective. Saving can be effected in every respect—even in respect of our water power. Indeed, there is nothing in which there is not room for further study and co-operation and co-ordination of effort to the end that America and Canada too may remain as long as possible the chief influence for good on this earth.

I have heard something of standardization since I have been here; I think that next to conservation, that is the most important subject we have to deal with. There is an enormous amount of waste in the production of a great many articles which are duplicates. I cannot tell you how many thousands of different parts and kinds of steel were formerly ordered for automobiles; you probably know that better than I do. But there is not one aspect of manufacturing connected with engineering that is not susceptible of improvement by co-operation amongst manufacturers, to the end that articles for like purposes shall be produced in the same way and shall be standard. I think our economic supremacy among the nations is dependent upon that.

Then, there is the labour question. During the past six months we have in the United States been very much involved in the question of the relation between labour and the employer and in the re-employment of soldiers. I do not know any men who are better qualified to take a hand in that than the engineers. But in this connection I want to destroy what may be called another illusion; a man is not competent to organize and direct industries or to handle labour questions simply because he is an engineer, but he may become competent by interesting himself in them if it is his natural field. I have heard a great many people say: you ought to put engineers into the Administration. I say, not unless they fit themselves to go into the Administration. I have heard again that the engineer ought to take an active part in politics and in the public life of his country—not at all, unless he fits himself for it; and it is his business to fit himself. In other words, our profession is a great profession only in proportion as we make it so, and not by reason of the fact that we are called engineers.

We keep talking about this having been an engineers' war, about machinery having won the war. But it is the blood of our sons which has won the war; it is the men who have done it. When I heard the statistics read by your president yesterday, I rejoiced that men in my profession, members of this *Institute*, could so help the world in this crisis. I am going to ask that our societies in New York prepare similar statistics, and we will see if we can approach your record. Of course, we were not in it so long; I sometimes think we were tardy in getting in. We got there, and we might have done a great deal more and suffered a great deal more if you fellows had not pretty nearly cleaned the thing up before we got in to help. Nevertheless, we ought to keep in mind the fact that machinery alone did not win the war; what brings such a victory as ours is the willingness of men to give their lives for a great cause.

The same thing, gentlemen, may apply in time of peace; a man may help his country and the community by willingness to dedicate himself to a profession, to give himself to the advancement of the human race; and that willingness is expressed in the one word, "service." If I were to try to visualize the condition necessary to the progress of the world to-day, I would express it in two words, in the nature of a formula for our profession: "to serve." At the beginning of the war we heard very much the phrase "to make the world safe for democracy." After all, that is but a method of saying that we are seeking a form of government for the human race that will permit every individual to develop the maximum of his possibilities in the service of mankind. That is what democracy means. Our profession will have great power in the future of peace, in the league of nations, because no league of nations will last if the proper spirit is not there. But we will keep the peace by a reverent attitude of mind towards the energy and materials and that patrimony which the good God has given us. Without that attitude of mind, we cannot achieve what should be our great purpose.

About two months ago it was proposed in New York that the American Society of Mechanical Engineers go to London for a meeting in a year or two. What I want to see within the next two years in London or Paris is a great meeting of all the engineers of this continent—civil, mechanical, electrical, mining—met together to rejoice over that peace that I hope is going to come out of the present proceedings in Paris.

I hope to see you, gentlemen, at some of our meetings in the future.

Afternoon Sessions, Wednesday, February 12th

After the completion of Mr. Riddell's paper and the discussion thereon, Major L. Anthes, member of the Advisory Council of Soldiers' Civil Re-establishment, was introduced and before reading his paper, emphasized the necessity for individual and general co-operation on on the part of everybody who is interested in our national life. The reconstruction period is one in which the engineers of this country can assert themselves. We all admit that they are men highly trained technically broad in their ideas and in their general knowledge. If engineers were much more closely associated with industry in this country it would be very much better for the engineer and the technical man.

Continuing, Major Anthes read his paper, the subject being

Soldiers Civil Re-establishment

Nothing is so disturbing to civilization as a world war carried on for a number of years and increasing in intensity, and involving nation after nation as the years go on. War is most insistent and insatiable in its demands, it takes of our best, and gambles with a world's resources with an intensity that shakes empires to their very foundations. All so-called normal conditions of life are not only disturbed, but in many instances revolutionized, and while we have the precedents of other wars to go on, such are the varying conditions with the march of progress that the problems of reconstruction become more involved, and the readjustment more complex. Happily the advance of intelligence and the adaptability of science have created means whereby solutions may be arrived at which were impossible of attainment in years gone by.

Whereas the shock of war, with the devilish contrivances that modern sicence has contributed to its destructiveness, has carried millions of men through almost inconceivable trials, fortunately an intelligent sympathy has been aroused, and a sense of duty and responsibility awakened in those who have not undergone the stress of battle so that it is easier to obtain the co-operation of a thankful people in helping to reclaim and re-establish those who have faced a sacrifice essential to the deliverance of a democratic world from the soulless might of tyranny.

The accomplishment of placing our war heroes again in civil life, with the greatest of speed and the least disturbance to economic conditions, is in itself the essence of reconstruction. Even as each individual soldier on the battlefield of Europe contributed in a measure to the overthrow of despotism and the winning of a world's freedom, so is it essential that each individual in a community shall contribute in some measure to the task of readjustment which is now demanded of this country.

I desire briefly to outline the machinery that has been designed and put into operation for the accomplishment of the purpose for which our department has been created. The Department of Soldiers' Civil Re-establishment, as is now generally known, taken up the control of the disabled soldier after his discharge, and tries to refit him to a normal condition of life as speedily as possible. For the purpose of re-establishing the soldier who has been more fortunate than his disabled brother, and whose only drawback is his severance from normal pursuits on account of his service overseas, the Information and Service Branch of the S. C. R. (late Demobilization Branch) has been created. After long conferences with the Dominion Department of Labor, Provincial Departments of Labor, and Returned Soldiers' Commissions, it was decided that the opening of a chain of Labor Bureaux from coast to coast, under Provincial control and administration, and with Federal supervision, was a logical means of bringing the man desirous of work into contact with employment. It was unanimously agreed that in all matters of employment the returned soldier was entitled to preference, and that this preference should be shown him. While at first it was suggested that a separate chain of labor bureaux should be established to handle the returned soldier, it was ultimately decided, and I think logically, that the only way in which the soldier could be given preference was to direct all applicants to the one chain of labor bureaux, where all opportunities for employment would be kept on record. In order to make these labor bureaux as efficient as possible it is necessary to win the co-operation of the employer of labor, and to do this he must be given efficient service. Nothing is more aggravating to an employer than to be harassed by a variety of independent solicitors for employment agencies and the confusion which results therefrom. Therefore, under the Employment Co-ordination Act, the Provinces have agreed with the Federal Department of Labor to pass legislation closing the independent labor bureaux, and to co-operate with the Dominion Government in creating a chain of governmentally controlled and supervised bureaux.

Labor scouts, who are, plainly speaking, employment salesmen, solicit the employer for his labor requirements, endeavoring to sell him a satisfactory and efficient labor service. The employer, on the other hand, will communicate his requirements to the nearest Government Labor Bureau, and will report on forms supplied periodically by the Federal Department of Labor, the number of employees on his payroll, and the prospective increase or decrease for the period following. In this way an intelligent survey of employment conditions throughout Canada will be maintained. Federal and Provincial clearing houses, Federal and Provincial superintendents of labor, and standing committees on labor—Federal, Provincial, and Municipal—will contribute to the stabilizing of this all-inclusive system. In each of these labor bureaux throughout Canada will be a representative of the Department of Soldiers' Civil Re-Establishment, whose duty it will be to meet and interrogate each returned soldier applicant, directing him to the proper authorities as his case may require, or if he is ready for employment, obtaining for him that preference over the civilian applicant that is his just due. In each military district is a unit of the Department of Soldiers' Civil Re-establishment which takes up the direction of the disabled and discharged soldier as he is released from the control of the military in his district. A Unit Service Officer administers the machinery which has to do with the soldier who is seeking employment. Special representatives under the direction of Information and Service Headquarters at Ottawa, keep a constant survey of employment conditions and assist in organization in their respective districts. The close liaison between the Department of Soldiers' Civil Re-establishment, the Federal Department of Labor, and the Provincial Departments of Labor, should make for the greatest efficiency in the placing of the soldier in employment and helping him to attain his pre-war efficiency.

The foregoing is an outline of the machinery that is essential in this work, but so far as the returned soldier is concerned, it is only contributory to his re-establishment in civil life. I do not desire to dwell at length on the severe hardships, sacrifices, and disabilities which, during the last five years have tended to remove the man who has served overseas, from normal conditions of pre-war times. If the public at large does not realize by this time that the returned soldier cannot be expected to take up where he left off when the call to arms came, and quietly settle down to pre-war conditions, the fact will never be realized.

Sympathy and co-operation are words which have been extensively used in reference to the re-establishment of the soldier and it is our desire to justify the use of these two words by seeing them put into practical application. It has been necessary to bring to the attention of employers, and especially industrial employers, the fact that a man who has suffered the shock of battle cannot be expected to settle down to his occupational pursuit with the same facility that he did in prewar times. Noisy machinery, the confinement of workshops, and the general change of atmosphere, are bound to have a more or less depressing and disturbing effect. We are asking industrial employers to take a direct interest in the returned soldier going into their plants, give him more or less freedom to come and go at his own pleasure during the first few weeks or months of his employment, and at the same time pay him the standard wage for a full day's work. This, I grant, is asking the employer to make a personal sacrifice, but when it is brought home to him that the sacrifice he makes in this way cannot begin to measure up to the sacrifices that have been made for him, it is not difficult to make him appreciate his responsibility and to win his co-operation.

While the absorption of the mechanic, and the man accustomed to less skilled labor, presents no very serious problem,—what of the thousands of officers, students, and men of professional calling who have lost ground through the hiatus of war? Many of the officers were boys who went from banks, offices, and colleges, joining the ranks before going overseas, and by persistent application, intelligence, and outstanding bravery, won not only minor but senior rank on the field. And, furthermore, senior rank brings senior pay,—and is it to be expected that these men of oustanding ability should go back to the point where they left off when they answered the call to arms? It is true that many of those in the class which I have just referred to, have been promised their old positions upon their return—but is it reasonable to expect that they can accomodate themselves to their individual pre-war status?

Of particular interest to a body such as yourselves is the young engineer and the engineering student. In the ranks of the first contingents of Field Companies that went overseas, was a large number of graduate and undergraduate engineers. Owing to the restricted size of a field company, many men of this class joined the Artillery, Infantry, and other branches of the service. A review of the number of technical students enrolled for technical courses during the past four years, as compared with pre-war enrollments, to say nothing of broken courses, reveals an appalling state of affairs from an economic standpoint. Owing to the necessity of quick decision and immediate action which the exigencies of war demand of the military engineer, there is not time for mathematical precision so necessary in the civil calling of an engineer, and broad formulæ and more or less primitive expedients in many cases are applied. While this had a tendency to broaden a young man's comprehension and make him more self-reliant, how is he going to meet the more technical demands of his profession when he returns to civil life?

In Europe and in the United States, the large engineering bodies have realized their duty towards the man who has contributed so largely to the success of the Allies in a war which has been essentially an engineering war. "In Great Britain, the Ministry of Labour established an Appointments Department early in 1918, to assist and advise those requiring professional and business appointments on their return to civil life. There are two divisions of this department; one deals with training, the other with employment. Before demobilization an officer may fill in a card stating his wishes as to employment, his qualifications, etc., and this will be forwarded to the Appointments Department. The United Kingdom has been divided into eleven districts and in each there is a District Directorate. The number of men placed in positions has increased steadily. In some cities of the United States there are special professional sections of the U. S. Employment Service devoted to the placement of engineers, technicians and teachers. In Chicago there is a special office of the employment service devoted to the placing of qualified engineers and teachers. Its work has been very successful as shown by the following figures:—Organized July 1, 1918, it made 400 placements in July, 1100 in August, and 1600 in September."

Being myself a military engineer, and having come into contact with a great many of the graduate and undergraduate engineers who have gone from this country overseas, this is a matter to which I have given considerable thought.

It has been suggested that all overseas engineers be asked to form an engineering organization for the promotion of their own interests. While there is much that can be said to the advantage of such an organization, I believe that if the engineering bodies of Canada already in existence are willing to bear a proportion of the responsibility of seeing their overseas membership again established in civil life, such a step will be unnecessary.

I have not attempted to outline every feature of the work of the Information and Service Branch of the Department of Soldiers' Civil Re-Establishment, as it would take too long, and the outstanding principle would be more or less submerged in detail. In closing I just wish to draw the attention of your organization to the fact that in the matter of vocational training in our department, the returned engineer is playing the most outstanding part. The Director of the Vocational Branch, Mr. Segsworth, is himself an engineer, and many others will be found throughout his organization. Just as the war has demanded all that is best in engineering skill and operation, so do the problems of reconstruction demand the same application of engineering principles.

In response to a question from E. M. Proctor, A.M.E.I.C., as to whom returned soldiers who are engineers should apply for information, Major Anthes stated that the engineering organizations were being asked to appoint Committees to act in co-operation with the Information and Service Branch of the Department of Soldiers' Civil Re-establishment. Lieut F. S. Rutherford, A.M.E.I.C., was being released from the Militia Department for the purpose of getting in touch with the returned engineers. The head office of the department in Ottawa is at 130 Queen St., and in Toronto at 287 Queen St. West, where information will be given out.

Referring to the part which engineers are taking in addition to the Department of Infoımation and Service of which Major Anthes is the head, Professor Haultain stated that "there are two other branches which have engineers at the head. There is the branch which is responsible for the manufacture and supply of artificial limbs, which has at its head Major Coulthard, a mining engineer. The Vocational Branch has at its head Major Segsworth a mining engineer. Major Segsworth's divisional chief in Nova Scotia is a mining engineer; in Quebec he has an electrical engineer; in Ontario, I am in charge; in Manitoba, another engineer is in charge and in Alberta there is also an engineer; I do not think there are engineers in charge in Saskatchewan and British Columbia. On my own staff there are forty odd engineers and architects and that is in Ontario alone. We have room at the present time for twenty more engineers, if we can get them. If any of you know of any returned engineers who would like to take up this work, we would be glad to hear of them."

Col. Leonard: "I may say, as a concrete example of the work that this Department is doing, that we got from Prof. Haultain's department, in the industry with which I am connected, a man who, before the war, was a labourer. To-day he is one of our assayers, and is performing most excellent service.

The discussion was then closed.

National Highways and Good Roads

Capt. J. Duchastel, M.E.I.C., Honoury President, Good Roads Association, before reading his paper, which appeared in the February issue of *The Journal,* stated that his idea in presenting the paper was to elicit discussion upon this very important subject, which means more to Canada at the present time than it ever did before. It is understood that the Federal Government is on the verge of introducing a measure to aid the construction of good roads in Canada. This is a new venture and probably there may be some difficulties in the way. There are certainly some problems that will have to be dealt with immediately.

Mr. Francis: "Mr. Chairman and Gentlemen: *The Institute* is to be congratulated on having one as competent as Capt. Duchastel to present to it this highly important subject. He points out the four underlying principles in connection with road improvements. We all know that no road improvements can be carried out unless it is part of a comprehensive scheme; unless it is under competent authority, unless a standard specification is adopted, and we will all agree that no grant should be made unless an undertaking is given to keep the roads in proper condition and to provide for their maintenance. I have much pleasure in moving a hearty vote of thanks to Capt. Duchastel for his paper."

C. A. McGrath, M.E.I.C.: "Mr. Chairman, a few years ago, in a moment of weakness, I found myself accepting a seat on the Highways Commission in the Province of Ontario. I repeat, sir, it was in a moment of weakness—possibly a willingness to be agreeable had something to do with it. I think, however, that it was probably due to the fact that the then Premier, the late Sir James Whitney, practically conscripted me. Sir James Whitney, in my judgment, belonged to a type of public man very essential in these days, with the country faced with great problems—problems requiring the best attention of every citizen in the country. Well, I became a member of the Highways Commission, and now I find myself paying the penalty by being called on to discuss very briefly the road question as brought forward by Mr. Duchastel.

Let me confess at once that I never brought to the highway problem any technical training of any value in the building of roads. We all know that the type of highway depends upon the traffic it has to carry and the availability of road material. We all know that not a penny should be put into a good road until there is a thoroughly worked-out scheme for the maintenance of that road, and which would go into effect from the moment the road is completed. We all know that good roads cost from $5,000 a mile up to $20,000 and $25,000 and even higher. Therefore, it is a problem of tremendous financing, especially in a young country where roads are essential to its development.

While it is some time—1914, I believe—since I was associated with the Ontario Highways, and I have not kept myself in touch with road building policy, still I am not disposed to agree with Mr. Duchastel if I understood him to suggest, that the proposed Dominion grant should be divided amongst the provinces on the basis of population alone. That policy might be sound in a thickly settled and finished country, but in a country with large areas in process of settlement, I consider the area factor has to be taken into account. My recollection is, that that principle is embodied in the provision for subsidizing roads in the United States. As I am not a practical road-builder I shall not take up any of your time attempting to discuss that which I know little about. There is, however, a feature of the problem, that I would like to speak on for a few moments.

Those of you who may have looked over the report of the Ontario Highways Commission as presented in 1914, will find a suggestion in connection with road development. It is the making use of a few of our most successful business minds in an advisory way. I am not suggesting that engineers are not business men, but we have men, engineers and others, who have pushed their heads through the crust of the business world, who have got the habit of doing big things in a big way. There is ample work for the biggest of them, in working out ways and means for stimulating road development.

From time to time I have advanced that idea, with, I must confess, no success. Before the war I was told that such men could not be taken from their own business interests. We now know they can, as many rendered very splendid services during the great crisis through which the world passed during the last four years.

As I see it there are two main systems of highways. There is that system necessary to meet the business needs of the producer, the agriculturist, the man engaged in the basic industry of Canada. The construction of roads in that system is of primary importance. The other system is what might be termed revenue producers—motor tourist roads.

Respecting the former—those to meet the business needs of the producers,—I understand the Dominion Government contemplates stimulating their development by large subsidies to the various provinces for expenditure through their respective Highway Departments. The motor tourist road will have to remain in the background unless ways and means are worked out in order to carry their development forward also. To that subject I desire to briefly draw your attention trusting that I can show that they also are very necessary if for no other reason than as producers of revenue to Canada.

We have to the south of us a great people, a nation of one hundred million, with an immigration during the 10 years ending the 30th June, 1914, which averaged 1,000,000 annually. Its natural increase, births over deaths, was probably the same. In other words, in every four or five years it was adding to its population a number equal to the total population of Canada, while without any immigration its natural increase in eight years is equal to our entire population. I think we are pretty well agreed that the United States of America, if not the wealthiest nation in the world, is certainly very close to it. In other words, we have at our very doors a country—a vast reservoir of people—with a vast reservoir of wealth. So far as I am concerned I am not worrying about any Canadian immigration problem. I have a pretty fair idea where to find people to place on our vacant lands. I repeat, a reservoir of people with vast wealth and lying within parallels of latitude where it is uncomfortably hot in mid-summer. That means but one thing, a great amount of wealth expended in travel—to their own mountains, to Europe and Asia—and what about Canada, with its northern latitudes? They will come to Canada, with its cooler summers, if Canada is made attractive for the tourist. Have we then the vision to look forward to the possibilities of such business, with the revenues which will come with it? The tourist traffic has been the life of some of the older countries of Europe. I will put it figuratively; let us prepare the target, provided we believe we can produce the goods.

May I draw your attention to the Laurentian hills that traverse the Province of Quebec and westward through Ontario. I never look at them without feeling that we have great resources in their beauty, such as winding valleys, wooded slopes, towering hills, emerald lakes and fishing streams, and that if we only had them explored with the view of having them used for tourist trade, we would find there an opportunity to do much towards the development of Canada through attractive summer hotels, motor roads, etc. Let us assume that we had a motor road running up the Gatineau Valley for seventy-five miles, thence westward across the mountains to Pembroke, then down through Algonquin Park and on to Toronto. What a wealth of colouring is to be found along such a route in the autumn! Of course, it would cost a vast sum of money, but I have confidence that it would bring a splendid return to the country. If I am right, Canada has a tremendous asset awaiting development. A few years ago I suggested to the Government of the Province of Quebec the desirability of setting apart a few explorers to hunt out the beauty spots for chalets, etc.—the expenditure would be small—they might be organized into a tourist development branch of some existing department of the government.

I go down the St. Lawrence River frequently. Where is there another St. Lawrence River? Fifteen or twenty miles across, with some of the most beautiful scenery within its valley. What are we doing towards developing the St. Lawrence river for tourist purposes? I know of nothing being done in that direction. The one objection to the St. Lawrence is that the water is rather cold for bathing. But that is a problem that engineers can grapple with, and that difficulty can be overcome. If such a government service as I have referred to existed, it could advise those who have summer hotel resorts along the river, where they can find locations in their immediate neighborhood where it is feasible to hold water at high tide in artificial reservoirs which can be heated by the sun's rays or mechanical means. Why should the field geologists and timber explorers of our respective governments not be mobilized under some central organization for a few years, all being called upon to hunt out what Canada has to offer in the way of attracting tourist motor travel?

Now I come to the last stage of my remarks. I know that no nation on earth has the opportunity that Canada has, in view of the enormous population and wealth immediately to the south of us. I believe Canada has outstanding attractions for the tourist. If I am right in this latter view, how are we to connect the two? It will not only be a question of tourist roads, but tourist resorts, with all that that implies, if it is to be successful. I quite appreciate that the Government cannot take, under the country's existing financial obligation, large sums of monies for such roads. How are they to be financed? It is a great problem. It requires the fertility of mind of the business man who has got the habit of doing, as I have already said, big things in a big way, who in pushing his head through the business crust of the country, has been forced to overcome great obstacles. I suggest no solution, though I see no reason why motors using "tourist roads" shall not carry an additional license.

My suggestion is for the government to select, say, three of our most capable men, to work in an honorary way and in an advisory capacity. Give them a very small staff. I am sure each Provincial Government would undertake any work for them looking to the determination of what its asset is in the way of tourist attractions. The problem of financing such roads would be one demanding that resourcefulness of mind and courage that has enabled many great things being done in Canada in the past. In fact it seems to me they might be of very great assistance to the Dominion Government in many issues that will arise in connection with the expenditures of the proposed subsidies to the highways of the country. In connection with this latter, I would say that the chief highway officers of each province should be called into convention and a standard of Provincial Departmental Highway be agreed upon. This is the day of standardization. No Dominion monies should go to any province until the same has a highway department with the necessary technical qualifications fully up to the agreed-upon standard. Occasionally some good thing happens through an accident. The sound way however is through systematic investigation and real thinking. A well-known consulting engineer quite recently said: "the nation that does the deepest thinking in the next ten years, is the nation that is going to lead the world."

A. W. Campbell, M.E.I.C., Dominion Highways Commissioner: "Mr. President, Ladies and Gentlemen; owing to the peculiar nature of my position I am here this afternoon more to listen to your discussion, and to get some information, than to attempt to give any information. I have listened with a great deal of interest to the valuable paper that has been read. It contains a great deal of practical information, and it has marked out some lines in which we might engaged for a little while in a very valuable discussion. The questions which have been brought out by that paper are questions which are of very great interest at the present time, in laying down what may be called the elementary methods of doing something towards the improvement of our roads.

One very important question has been raised by Mr. Magrath and that is as to the development of our natural resources and the opening up of the beautiful scenery which extends throughout the length and breadth of this country from ocean to ocean. The importance of making that development at the present time can be readily appreciated from the fact that the motor vehicle is becoming a very serviceable one now on account of its pleasure-giving proclivities and also on account of its being a business vehicle. In connection with the question of good roads it is interesting to know that the people of this country have something over $200,000,000 invested in motors to-day, and that the revenues derived from the operation of motor cars amount to a very considerable sum. The revenue derived by the province of Ontario is in the neighbourhood of $1,250,000, which should really go towards the improvement of roads.

The broad question of how the resources of this country should be developed along profitable and desirable lines, is a very important one. As Mr. Magrath has already pointed out, it is a question involving very large sums of money, going up into the millions. This is largely an engineering question, and no doubt, in the expenditure of that money, engineers who are working in Canada today will be employed, as well as many more, especially those who have been serving at the front during the last four years, who have been engaged in railway and highway construction, and who have had that peculiar training and experience that will fit them to assist us in the development of these roads.

There are some features in connection with the United States measure which has been brought to our attention in this paper, to which I would like to refer. One of these is as to how any money that may be appropriated by the Federal Government will be divided among the provinces. It has been pointed out that by the legislation in the United States, area, population, and road mileage in the different states are taken as the basis, one-third upon each score. It is suggested by the paper that the distribution should be made on the basis of population. That is a suggestion as to which a discussion has already arisen. I should very much like to hear this point more fully discussed. The question of maintenance has been very prominently brought to our attention, and I do think it is a matter of very great consequence. I particularly agree with that feature of the paper, and also with the suggestion that the provincial department should be responsible for road maintenance. It was not made quite clear to me as to how this was going to be brought about. In order to have jurisdiction, I suppose the jurisdiction of the municipality should pass to the province, and the province should then control the expenditure for maintenance, and also be responsible afterwards for any accident that might happen on the road and for the maintenance of the road in proper condition. These are only some of the smaller points that have been brought to my attention by this paper, and I do hope to get a lot of information from the discussion which will take place pursuant to the paper."

George Hogarth, M.E.I.C., Chief Engineer, Department of Highways, Ontario: "Mr. President, Ladies and Gentlemen, we have all listened with great interest too Mr. Duchastel's paper on national highways and good roads. There has been brought out in that paper the question of federal aid. We do not know the amount of Federal aid that will be granted, we do not know the direction in which the money will be spent, but we do feel that, whatever aid may be granted, it will be adequate for the needs of the provinces, and that it will lead to an era of road-building in Canada, the like of which we have never seen in the past.

For the information of the members of *The Institute* it might be well to go into the question of the organization that we have in Ontario to-day for the purpose of undertaking road work. It is quite possible that this organization that we have now might be used as a means for distributing the federal aid. Federal aid might well be extended to an organization already carrying out an extensive programme of road improvement that covers the construction of every type of road from the earth road to the higher type of pavement. We have really three systems in Ontario, all under different municipal management. First, there is our township system, which is controlled by the township council. The roads which would be constructed by these councils would be the earth roads and probably the gravel, or broken stone roads that would lead the traffic out to the main travelled highways. The next type of management that we have in Ontario is what we call our county good roads system, under which the counties have power to assume control of certain main roads, for the purpose of improvement and construction. That would apply to all those roads that are designated by County by-law, and approved by the Government of Ontario, the province granting aid and encouragement to the extent of forty per cent on the cost of construction, and twenty per cent on the cost of maintenance. These roads are really the main market roads of Ontario. They lead to the important market centres, and furnish the farming communities with the means of transporting the farm produce to the local market centres and shipping points. We have to-day in Ontario some forty counties, nearly all of which are organized and able to enlarge their scheme of road improvement, and to take advantage of any encouragement or aid offered by the federal government.

In addition to the county system we have also got within the last year, what we have designated as provincial county roads. That is a higher type of county road.

These main roads lead through the counties, possibly joining up the larger towns, and in order to encourage the building of such roads up to the proper standard, the province has granted aid to the extent of sixty per cent of the cost of construction and sixty per cent of the cost of maintenance. The next highest type ofroad that we have in Ontario is what is called the provincial highway and within the last year or so we have been authorized to designate a provincial highway from the eastern provincial boundary to the western. That highway will be constructed by the Highways Department of Ontario and the work will be carried out under their direction. The financial burden will be borne by the Government, and thirty per cent of the cost of construction will be charged back to what is termed in our Act the local municipality. That term may apply either to a township or a county according to the wishes of the people affected.

Reference has also been made to the maintenance of our highways. It is very important, when we have constructed these roads, that they should be maintained. In the past it has been the custom in nearly all the municipalities to construct a road and let it wear out. That has resulted in many fine stretches of pavement and roadway going to pieces; whereas, there must be a certain annual expenditure in order to keep the roads in the best condition.

The question of maintenance is a big one with us to-day, but we feel that with encouragement in any direction the roads of Ontario can be kept up, and can be kept in a safe and proper condition, and in such a condition as to enable traffic to travel over them comfortably. In conclusion, I would say that I think we all agree that federal aid for the highways of the Dominion is a very important matter, and that with the encouragement that federal aid will give the municipalities we should build many miles of the best types of highways to be found in any country."

A. B. Macallum, M.E.I.C., Commissioner of Works for Ottawa: Mr. Chairman and Gentlemen, the other evening, at a meeting of the Good Roads Association, I took the opportunity of congratulating the Government upon the wisdom that it had displayed in appointing an engineer to take charge of the Federal Good Roads scheme, and I am living in hopes that the wisdom of appointing engineers to take charge of engineering schemes will be generally recognized.

Touching on the paper, I should like to speak of one point that Mr. Duchastel referred to, and that is the weight of loads that should be carried on a highway. At the present time we do not know what it is. It is manifestly absurd to assume that a locomotive would go over a road with rubber tires. Yet, what limit are we going to put on those loads? In London it is found that passenger trucks require 12-14 inch concrete bases, and that they had worn out a 6-8 inch base. In Ottawa we found it necessary, on Rideau street, to put in an 8-inch concrete base under a pavement. One thing that might help us somewhat is the fact that it has been found that the unit that can be economically used is the 5-ton truck. It has been found that on anything over a seven and a half-ton truck the elastic limit of the tires is exceeded, which is rather odd, and that the rubber tires would not stay on the trucks. It is impossible to widen out the wheels beyond eighteen inches because, with the camber of the road, or the dip beside street car tracks, there would only be a bearing on one edge of the wheel. If it is possible to get to the stage where they can put something else on to take the place of the rubber tire, it is going to increase the weight of the truck. Then we are going to get a load greater than a five-ton truck, and the pavements that are built to-day will not stand up. That has been found to be true in the United States, and there has been a consequent loss of millions of dollars. It means the use of steel trailers. It has been found in New York that trucks are using steel trailers behind the ordinary motor truck upon pavements made of granite rock. The limit of speed is six miles an hour, but it is human nature to run to the speed limit of the vehicle, which means running at twenty miles an hour, and these pavements were all smashed. In any legislation that is brought forward there should be a limit put on wheel loads."

This concluded the discussion.

R. M. Wilson, M.E.I.C., Chief Engineer, Montreal Light, Heat & Power Company, on rising to deliver his paper stated that he wished to correct an error in the program which states that the paper he prepared was on Frazil; the title should read

Design of Hydro-Plants for Combatting Ice Troubles

The paper by Mr. Wilson and the discussion thereon, by K. B. Thornton, A.M.E.I.C., Manager Public Service Corporation, Montreal, John Murphy, M.E.I.C., Electrical Engineer, Department of Railways and Canals, Ottawa, and G. Gordon Gale, M.E.I.C. General Manager, Hull Electric Company, Ottawa, form a very important contribution to the literature on this subject and will appear in full in the next issue of *The Journal*.

President's Reception

In the evening an enjoyable social function was held, attended by about four hundred of the members and their wives and friends, the occasion being the reception of the President.

In receiving the guests, President Leonard was assisted by Mrs. Leonard, Past President H. H. Vaughan and Mrs. Vaughan, Major Corriveau and Mrs. Corriveau.

This was a social event of a brilliant nature which showed that the members of the profession are not devoid of the social graces with which they are generally not credited. It was an evening such as will recall pleasant memories for a long time to those who were present, and for the success of which the members of the Ottawa Branch and their wives deserve great credit.

Thursday Morning, February 13th

The meeting was called to order at nine a.m., by President Leonard, who announced that John Murphy, M.E.I.C., Electrical Engineer, of the Department of Railways and Canals, and the Railway Commission, would give his paper on

Railway Electrification.

This is a subject which touches on the development of electrical engineering and also is a vital factor in the railway situation and in the economic progress of the country. The paper by Mr. Murphy on this subject was followed by papers on F. H. Shepard, Director of Heavy Traction, Westinghouse Electric and Manufacturing Company, and W. G. Gordon, Transportation Engineer, Canadian General Electric Company Limited. Mr. Shepard's paper was illustrated by lantern slides and moving pictures.

These papers together with the discussion thereon will appear in full in the next issue of *The Journal.*

Dr. C. A. Adams, President, A.I.E.E.

During the discussion, Dr. Comfort A. Adams, President of the American Institute of Electrical Engineers, entered the room, his entrance giving rise to a spontaneous, enthusiastic welcome from those present. Dr. Adams' presence was all the more appreciated when it was known that to be present at all it was possible for him to stay only a few hours, and to come all the way from his native city to be present at our gathering when his time was so limited, shows all the more the sincerity of his friendly co-operative spirit. When called upon to address the meeting Dr. Adams said: "Mr. President and gentlemen of *The Engineering Institute of Canada*, I bring you greetings, and most cordial ones, from your sister society across the border, the American Institute of Electrical Engineers. I bring you also congratulations on the formation of this organization which has no specific title. We are all engineers and I think there is hardly any illustration that brings that more forcibly to our attention than the very subject which is before you this morning. It is not a question of electrical engineering or railway engineering, or civil engineering, or mechanical engineering, but it is a subject that involves them all. I am absolutely convinced that you have taken the right step in changing over from the old Society of Civil Engineers to your present form, which takes in all of the engineers of Canada.

Speaking of the border between this and the United States, we like to think of it as a very imaginary line. We are not only of the same blood but in a large degree we are of the same language. We have the same monetary system and the same system of weights and measures. These are, in many cases, barriers between nations, but here we are particularly fortunate in having a marked absence of these barriers. There are no forts on this border, there are no battleships on our Lakes to protect us from invasion. We have no fear of it.

Taking up the subject in hand here, I was very forcibly carried back to the very earliest days of my practical experience in electrical engineering by some of Mr. Shepard's illustrations. Away back in 1891 Mr. Sydney Short, then with the Brown Electric Company in Cleveland, designed the first gearless railway motor. I had a considerable hand in that design and, although I have not been particularly connected with railway interests since that time, I have followed it with a great deal of interest. I had also a hand in the early days in developing the B. & O. locomotive motor and the methods of coupling.

There are two fundamental points which have impressed me in connection with electrical railroading. One is reliability. We used to hear in the old days, and still do hear from those who are not as intimately connected with the subject as some of us are, that electrical apparatus is unreliable, that you cannot depend upon it. I think we have had evidence this morning to show that it is absolutely reliable. I recall an incident that occurred a few years ago when I was called upon to design a particular machine for a client. He asked: "Have you ever done it before; have you ever designed that kind of a machine?" I said: "No, not exactly like this." He said: "How do you know it will work; how do you know that it will do what you claim it will do?" "The General Electric Company and the Westinghouse Company refused to guarantee any such thing as that. "I said: "I am not guaranteeing it, but I know it will do it." I think that is characteristic of the electrical business. It has been true in regard to the electrical drive of battleships and merchant ships and wherever it has been tried out, notwithstanding the fact that the very first instance of the application of a drive of that sort was a success. We may leave the practical details, but fundamentally there is no question about it that there is vastly greater certainty in the design of electrical apparatus to-day than there is in any other type of apparatus that we have.

The second point that impresses me in this connection is the question of conservation. We, on this continent, in Canada and in the United States—the United States particularly—have been squandering our natural resources for generations, and particularly during the past generation. We call it development, but, as a matter of fact it is the most foolhardy squandering of our sources of power. In the evolution of a nation we find a gradual change from the hand to mouth method to the method of co-operation and far-sightedness, and this is one of the steps between the hand to mouth, careless wasting of our resources, and the economical use of those resources, even though it may involve a considerable increase in capital expenditure. The difference between the hand to mouth method and the farsighted method is just that of the change from larger operating costs and smaller capital expenditure to smaller operating cost and larger capital expenditure, because that is absolutely typical of its development. It is not, in the long run, going to be a matter of judgment and opinion; it is going to be a matter of necessity and we have got to come to it. There is no question on that point whatsoever. I look forward to the time, as I think most of us do, when the railways of this country, and of all other countries, will be operated largely by electrical power.

There is one matter that is of a purely general nature that has absorbed a large part of my efforts and attention during the past year or two, and that relates in general to the broad field of co-operation. It has so many branches that I hardly know where to begin. But, as engineers, we are in some degree responsible for the improvement in the bonds which tie the different parts of the country together, both in communication and transportation, and the bonds which similarly tie different countries and nations together. Therefore, it seems to me that as the process of bonding ourselves together is due to our efforts in some degree, we should take the lead in that co-operation without which such bonds cannot exist. In the case of our engineering societies it is absolutely vital that we should feel a closer and more intimate brotherhood, and one of the great advantages of meetings of this sort is that we can all get together, shake each other by the hand, and meet face to face. As has been said so often, the chief barriers between different groups and societies, as between different nations, are the barriers which come from lack of knowledge of each other and lack of association. When we come to know each other, we find we are all the same sort of human beings after all, so that, the chief message that I wish to bring to you from the other side is that we feel a kinship which is most intimate, and that we wish to establish and maintain the most hearty and the most vigorous co-operation in every field of endeavour that we are connected with.

Dr. Adams concluded by extending a hearty invitation to the members of *The Institute* to attend the mid-winter convention of the American Institute of Electrical Engineers.

Thursday Luncheon

Members of *The Institute* who have attended the annual gathering for years state that this luncheon was the most largely attended of any similar function ever held. An hour before sitting down it was no longer possible to furnish tickets so that many were disappointed. The main dining hall of the Chateau Laurier was taxed to its utmost to accommodate the gathering of ladies and gentlemen to the number of nearly four hundred and fifty who attended this luncheon at which President Leonard presided, the guest of the day being Hon. F. B. Carvell, Minister of Public Works of Canada. Dr. R. N. Hollis and Mrs. Hollis and Dr. C. A. Adams were also guests and were seated at the head table together with members of Council of *The Institute*, members of the Ottawa Committee, the visiting ladies and wives of officers of the Ottawa branch.

Hon. F. B. Carvell, Minister of Public Works, gave a somewhat lengthy address which was filled with optimism regarding the future of Canada. In his opening remarks he pointed out that the most important problem the country has before it at the present time is in getting Canada back to a peace basis and it is realized that the Government has great difficulties to face in this respect, and the country at large has a responsibility in this connection as well. There is at present a certain amount of unrest which is natural, due to the abnormal conditions through which we have passed. It is the duty of every man and woman in Canada who has the power of employing labor to see that everything possible is done with a view to helping to relieve the situation.

Possibly no class of people in the whole country have a greater opportunity of working out the problems which the Government and the people have to face, than members of the engineering profession, and it was therefore fitting that the annual meeting of *The Institute* should be held in Ottawa, for the exchange of ideas.

Stating that unemployment existed in some parts of Canada at the present time and in case it might grow worse in the next few months he proposed outlining briefly what the Government was planning to do to promote staple conditions. He felt that the Government's duty to-day was to expend public monies in a way as best to meet conditions which exist. No money would be spent because a member desired public works for his own constituency. The money of the people of Canada will be spent where it will do the most good toward finding employment for laboring men and returned soldiers It is proposed to spend a considerable amount of money in the construction of highways in different parts of Canada in co-operation with the various Provinces, subject to the approval of plans and specifications under which the roads shall be constructed, the location of the roads by the Federal Government and supervision of the manner in which they are constructed. He has always been a firm believer in the principle of expending public money in the construction of highways.

Such projects can only be made a success however if all the Governments concerned realize that they must employ engineers and must act upon their advice. He believed that more money had been squandered in Canada during the past forty-five or fifty years in the attempt to build roads, where engineering supervision was not carried out than in all other public works put together. He hoped all parties concerned will realize that in the expenditure of these millions of public money the engineer must be the first as well as the last man on the job. It is impossible to succeed in any other way. During the past few years the railways of Canada have not been able to keep their equipment up to standard but it was known that the greatest railway system had put aside a very large amount of money for betterment and it was confidently expected that these betterments would be carried out during the coming year. In looking over the estimates of the Minister of Railways and Canals he found that a great deal of money would be required in bringing the Canadian Northern Railway to a proper standard. It was likely that there would be as much money expended on improving the Canadian Government Railway System during the coming year as on any other branch of public work.

It is very likely that there will be supplementary estimates at the coming session of Parliament which will further provide means of relieving unemployment.

The Minister believed that it is not only the Government, which had responsibility in carrying the country through the serious times of bringing it back to a peace basis, but also the great corporations whether industrial or public utilities, and in particular everyone in the country who is in a position to employ labor. The corporations throughout Canada have a duty of carrying on during the next year whether the profits are large or whether there are any profits. A year from now will see settled conditions and the soldiers absorbed once more into civil life.

No country among the warring nations is to-day in a better condition economically than Canada and if every man or woman in the country does his or her duty, there should be no great unrest.

The immense debt with which the country has been burdened by the war means that from now on the interest to be paid every year of from one hundred to one hundred and fifteen million dollars per annum would take nearly as much as the actual liquid revenues amounted to before the war, and in addition it would require another fifty million dollars for pensions. He could not see how we could possibly get along on less revenue than from three hundred to three hundred and fifty million dollars a year and suggested that proper consideration shouid be given to this problem. During the coming year however, will be spent even if necessary to borrow it as it would be a duty to do so in order to bring the country back to a condition of peace.

Continuing Mr. Carvell said:

I hope that no one will consider that I am pessimistic about Canada's future. I have said that probably none of the warring nations are in as good a position as we are, and I repeat it. Probably no country in the world possesses such valuable natural resources as Canada does. All we require is a little time to develop these resources, a little time in order that our people may get back to the ordinary vocations of life, a little time in order that our transportation facilities may be somewhat improved. When that time comes I have no doubt whatever that even with our increased public debt, the resources of our country and the ability of our people will be sufficient to meet all the larger expenditures which we shall be called upon to make.

I do not need to say that it has given me a great deal of pleasure to meet a body of this kind. You are displaying a great deal of public-spiritedness in coming here at great expense and trouble to yourselves; you are coming here, I believe, for the good of the country. I have no doubt that your deliberations will result in great benefit to Canada, because there never was a time in our history when the engineering profession played such a part as that which they have an opportunity of playing during the next three or four years. Nor has there ever been a time in the history of the world when the engineering profession played such a part as it has played during the war. The war has been practically a war of engineering; our success on the western front was largely due to the tremendous engineering abilities of the men that Canada sent over there. I have not had the pleasure of visiting the front, but my colleagues who have been there tell me that in their opinion many of the great military operations carried on would not have been possible had it not been for the railway construction and general engineering work carried on by the Canadian engineers. That is perhaps one of the greatest tributes to the Canadian engineering fraternity which the war has produced; it is another evidence that when Canadians are given an opportunity to do so they rise to the occasion. That brings me back to the last thought that I wish to place before you; it is that when Canada is given a chance to get back to the ordinary times of peace, I have no hesitation whatever in saying that Canada will rise to the occasion. We will carry on the affairs of the country, we will pay the interest on our debt, we will pay our pensions, and we will continue to be one of the most prosperous countries on the earth. (Applause).

The luncheon proceedings concluded by the singing of God Save the King.

Visit to Parliament Buildings.

At the conclusion of the luncheon program, President Leonard announced that immediately following a group photograth would be taken in front of the Chateau, followed by a visit to the Parliament Buildings. At four-thirty p.m. the program would be resumed consisting of the papers which had been postponed from previous sessions.

Besides the group photograph which is reproduced in this issue of *The Journal*, B. E. Norrish, A.M.E.I.C., had motion pictures taken, both in front of the Chateau and as the visitors entered the Parliament Buildings.

The trip to the Parliament Buildings was arranged through the courtesy of J. B. Hunter, Deputy Minister of Public Works, and John A. Pearson, Chief Architect of the Buildings, both of whom accompanied the party.

In the rotunda of the Commons entrance, Mr. Hunter made the following remarks:—

"Mr. President and ladies and gentlemen, I cordially welcome you on the occasion of your visit to the new Parliament Buildings of Canada. You have come in by the new Commons entrance, and I think you have all been pleased with what you have already seen. As you go through the other parts of the building I know that you will be delighted with the development of the plan; there is a largeness of conception which will impress itself upon you and you will appreciate the immense amount of labour and thought which has been put into the design, all of which is due to the great creative genius of that master-builder, John A. Pearson.

May I say a few words about what has led up to the present stage in the construction of this building. By the disastrous fire of February 3rd, 1916, the old building was left practically in ruins. The debris was immediately cleared away. Seven lives were lost in that fire, and of one of the vactims, Mr. Law, M.P., no trace could be found. Owing to the building having rather outgrown its usefulness — it had become badly ventilated, dirty, unsanitary — there was very little regret over the occasion of erecting a new structure in keeping with the needs and future of Canada.

Immediately after the fire the Minister of Public Works summoned Mr. Pearson and Mr. Marchand and asked them to go over the matter and make a report. Afterwards these two gentlemen, Mr. Pearson as Chief Architect and Mr. Marchand as Associate, were commissioned to prepare plans and, departing from the procedure which had been followed in the erection of buildings on previous occasions under government supervision — a practice which had sometimes led to investigations and squabbles under the old party system — it was decided that members from both sides of the House and members of the Senate should form a joint Committee to have superintendence of and direction over the work. I think that this plan has worked out exceptionally well. The gentlemen who were appointed to the Committee took a keen interest in the work. As soon as Messrs. Pearson and Marchand had their plans completed, they were thoroughly discussed and some slight alterations suggested which were heartily co-operated in by the architects. Finally the contract was awarded to Messrs. Lyall & Sons on the basis of these plans, which was another departure for the Department of Public Works, because it was a forced contract. But under the circumstances it was considered that the following of this procedure would enable an earlier start, which it did, and would also ensure the very best workmanship, which it was necessary to have in the Parliament Buildings of Canada.

The work proceeded in 1916 until the foundations were in by September 1st. In that connection, it was possible to arrange a very happy ceremony in the laying of the corner-stone. The old corner-stone was inside the building in the basement, on the Senate side. No doubt a great many Ottawans and visitors to Ottawa in the past have — well, I was going to say stumbled over that stone, because it used to be near the old parliamentary restaurant. But I will not say any more about that; we are not in the old days now. The original corner-stone was laid by the Prince of Wales, who afterwards became King Edward the Seventh, and it was arranged to have the stone re-laid in the new structure by his brother, who fortuitously happened to be in Canada at the time. The Duke of Connaught, therefore, graciously consented to re-lay this stone, and below the previous inscription is the human touch: "Re-laid by his brother, Arthur, Duke of Connaught, September 1st, 1916,"— exactly 57 years from the time the late King Edward laid the stone as Prince of Wales. The monument of the Duke of Connaught's gracious mother, Queen Victoria, was nearby; it had been unveiled by the present King when he was out here as Duke of York. All these circumstances contributed to the Duke of Connaught's being visibly affected.

After the laying of the corner-stone the erection of the walls proceeded and by winter the second storey had been reached. The work on the Hill was closed down for the winter, but on Sussex street work was carried on in the stone sheds on the outside stone, and on a small portion of the interior stone, most of which was not delivered until 1917. Then, in the spring of 1917, the work was got at early and the building made rapid progress. By the fall the roof was on and by heating with salamanders, the brick partitions in the floor and so on were gone on with and carried pretty well to completion. But the feature of 1917 was the semi-centennial of the Confederation of the Canadian provinces, and the building was dedicated by the present Governor-General. Addresses were given by the Prime Minister and other noted men upon this occasion. I want to read to you the inscription on the Confederation column at the main entrence, which you will see as we go through the building:

> "On the fiftieth anniversary of the Confederation of British colonies in North America as the Dominion of Canada the Canadian Parliament and people dedicate this building in process of reconstruction after damage by fire as a memorial of the

deeds of their forefathers and of the valour of those Canadians who in the great War fought for the liberties of Canada, of the Empire and of humanity."

You will see that this is a worthy dedication and a worthy monument to the cause for which our soldiers fought.

In 1918 we went ahead with the heating plant. It was decided to remove all heating appliances from the main building and erect a central heating plant which would take care also of the new departmental buildings which it is intended to erect on what is known as the Wellington street area, west of Parliament grounds. That progressed during 1918, the tunnel was built connecting with this building, and the interior work was proceeded with which you will see to-day.

I will give you a few figures of the dimensions of the building. The building is different in lay-out from the old structure. You will remember that when you came up the stairs of the main entrance of the old building you were faced by a blank wall, and you could go to the right or to the left. By the removal of the heating plant it has now been possible so to develop the plan that when you come up the main steps and stand near this Confederation column you can look north, east and west. The corridors are well-lighted. In order to get better ventilation and light, and on account of various other considerations, the Commons and Senate Chambers have been placed at the extreme ends of the building, the Senate on the East side and the Commons on the West. The restaurant remains in the same position, above the Commons Chamber on the top storey of the west side, and commands that splendid view over the Ottawa river which I do not think can be surpassed. I am told that it cannot be surpassed in the world on a summer evening when the sun is setting; that is quite believable.

The building is 471 feet long from east to west and 194 feet wide, being 245 wide including the pavilions — that is, both ends. It is 90 feet high. The tower, of which you see the connecting walls standing, has not been constructed, but it is expected to start that this year, and by next winter we hope to have four or five storeys of the tower erected. It would be 250 or 260 feet high and will overtop the Mackenzie tower. The old tower did not do that.

The old Commons and Senate Chambers were the same size, 82 feet by 46 feet. The Commons Chamber has now been enlarged; it is 97 feet by 62 feet, so that care has been taken to provide for the increased membership which is expected. The Senate Chamber is a little smaller, 80 feet by 41 feet 6 inches. You know, the Senators do not increase as fast as the Members of the House of Commons. There are 365 offices in the building; there is an increased area over the old building of about 90 per cent. The old building had no cellar; now a cellar has been excavated and so much additional space acquired. A storey has also been added. Eighty-two of the offices are in what we call the office blocks; they are on the sites of the old Chambers, the Senate and the Commons.

You will notice as you pass through the building how well the proportions have been kept by the architect. In these office blocks are the Railway Committee room and the reading room and the Senate Chamber on the other side. Mr. Pearson and myself are, of course, familiar with the building, and if you follow us we will visit the Commons Chamber first and then go right through to the top storey, where the restaurant is placed.

Afternoon Session, Thursday, February 13th

At four-thirty p.m. the meetings were resumed in the Assembly Hall at the Chateau Laurier, President R. W. Loenard in the Chair.

The first paper on the program was by J. L. Busfield, A.M.E.I.C., fully illustrated by latern slides, on the Montreal Tunnel.

Mr. Busfield's paper fully illustrated will be published in the April issue of *The Journal.*

In discussing this paper H. K. Wicksteed, M.E.I.C. stated that Mr. Busfield had given a splendid description of the construction and equipment of the tunnel and the hearty thanks of *The Institute* were due him for the trouble which he had taken in getting all this information together and giving it in such an interesting manner.

In the temporary absence of the President, John Murphy, Member of Council occupied the Chair, and announced that there were still two papers on the program one by Dr. Dawson and one by the President. Dr. W. Bell Dawson, M.E.I.C., Superintendent of Tidal Survey, Dept. of Naval Service then read his paper;

Mean Sea Level Datum for Canada.

This paper was published in full in the February issue of *The Journal.*

Discussing the paper Geo. A. Mountain stated that we were partly in sympathy with Dr. Dawson's suggestion that a mean sea level datum be established throughout Canada. It would facilitate work for everybody. He appreciated Dr. Dawson's paper and was pleased to have heard it.

C. C. Kirby of St. John, N.B., asked if the monuments through the state of Maine placed on bridges by the U.S. Postal Geodetic Survey were for the same datum that Canada has now adopted, and in reply Dr. Dawson stated that the leveling of the frontier of New Brunswick has connected with the United States Geodetic Survey bench marks, and it has since been connected with Halifax. "The mean sea level datum is carried from New York, I assume, along the shore by land levelling, and our levels now connect from the frontier of Maine to Halifax. The final revision of that work, when made by the geodetic survey, will correlate all the levels with the same datum."

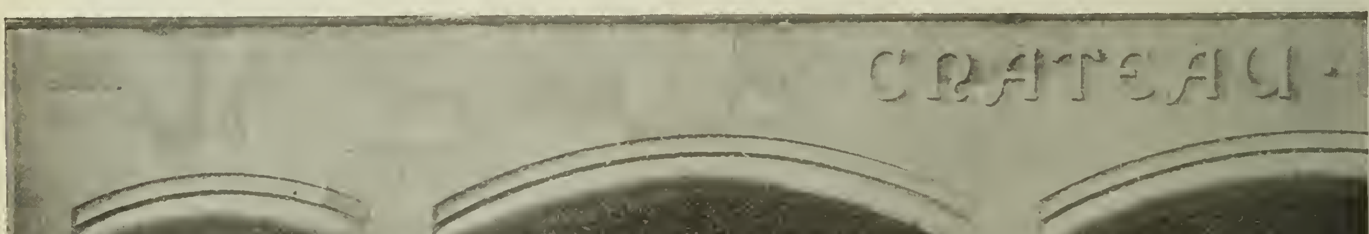
Mr. Wicksteed: No one realizes more completely than I do the importance of Dr. Dawson's work and how much we are indebted to the Government departments for these precise levels. In the case of the Canadian Northern terrain, for instance, we must have run seven thousand or eight thousand miles — probably ten thousand miles of railroad levels. Of course, railroad surveying as a rule is not precise work, but when we have points to which we can close at the end of our individual surveys such as Dr. Dawson and the Geodetic Survey have provided us with, it is a very comfortable feeling to find that we are coming out within a foot or two anyway, at the end of fifty or sixty miles. I hope that Dr. Dawson and the other surveyors will be given the opportunity to complete that work, because the task of establishing levels throughout the different parts of Canada is a very important one indeed in the Government service.

Dr. Dawson: Perhaps I may be allowed to say a word on behalf of Mr. Ogilvie, who is not here. In the geodetic survey, which is under his charge, it is possible to run only main through lines across the country. I can confidently say that he appreciates such levels as you speak of, on railways, which serve to extend the levels in the trunk lines in lateral directions and to carry them from the main line to other points, perhaps cities and towns, which will utilize the same elevations. So that you must not disparage railway levels; in my own experience I have found them extremely accurate. The great difficulty is that very often they are not fixed by bench-marks, and for this reason a very large amount of work has been lost. As there is now a continuous line from Halifax across Canada to Vancouver, railway levelling that would extend these levels laterally in any direction is of great benefit in carrying them over the length and breadth of the country. In the meridian lines and township lines, which the Surveyor General's department is running, they are continually intersecting the main lines of the geodetic levels, and thus extending the network of levelling by establishing lake levels, water-power levels, and so on; in extension of the through line across the continent. So that I think this lateral work is of very great service.

In speaking to Dr. Deville, the Surveyor General, he said that he was quite in accord with the attitude of the Railway Commission, represented by Mr. Mountain, in the principle of adopting mean sea level as a general datum. Thus we have the Railway Commission, the Surveyor General, and the actual surveyors engaged in the work supporting this view; and if we get the interest of the railway engineers and the city engineers it will facilitate the work very much indeed.

G. Blanchard Dodge: The paper is a valuable addition to the literature on Mean Sea Level. The available information on this subject is very meagre. A masterly treatise was written many years ago by Monsieur Lallemard, Chief of the levelling in France, but it is now difficult to obtain.

The connection between the determination of mean sea level by tide gauges around the coast and the transference of such determination to the interior by precise levelling is well brought out. Dr. Dawson, however, does not seem to have referred to his tide gauges at Port



Group Photo Ottawa Professional

Nelson on Hudson Bay. A connection between Hudson Bay and the Pacific is now only waiting the completion of the last 200 miles of the Hudson Bay Railway, as precise levels, of a high order of accuracy, have already been run to the end of the steel by the Surveyor General's Branch. This Branch has run precise levels from Calgary to that point by way of Saskatoon and Prince Albert, a distance of 800 miles, and from Calgary to Vancouver the levelling has been run by the Geodetic Survey.

Dr. Dawson emphasizes the necessity of all organizations using the same datum, but city engineers in the west, where the elevation is very great, do not like, so many figures. This difficulty, of course, could be got over by simply cutting off the thousands and certain of the hundreds, so that a point in a city whose elevation is 2418 feet would be recorded by the city engineer as, say, 118 feet.

Regarding a general precise datum in the west it may be noted that 6,600 miles of precise levels have been already run in the prairie provinces, slightly more than half of this having been done by the Surveyor General's Branch, and slightly less than half by the Geodetic Survey. These two organizations use the same datum, and it is rapidly being adopted by the great railways.

It cannot be too strongly emphasized that work like Dr. Dawson's must always be the real foundation of any system of precise levelling, because no matter how accurate levels are, they cannot carry a datum from one part of the open coast to another part as accurately as the sea itself can record it. Each tide gauge well placed on the open sea must, therefore, always be a new starting point in a level net.

Following the discussion of Dr. Dawson's paper Lieut.-Col. Leonard presented his paper on

Mining and Metallurgy of Cobalt Silver-Ores

which was published in the February *Journal*.

After reading his paper Col. Leonard was asked regarding the large areas of mineral land as to why it was not developed by the Government, to which he replied that the present policy which was almost universal was to encourage individual effort and even then it required much hard work and patient effort to succeed as a mining prospector.

Moving Pictures

The reading of President Leonard's paper and the brief discussion concluded the technical portion of the program of the professional meeting.

In the evening at eight thirty, B. E. Norrish, A.M.E.I.C. presented to an audience of ladies and gentlemen which filled the room, a number of highly interesting motion picture films illustrating the development of

Meeting, February 13th, 1919.

various industries throughout Canada, and which illustrated the splendid work which the Department of Trade and Commerce has been doing in having these educational films prepared in order that the whole world can know of Canada's magnificient scenery, her rich natural resources, and the industrial progress she is making.

This concluded the final session of what is without doubt the most successful gathering of engineers ever held in Canada.

Registration

The official register shows that the following were in attendance and in addition seventy-two ladies signed the register, their presence adding much to the success and enjoyment of the gathering.

Dr. M. Murphy, Ottawa; H. H. Vaughan, Montreal; R. W. Leonard, St. Catherines; W. F. Tye, Montreal; Geo. A. Mountain, Ottawa; J. M. R. Fairbairn, Montreal; James White, Ottawa; John Murphy, Ottawa; C. A. Magrath, Ottawa; Fraser S. Keith, Montreal; T. L. Simmons, Ottawa; C. R. Coutlee, Ottawa; J. A. Robert, Ottawa; H. A. Belanger, Ottawa; B. Stuart McKenzie, Winnipeg, Man.; J. A. Walker, Lieut., Ottawa; A. B. Macallum, Ottawa; F. W. G. Smith, Ottawa; Guy C. Dunn, Winnipeg; H. D. Parizeau, Ottawa; E. A. Stone, Ottawa; Martin Wolff, Ottawa; P. Sherrin, Ottawa; R. de B. Corriveau, Ottawa; H. E. Smaill, Ottawa; H. T. Hazen, Toronto; A. T. Phillips, Ottawa; A. M. Wonfold, New Westminster; Alex. Ferguson, Ottawa; F. W. White, Ottawa; G. B. Dodge, Ottawa; A. R. Decary, Quebec; A. B. Normandin, Quebec; W. R. Gross, New Westminster; Alfred D. Flinn, New York; G. J. Desbarats, Ottawa; J. B. Challies, Ottawa; Major W. G. Swan, Vancouver; V. F. W. Forneret, Ottawa; C. T. Trotter, Ottawa; Col. A. P. Deroche, Ottawa; T. R. Courtright, North Bay; Ralph S. Burley, Ottawa; K. B. Thornton, Montreal; E. Brydone Jack, Winnipeg; W. Bell Dawson, Ottawa; H. M. Davy, Ottawa; H. B. R. Craig, Fort William; J. M. Wilson, Toronto; F. G. Goodspeed, St. John, N.B.; C. P. Edwards, Ottawa; J. H. Thompson, Ottawa; A. d'Odet d'Orsonnens, Ottawa; D. W. McLachlan, Ottawa; M. F. Cochrane, Ottawa; W. W. Berny, Ottawa; A. W. Blanchet, Ottawa; T. H. J. Clunn, Ottawa; A. M. Beale, Ottawa; H. W. Jones, Ottawa; J. B. Cochrane, Ottawa; E. J. Walsh, Ottawa; C. N. Monsarrat, Ottawa; C. O. Wood, Ottawa; R. F. Uniacke, Ottawa; N. E. D. Sheppard, Ottawa; Norman Marr, Ottawa; G. G. McEwen, Ottawa; N. F. Ballantyne, Ottawa; Chas. F. X. Chaloner, Ottawa; E. A. Jamieson, Vancouver; J. A. Vermette, Ottawa; Alan K. Hay, Ottawa; A. St. Laurent, Ottawa; Emile M. Longtin, Ottawa; A. B. Lambe, Ottawa; J. L. Rannie, Ottawa; S. J. Chapleau, Ottawa; J. M. Somerville, Ottawa; F. B. Reid, Ottawa; Wm. H. 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The Development and Future of Aviation in Canada*

By M. R. Riddell, Chief Engineer Canadian Aeroplanes Ltd.

One of the most notable features of the late European war has been the rapid development of the aeroplane from a more or less experimental toy to one of the most formidable of the many engines of war employed in that great conflict. Of course it may be that the great development along the special line has been at the expense of development in other directions, but even if this is so it is not too much to say that a tremendous impetus has been given by the war to aerial navigation generally.

As far as Canada is concerned, while a Canadian—J. A. D. McCurdy—was one of the earliest aviators, on this side of the Atlantic at any rate, beyond a little experimental work by Messrs. McCurdy and Baldwin in the early days, under the direction of Professor Bell, nothing was done in the line of aerial development until the spring of 1915.

At that time Mr. McCurdy, who had in the meantime become associated with the Curtis Aeroplane Co. of Hammondsport and Buffalo, organized a Canadian company known as Curtiss Aeroplanes and Motors Limited, with headquarters in Toronto. The special object of this new company was the manufacture of aeroplane parts for British orders, but soon much more interesting work was undertaken.

Just before the outbreak of the war a large twin-engined flying boat had been under construction at the Hammondsport works of the Curtiss Co. She was known as the "America," and it had been intended to attempt a Transatlantic flight in her.

This "America" (afterwards known serially as the H-4 type) was the forerunner of the series of large flying boats built by the Curtiss Co. for war service of the Allies. She was of approximately 76 foot wing spread, and was powered with two Curtiss 90 H.P. motors.

While the outbreak of the war put a stop to the proposed Transatlantic flight, it was suggested that a large twin engined bombing plane along the lines of the "America" might be constructed. As the Hammondsport and Buffalo plants were crowded with other work, the working out of this new machine was entrusted to the Canadian plant.

The original intention was to have the "Canada," as this machine was afterwards known, practically a duplicate of the "America," but with fuselage and landing gear instead of a hull, and two of the V.X. type 170 H.P. Curtiss motors instead of the smaller ones fitted in the "America." With these more powerful motors it was expected that a speed of 85 miles per hour would be attained as against the 60 miles per hour speed of the "America." Owing to these changed conditions, however, it was found necessary to change almost every part so that the "Canada" as built was practically a new design throughout.

"Avro 504-K" Type Training Plane (R.A.F. Serial Number C-1501) Built by Canadian Aeroplanes Limited, Toronto, October, 1918.

Actual construction work was begun towards the end of June, 1915, and the first trial flight was made about the end of July. As there had been some delay in the delivery of the V.X. Motors intended for her, for this first trial she was fitted with two 90 H.P. motors similar to those in the "America." This first flight was successful, the "Canada" showing a speed of upwards of 70 miles per hour with these smaller motors, balancing and handling well.

Some slight alterations were made as a result of this initial flight before she was again tried, this time with her proper motors. On this occasion she had a bad mishap on landing, and was partially wrecked. After repairs she was again tried and this time made a most successful flight, attaining a speed of better than 87 miles

*Read at Ottawa Professional Meeting, E.I.C., Wednesday Feb. 12th.

per hour, with a climb of over 3500 ft. in less than 7 minutes.

As a result of this successful trial an order was placed by the British Government for eleven more machines of this type, with certain modifications that had been found desirable.

In the meantime the "Canada" had been shipped to England, where she underwent a series of further tests. On one of these tests after the motors had been "tuned up," and the stranded wire in the interplane bracing replaced by "stream line" wire of much lower resistance an average speed of 102 miles per hour was recorded.

The "C" machines as these next eleven were known were in general similar to the "Canada" but embodied many refinements and improvements in arrangement and detail.

These "C" machines were duly completed and shipped and work was started on a still further improved type to be known as the "C-2," when instructions were received (in June 1916) to cancel the order for "C-2" machines and stop all further work on the type.

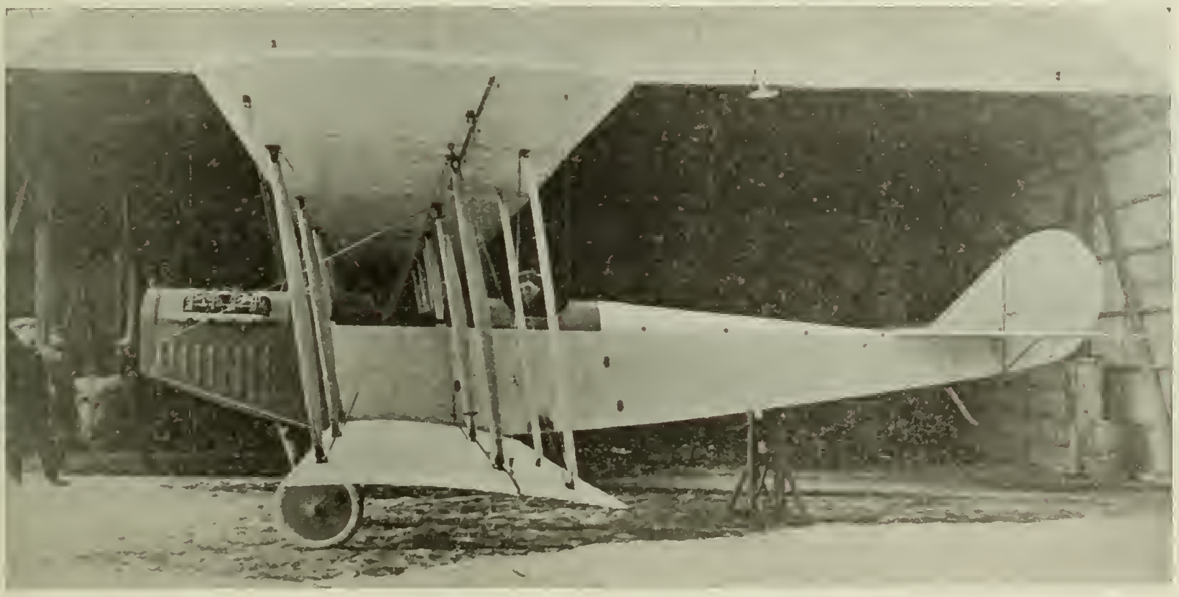
What probably caused this decision on the part of the English authorities was the trouble that had been experienced with the V.X. type of Curtiss motor; also at that time reprisal raids were not in vogue, and the cry was for small machines of very high speed for scouting and fighting.

It seems a pity, however, that none of this "Canada" type were ever used in active service. At the time of their production (late 1915 and early 1916) they were probably quite the best machines of the type in existence, although of course not equal to later larger and more powerful machines of the same general type such as the Handley Pages.

The "Canada" and the "C's" were twin-engined biplanes, with a maximum wing spread of 76 feet, engines of approximately 350 H.P., and a speed of approximately 100 miles per hour (with streamline wire). The total flying weight with a military load of about 1000 pounds, 200 gallons of gasoline and a crew of three, was approximately 7000 pounds. The 200 gallons of gasoline would give a flying radius of between 500 and 600 miles at full power.

While work on the "C's" was at its height a force of about 600 men was employed.

After work on the "C-2's" was stopped, as noted above, the manufacturing activities of the Curtiss Aeroplanes & Motors Limited, were considerably curtailed, the manufacture of spare parts for British Buffalo orders, and the construction of some training planes of the JN-3 type as well as a few hydro aeroplanes for a foreign government, being all that was undertaken until the decision of the British authorities to establish training squadrons in Canada changed the general aeroplane situation considerably.



"JN-4" Type Training Plane (R.A.F. Serial Number C-101) Built by Canadian Aeroplanes Limited, Toronto, January 1917. (First Machine Turned Out by C. A. L.)

From the date of its incorporation Curtiss Aeroplanes and Motors Limited had maintained a flying school for the training of cadets for the air services, which although officially recognized by the British Government, was conducted as a private concern along purely civilian lines.

Pupils first of all received instruction on flying boats and after they had attained sufficient skill on these the course was completed on land machines of the training type. Many aviators were turned out who afterwards won distinction in the air services and the attention of the British Government was called to the fact that not only was there much excellent human material available in Canada, but the Canadian climate was such as to afford a greater number of possible flying hours, during the spring, summer and fall at any rate.

On account of these considerations it was decided to establish extensive training fields in Canada.

For this training, in order to obtain machines quickly it was decided to use the JN type, similar to those employed by the Curtiss School, and an order for a large number of JN-4's (the latest model of the JN type at that time) was issued.

In connection with the order a new firm under the auspices of the Imperial Munitions Board was organized to undertake the work of manufacturing these planes and others which might subsequently be required, as it was felt, rightly or wrongly, that there was no private enterprise existing capable of handling the proposition satisfactorily.

This new firm was known as Canadian Aeroplanes Limited and was under the direction of F. W. (now Sir Frank) Baillie.

Canadian Aeroplanes Limited acquired the manufacturing business of Curtiss Aeroplanes and Motors Limited, except the business of manufacturing parts for the Buffalo firm, and immediately proceeded with the work of turning out the JN-4 machines.

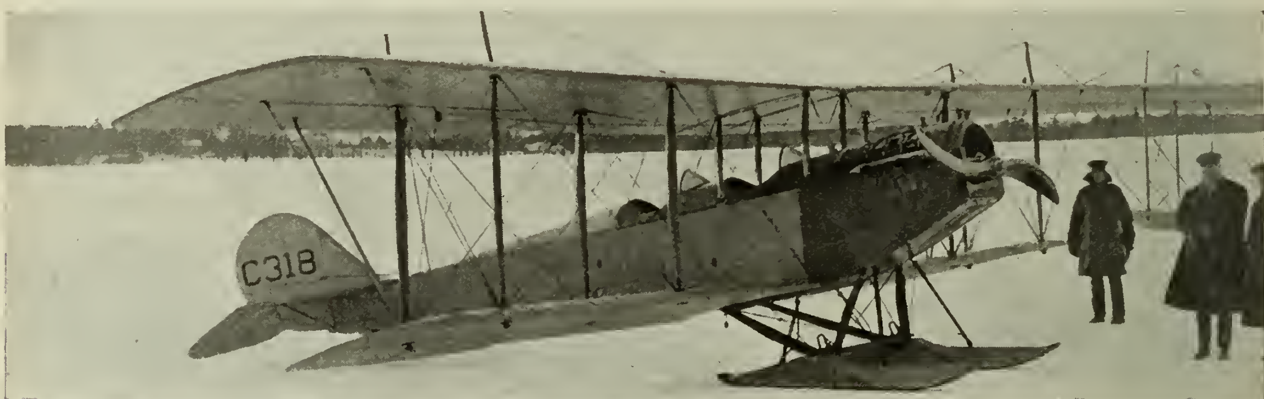
Limited would not be nearly large enough to produce a sufficient number of machines in a reasonable time, and steps were taken to erect a new plant specially for the purpose. A site was chosen, and work was started about the beginning of February. The construction was pushed so rapidly that by May the transfer to the new plant was practically complete.

With some extensions subsequently added the new buildings provided a floor space of approximately 235,000 sq. ft. or about 5½ acres.

The manufacturing equipment was most complete and provided for the production of practically every part of an aeroplane with the exception of the motors and instruments such as tachometers, gauges, altimeters, etc.

A well equipped testing department provided for the testing of all raw materials as well as finished parts; and a research department allowed experiments to be made on the proper heat treatment for various metal parts, the qualities of various samples of dopes and paints, etc.

While production was pushed to the limit, all materials and workmanship had to run the gauntlet of the testing department, the company's inspection department and the A-I-D, or government inspectors, the result of all this care being that as far as I have information no accident ever occurred with one of our machines that could be traced to defective material or workmanship.



"JN-4" Type Training Plane C-318 (Fitted with Snowshoes), February 1918.

The Curtiss Aeroplanes and Motors Limited continued their work of manufacturing spares for British Buffalo orders.

The greater part of the engineering and manufacturing staffs of the Curtis Aeroplanes & Motors remained with the Canadian Aeroplanes Limited.

Before beginning production of JN-4 machines on a large scale, it was found desirable to make some slight changes from the Buffalo design. The bridge type of control with which the Buffalo machines were fitted was changed to the more usual " joy stick, " metal construction was adopted for the rudder, elevators, and fin, and the design of the tail was altered so as to give better " stream lining " and reduce risk of damage in landing. The first machine was completed on January 1st, 1917, and was taken out to the Long Branch flying field for test. The trial flight was very successful, the machine was officially accepted, and production work was started in earnest.

It was soon evident that the premises occupied by the old Curtiss Aeroplanes & Motors Limited which had been taken over by Canadian Aeroplanes

The production records climbed steadily from month to month, slowly at first, then by leaps and bounds until we reached a record of 318 machines in one month by the end of 1917. This result was achieved with a force of about 2500 men, and is a better figure than has been reached on a similar class of work with a similar number of employees anywhere else, as far as I have information.

At this rate the requirements of the Royal Air Force were soon supplied, and we were able to furnish the U. S. training fields with a number of training machines as well.

The total number of JN-4 machines turned out was approximately 1300 and spares sufficient to make the production equal to approximately 3000 complete machines in all; of these, 680 were furnished the U. S. fields.

The JN-4 is of course quite obsolete as a military machine, but has proved very satisfactory for training purposes. There are several variations of this model differing in details, but the Canadian JN-4 is a two-seater biplane of 44 feet wing spread (upper plane), flying weight about 2100 pounds, and fitted with a Curtiss OX motor of 90-100 H.P. The speed is about 70 miles per hour.

While the production of the JN-4 was proceeding, an experimental machine of another type was turned out in the experimental shop. This was the De Haviland 6, a training plane that had been used to a considerable extent in England and which at one time it was proposed to substitute for the JN-4.

This DH-6 was tried out in July, 1917, and was found satisfactory, but by this time production was swinging nicely on the JN-4's, they had proved very suitable for the purpose and it was felt that to change over to the DH-6 would unnecessarily delay the output of machines. No more of this type were therefore built.

The DH-6 is a two-seater biplane of about 36 feet wing spread, both upper and lower planes being alike, flying weight about the same as the JN-4. The DH-6 was designed for a R.A.F. engine of 90 H.P. The one in question was fitted with the same motor as used in the JN-4, and the speed was around 65 miles per hour.

The DH-6 is interesting as having a type of wing suitable for carrying heavy loads, at moderate speeds, the section being much more deeply cambered than that used in the JN-4, which was a modified form of Eiffel No. 36, a good general purpose curve.

When the wants of the R.A.F. had been satisfied for the time being, and there seemed a likelihood of a temporary lull in production a contract was obtained from the U.S. Navy for 50 flying boats of the new F-5 type. This boat had been developed at Felixstowe, England, and found the most suitable for patrol and anti-submarine work.

It is a large twin-engined boat, of about 102 ft. wing span, a total flying weight of around 14,000 lbs., and a a speed, fitted with two 400 H.P. Liberty 12's, of about 100 miles per hour. Its length from nose to tail is about fifty feet. Its armament consists of between four and six machine guns, one Davis six pounder, and four 230 lb. bombs which are hung on racks under the wings.

The crew numbers six men, and a system of inter-communicating telephones is fitted.

There is a wireless cabin in which is fitted a wireless set with a sending radius of about 25 miles and a receiving radius of about 1000 miles.

The engines, armament, bombs, wireless outfit, telephones, etc., were supplied by the U. S. Navy Department, but we had to make provision for the installation.

The construction of the first boat of our contract was commenced on April 22nd, 1918, and the boat was completed by July 15th, shipped to Philadelphia, and successfully tried out.

We afterwards worked up to a production of eight boats per month.

While the contract for F-5 boats was getting under way in the shops work was started on another type of machine for the R.A.F. training fields. While the JN-4 had been found suitable for general training, it was somewhat too slow, and was not sensitive enough to control for advanced work, so that cadets trained in Canada had to take additional training before proceeding to work on actual war machines.

Shipment of Canadian "JN-4" Training Planes to U. S. Training Fields. Mid-winter 1917-1918.

To avoid this it was decided to equip certain training squadrons with the "Avro" 504-K training plane which was in use in England.

The "Avro" 504-K is a biplane of 36 feet wing spread, both upper and lower planes having the same span. It is of lighter construction and considerably greater refinement of design than the JN-4, while the wing section is one adapted for higher speeds. With these differences the "Avro" is a considerably faster machine, the original machines of this model, which appeared in 1915, and were used to some extent at the front, having a speed of 90 miles per hour with an 80 H.P. Gnome Motor.

As a training machine the "Avro" 504-K is adapted to be fitted with seven different types of motor. For the Canadian training squadrons the "Avro" was fitted with 130 H.P. Clerget Motors, which were shipped out from England for the purpose. With this motor a speed of upwards of 100 miles per hour has been obtained.

It was found advisable to make some minor changes in the design on account of difficulty in obtaining material, and in order to reduce the number of spares necessary, by making certain parts interchangeable with corresponding parts of the JN-4. Thus the landing gear was completely redesigned, a V-type being used instead of the regular "Avro" type.

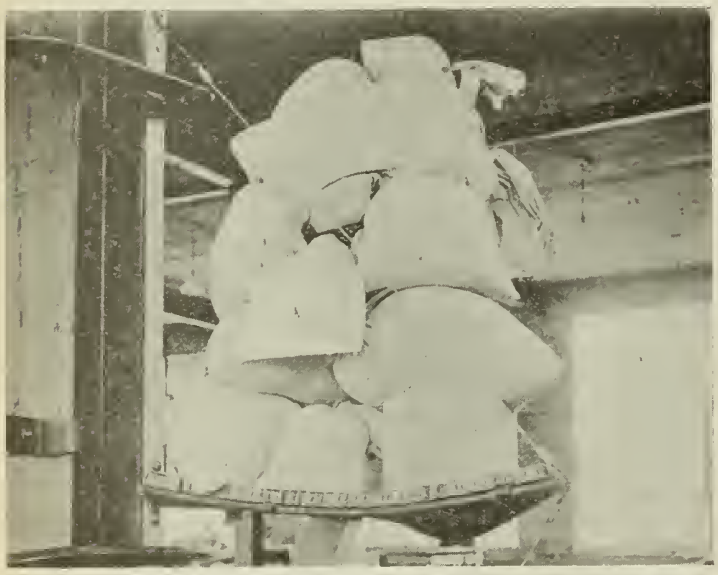
These changes caused delay and while the first machine of this type was delivered by October 1st, production was really only beginning when the armistice was signed and work stopped. We delivered only two machines of this type in all.

With the conclusion of the armistice the activities of the Canadian Aeroplanes came to an end, the R.A.F. order for 500 "Avros" being cancelled immediately and the U. S. contract for F-5 boats being cut from 50 to 30. The distasteful task of gradually discharging the staff of workers was immediately begun and by the end of January, 1919, when the F-5 contract was finally completed, the working force had been entirely disposed of except such office and other help as was necessary to complete the sale of the tools and fixtures, and the huge buildings lately so thronged with busy workers now stand empty and still.

The Curtiss Aeroplanes and Motors Limited which had been working on a contract for F-5 boat spares, has also discontinued aeroplane work, but has been able to retain a portion of its staff on another line of manufacture.

As will be seen from the foregoing the aeroplane industry of Canada during the war grew from nothing to very respectable dimensions. A large number of workmen were employed not only in the aeroplane factories, but also in supplying raw material—such as spruce lumber—and large numbers of machines of different types were successfully turned out. The quality of the workmanship in these machines was certainly equal to that found anywhere else, and the production records were unsurpassed. Canada has no reason to feel ashamed of her part in supplying the aeroplane needs of the Allies.

It is not possible to make more than a passing reference to the work of the R.A.F. in Canada. The complete account of this work is now being prepared in book form by the historical department of the R.A.F. and will shortly be issued.



Sand Bag Loading Test on Vertical Fin, Canadian "JN-4," May 1917.

It will be sufficient to note that as a result of the activities of the R.A.F. in training aviators, and of the firms building aeroplanes, there are now in Canada a large number of skilled workmen ready to produce aeroplanes and of skilled aviators ready to fly them when built.

"De Haviland 6" Type Training Plane Built by Canadian Aeroplanes Limited, July 1917.

Now that war activities are over the question naturally suggests itself—is the aeroplane destined to play a useful part in the industries of peace, or is it to rank in the future as in the past, as a purely military machine, with possibly an occasional one used here and there by an enthusiast for purposes of sport?

A careful study of the question would seem to bring one to the conclusion that there are at any rate several directions in which aeroplanes could be usefully employed apart from war purposes, and in what follows an attempt will be made to show what these appear to the writer to be.

It may be taken for granted that aeroplanes will still be required as a part of the equipment of the armed forces of the country. There are good people who tell us that there will never be another war and, therefore, no more armies or armaments are necessary.

Such statements always remind me of a passage in Scott's "Guy Mannering" where the sturdy yeoman, Dandie Dinmont is warning an English traveller against the dangers of the border wastes, and the female keeper of the wayside inn declares that there is no danger now, as they're all honest on the borders. Dinmont replies: "Aye Tib, that'll be when the deil's blind, and he's e'en no sair yet."

The country that neglects to keep its air service up to date and ready for immediate service will probably have to pay a terrible price sooner or later. Air raids in the next great war will be carried out by larger and more powerful machines used in vastly greater numbers than in the present war, and the country that is not in a position to defend itself from such attack, and loses the control of the air above its territories will be by that very fact defeated.

It seems, therefore certain that a considerable number of planes will be required for military purposes. But while this will, I believe, be the case, I am convinced that it is equally true that if the aeroplane industry is to develop to any respectable dimensions, it will have to be along commercial rather than military lines. This brings us to the question, is the commercial development of the aeroplane possible?

This is the problem that must be solved by businessmen and engineers working together if the aeroplane industry is to be a factor in the commercial life of the country.

The war has developed, in general, the following types of machines:

(*a*) The small fast scout plane, of very high speed and small carrying capacity, generally a single seater—as the Spad, the Sopwith Camel, the SE-5, etc.

(*b*) The larger and more powerful general purpose machine of high speed and fair carrying capacity—generally a double-seater, as the DH-4.

(*c*) The still larger bombing plane, generally at least twin-engined, of somewhat lower speed, but great carrying capacity as the Handley Page, the Super Handley Page, the DH-10, the Caproni, etc.

probably choose a " tank " as a motor vehicle for pleasure or commercial purposes.

In this connection it is interesting to note that the attempt to use DH-4's built for war purposes in the U. S. as mail carrying machines, has so far proved a failure, while machines specially built or adapted for mail carrying —the JN-4 type with the 150 H.P. Hispano Suika motor and the R-4 with the Liberty 12---have been very satisfactory.

For commercial uses more rugged construction will probably be found desirable, particularly with reference to parts affected in landing—greater reliability, and longer service without overhauling in the case of motors. As the attaining of a very high ceiling will not in general be necessary, lower compression pressures could be used satisfactorily, this, with somewhat heavier construction

"Avro 504-K" Type Training Plane C-1502. Last Plane Built by Canadian Aeroplanes Limited for R. A. F. November 1918.

(*d*) The flying boat for naval service, the largest types of which as the F-5 or NC-1 are of large carrying capacity, and in general correspond to the large bombing planes.

(*e*) The training plane, moderately sized, moderately powered, fairly slow and comparatively easily handled as the DH-6, the JN-4, the "Avro " 504-K, etc.

It seems probable that none of these war types at present in use will prove permanently satisfactory for commercial purposes without considerable alteration; in other words an aeroplane for commercial use will probably have to be specially designed for a particular class of service in order to prove satisfactory.

This is not remarkable nor are these considerations confined to aeroplanes. A warship would not make an efficient passenger or cargo vessel, and none of us would would tend to greatly increase the serviceable life of the motors. It should be constantly remembered, however, that increased weight in construction of plane or machinery cuts down the available load capacity.

The peace development of the aeroplane will probably be along the following general lines:

(*a*) Machines for sporting or pleasure purposes.

(*b*) Machines for what are generally termed " commercial " uses, including:

1. Machines for mail carrying;
2. Machines for carrying passengers and freight;
3. Machines for special purposes.

With regard to the use of aeroplanes for sport or pleasure, a considerable development may reasonably be expected along this line but of much smaller dimensions than has occurred in the case of the pleasure automobile.

The reasons are several, perhaps the chief being the aversion that so many have to leaving the safety of terra firma. One may produce facts and figures to prove that flying is really very safe—as for example that the mail carrying planes between New York and Washington during the months of September and October flew over 22,000 miles and carried over 30,000 lbs. of mail in all weathers without serious accident and with only one forced landing—but a certain number will always remain unconvinced.

Another drawback is the space required for taking off and alighting—which certainly limits if it does not entirely preclude the use of aeroplanes in crowded quarters such as cities. Improvement in this respect will probably be made, and already a successful landing has been made on the roof of a building, but this objection will probably remain, more or less.

Another factor is that of cost. Such machines as were available before the war, cost in the neighborhood of $7,500.00 at least, and required the constant attention of skilled mechanics to keep in flying condition—they were at best rich men's toys.

Just at present and for some time there will probably be available numbers of machines which have been built for war purposes, at sacrifice prices, but the upkeep cost of these machines will probably be considerable, and in any case the supply will soon be exhausted.

Since the war several firms have turned their attention to producing small one-man planes of moderate size and power, and with a reasonable first and upkeep cost. Several of these are advertised to sell around $2,500.00.

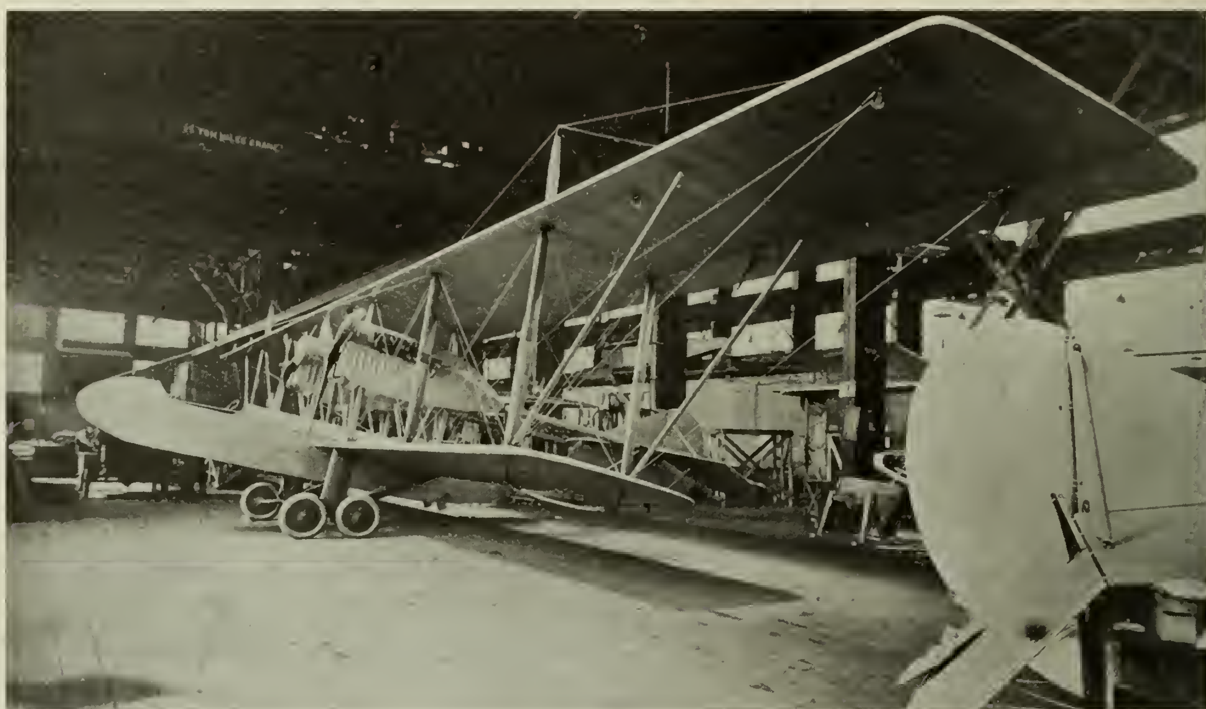
It is practically certain, however, that a five-passenger machine will never be available at anything like the price of a " flivver."

Coming now to the purely commercial machines, those engaged in the transportation of passengers, mail and freight, while reliable data as to running costs of aerial transport under peace conditions are not available, nevertheless it is possible to form some fair estimate of the conditions under which it will be possible to compete with other established means of transport.

In long settled territories where competing methods of transport, such as railways, steam or electric are well developed, the governing advantage of aerial transport will be speed. As the aerodromes will probably have to be located on the outskirts of cities, some time will be lost in conveying passengers or freight from the collection point to the aerodrome. It follows, therefore, that there must be some minimum distance below which the advantage of speed will not exist, and as distances become longer the advantage of aerial transport in this respect will become more apparent. For short distances, therefore, it would seem that aerial transport is not likely to be commercially possible.

The absence of the necessity for a track gives the aerial transport system a great financial advantage, nor will this be nearly offset by the cost of necessary landing grounds at reasonable intervals, wireless installations, weather reporting services and signalling systems, to indicate routes by night or in fog.

Another advantage of the aerial transport lies in the fact that as compared with a railway train an aeroplane is a small traffic unit, and urgent traffic can be handled by a succession of planes from the aerodrome as



"C" Bombing Plane, Built by Curtiss Aeroplanes & Motors Limited, Toronto, 1915-1916.

the occasion arises, with time economy over the train which requires longer intervals between units to allow of the accumulation of sufficient load for a unit.

Considering now specially passenger traffic, this divides itself into two general classes, business and pleasure. At first the greater part of the passenger traffic will be business. On account of the higher speed of the aerial service, many business men will no doubt avail themselves of it, because although the fares will be higher, this will be more than offset by the economy of time. For instance, it will be possible, under favorable conditions, to fly from 400 to 500 miles out and home within the day, with sufficient time between flights for transaction of reasonable business.

Passenger service will probably begin by the use of single machines for rapid journeys in any direction, but later it will become possible to institute regular services along settled routes on scheduled time.

Pleasure traffic will probably be small in volume for some considerable time, and will be confined to those taking a trip for the novelty of the experience.

have to be supplied, and the method of entrance will have to involve less of an acrobatic performance than at present. This will mean added weight and the reduction of the passenger carrying capacity, but these changes will, in the writer's opinion, be found necessary if trade is to be secured.

Freight traffic will include :
(a) Mails.
(b) General Freight.

In mail carrying commercial conditions do not necessarily rigidly apply—in other words national considerations might demand that the use of aircraft should be developed, and in this case it might be good national business to bear part of the cost of an aerial mail service with this object in view.

Mails offer a very satisfactory class of freight for aeroplane carriage, because the load is fairly uniform, the weight small, and the demand for speed urgent.

For the longer distances the saving in time in the delivery of mails by aeroplane will be enormous—for instance it is estimated that mail could be conveyed from

"F5L" Type Flying Boat, Built by Canadian Aeroplanes Limited, Toronto, for U. S. Navy. First Canadian Boat under Test at Navy Yard, Philadelphia, August 1918.

As the safety and convenience of this method of travelling becomes more apparent, this traffic will increase in volume.

For passenger traffic two points will require special attention, safety and comfort. Safety, in fact, will have to be a primary consideration if support from the travelling public is expected. In this connection it may be noted that commercial machines can be made inherently stable and automatic stabilizers can be employed to an extent that has not been practicable in war machines—so that it would appear that commercial machines could be made aerodynamically much safer than the present war types. In use they will not be subjected to the severe and somewhat indeterminate stresses due to "stunting," and, therefore, for the same calculated factor of safety, they will really be structurally much safer.

The question of comfort will also require much attention. The travelling public will demand a much greater degree of comfort than is available in present machines. Some form of comfortably enclosed cabin will

London to Calcutta in four days against 16 days, the best possible at present.

Considerable experimental work has been done already along this line, and the results have in general been so satisfactory that in the immediate future the existing services will be greatly extended.

When we turn to the consideration of other freight, conditions are not quite so favorable. If reasonably high speed (which has already been noted as the principal asset of aerial transport in competition with other methods) is to be maintained, then the commercial load must not exceed approximately 25 per cent. of the total weight of the loaded aeroplane.

It would, therefore, seem that the class of freight that can be commercially handled by aeroplane in competition with other means of transport, will be limited to articles of high intrinsic value and small weight, or articles which are specially "rush." For instance, laces, jewels, precious metals, tea samples, drugs, dyes, chemicals, small spare parts of machines, etc.

For this class of service it would seem that aeroplane transport could only hope to act as auxiliary to surface methods of transport.

In undeveloped parts of the country where there are no established competing methods of transport, aerial transport, providing as it does ready means of reaching points previously practically inaccessible, will show to much greater advantage, and offers proportionately a better commercial proposition. Of course, the volume of such traffic will probably not be large.

In cases where traffic from one place to another is interrupted by some obstacle involving changes in the method of surface transport—such as a sea passage—aerial transport scores a great advantage.

This brings us to an exceedingly interesting question, namely, that of Transatlantic, or perhaps it would be better to say Transoceanic Aerial Service.

While we may reasonably expect a successful Transatlantic flight to be made by aeroplane or flying boat in the near future, possibly this coming summer, it seems probable that when regular aerial service over the Atlantic and other oceans is established, the aeroplane will not be the type of air vessel generally employed. For work of this kind, as well as for long flights overland, involving several days duration, the lighter than airship of the Zeppelin type appears to offer superior advantages in the way of comfort and safety. As compared with an aeroplane, the largest types of dirigible at present in existence have a gross weight of 60 tons with a disposable load of 30 tons—about nine times that of the largest existing type of aeroplane.

The maximum speed possible is probably not over 70 miles per hour as against about 100 miles per hour for the large type of aeroplane adapted to similar service, but even this is much higher than that possible at present with steamships. The large load carrying capacity makes possible the provision of much greater comfort for passengers, and with respect to safety, the breakdown of the machinery would not necessitate immediate landing—a factor of some importance in crossing a large body of water. Minor breakdowns could no doubt be repaired in the air and the journey continued without landing. On the other hand provision for landing and housing at the terminal points would probably be more expensive than in the case of aeroplanes, and the regularity of the service would probably be more adversely affected by bad weather.

Applying this discussion to Canada, this country seems to offer particular advantages for the establishment of aerial transport. Large portions of it are in the undeveloped state as regards transportation facilities. The use of the aeroplane would enable mail and express package freight as well as passenger service to be extended to points at present practically inaccessible, or in other words places which it takes days or weeks to reach under present conditions could be reached in a few hours by aeroplanes.

The development in Canada is likely to be first of all along the lines of a postal service. This will enable considerable experience in commercial flying to be obtained, and will familiarize the mind of the public with the idea of aerial transport, thus creating confidence. It is the lack of confidence on the part of the average man in the safety of aerial travel that is, as stated before, one of the most serious, if not the most serious difficulty in the way of development. This has been created by reading in the public press highly coloured accounts of fatal accidents; where these are considered by themselves, without reference to the peculiar circumstances under which most of them occurred (the intensive system of training in all kinds of stunt flying necessary under the late war conditions), and also without reference to the proportion of accidents to flights, an altogether exaggerated and distorted idea of the dangers of flying is created.

When public confidence in flying is once fairly established, the writer ventures to predict that development of aerial transportation systems along the lines suggested will be rapid.

In the meantime, research work in aerodynamics should be pushed, and it is gratifying to know that several of our universities are already taking the matter up.

A great many other problems will have to be dealt with as flying becomes more common—for instance, the establishing of flying rules of the road; questions with relation to trespass and liability in case of accident incurred in flying over private property; the determinations of the best air routes; custom problems, etc.

All this will take time; but it will be done and the writer is firmly of the opinion that in a comparatively short time flying will be so common as not to excite comment, and no one will think anything of travelling from Toronto to Montreal in about three hours or from Toronto to Winnipeg in ten.

When long distance flying becomes common, it will probably be found necessary to have stores of the spare parts most likely to be required, such as propellers and various engine parts, at conveniently located depots along the courses of travel. In the event of a mishap to any of these parts, repairs could then be quickly made, and the journey continued. On account of the weight it would not be feasible to carry spares (except small parts such as spark plugs, etc.) on board as is done in the case of a steamship. It is in this connection especially that standardization of parts of aircraft will prove so valuable not to say essential, more particularly with reference to international aerial services.

There remains to be considered special uses to which aeroplanes can be put.

One field in which it would appear that useful service could be rendered is that of fire patrol of forests. Destructive bush fires are very small at the beginning, and if immediately detected could be easily dealt with. A fire ranger from an elevation of say 5,000 feet could command a view of a wide stretch of territory and could detect the first signs of a fire.

For this service in Canada it is probable that the small flying boat or at any rate a hydro aeroplane (aeroplane fitted with pontoons instead of wheels) would be found best.

The writer has had survey experience in Northern Ontario and Quebec and can state that as far as his personal observation goes, possible landing grounds for aeroplanes are few and far between. On the other hand there are innumerable small lakes and rivers on which a small flying boat could alight in safety and from the surface of which it could take off.

Flying boats could also be employed in connection with life saving stations along our coasts, and in general coast patrol work.

A question which might reasonably arise in connection with the use of aeroplanes in all seasons in Canada is the question of rising from or alighting on a surface covered with snow, especially if the snow be soft, and of considerable depth. It is obvious that in the case of a machine equipped with the ordinary landing gear with wheels, a depth of soft snow might so impede its progress on the ground that it could never reach a flying speed, particularly in the case of a heavy machine. At the time when the R.A.F. established training squadrons in Canada it was considered so difficult if not impossible to continue flying under the ordinary conditions of a Canadian winter, that for the winter of 1917-1918 the bulk of the training camps were transferred to the South, only a small number remaining, more as an experiment than anything else. Experience proved that while a take off or a landing could be effected without special difficulty from a hard snow surface, there was always the possibility of one of the wheels striking a soft spot, when a spill was practically certain.

Then it was suggested that snow shoes or "skis" might be fitted instead of wheels. This was tried on several machines, and proved so satisfactory that a considerable number of machines were at once equipped with these "skis" and during the later part of the winter 1917-1918 much flying was done with them. It was even reported that a machine equipped in this manner took off and landed on a snow surface more easily than a wheel equipped machine on ordinary ground.

In fact so successful was the experiment that it had been intended during the winter of 1918-1919 to do the bulk of the training work at the Canadian Camps, and a large number of these snow shoes were ordered from Canadian Aeroplanes Limited. This order was partially completed at the time of the armistice.

From the experience of the R.A.F. therefore, it would appear that as far as snow conditions are concerned aeroplane service could be maintained throughout the winter.

D. O. LEWIS, M.E.I.C., Victoria, B.C.
Newly elected Vice President.

WALTER J. FRANCIS, M.E.I.C., Montreal.
Newly elected Vice President.

As commercial aerial service extends, new uses for the aeroplane will be continually found and in a comparatively small number of years instead of considering it as an interesting but somewhat impractical toy, flying will have become a matter of everyday life, and we will wonder how we ever got along without it.

As a result of the higher speed possible with aerial transport, nations will be brought in closer intercourse with one another, mutual understanding promoted and the possibility of international conflict lessened, so that while the aeroplane has proved it can serve its turn in war, it will also prove that it can help to bring about the condition wished for by the poet:—

"Now let us pray that come it may
As come it will for a' that
That man to man the world o'er
Shall brithers be, for a' that."

Industrial Illumination

*Geo. K. McDougall, Esq., A.M.E.I.C.**

Adequate illumination for industrial enterprises, with the improved means for obtaining it, is being appreciated by many and every day more interest is being shown in this subject due to the distinct bearing it has on efficiency and welfare of employees.

With a view of promoting interest and discussion on the subject of illumination, this paper has been prepared. The subject matter contained herein is simply a collection of information, briefly covered, which may be found more fully taken up in textbooks and technical articles on illumination.

Before touching on the practical side, the fundamental laws of reflection and transmission of light will be briefly covered, to allow of the easier understanding of their application.

The common laws of reflection and transmission are well known and widely utilized by designers of lighting equipment but unfortunately many mistakes are made in the application of such equipment by those who are not familiar with these laws.

Touching briefly first on the laws of reflection and transmission of light, we have:—

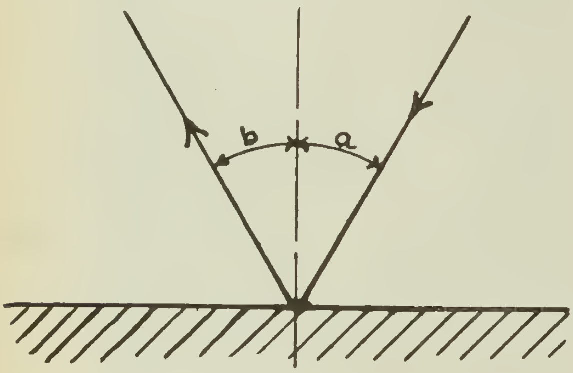


FIG. 1.
REFLECTION

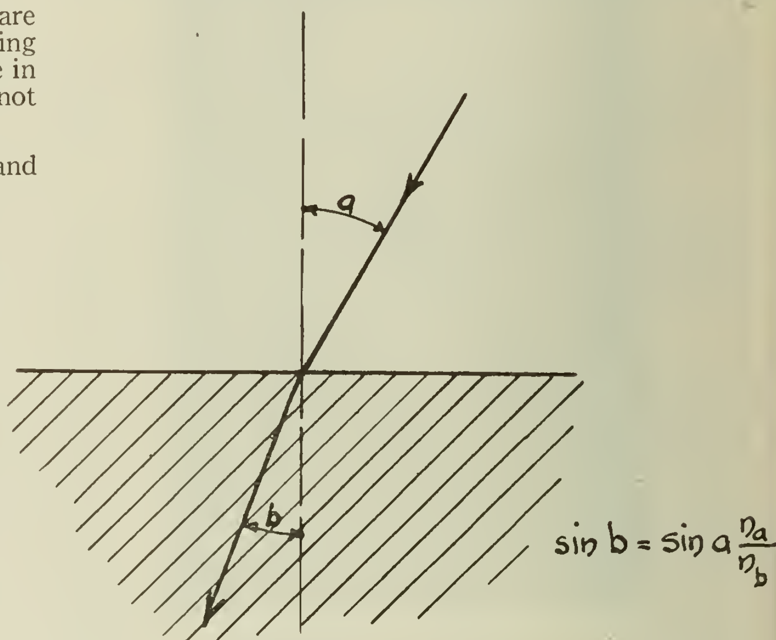


FIG. 2
REFRACTION.

1. *The Law of Reflection.* The angle of reflected light is equal to the angle of incident light.

2. *The Law of Refraction.* The sine of the angle of refraction of a light ray passing from one medium into another is equal to the sine of the angle of incidence multiplied by a factor which is determined by the relative refractive indices, or the relative optical densities of the two media.

The law of reflection is illustrated by Fig. 1. and the law of reflection by Fig. 2.

When we consider the result of a pencil of light rays, i.e., a collection of parallel light rays we may obtain results which appear quite different from those we would expect when applying these laws, due to differences between the different parts of the reflecting or refracting medium scattering the rays. Each individual ray, however, is following the regular laws in spite of the fact that collectively they are not.

This now brings us to the general laws of reflection and refraction of a collection, or pencil of light rays.

First considering the secondary laws of reflection, three in number:—

1. The law of regular or specular reflection.
2. The law of spread reflection.
3. The law of diffuse reflection.

Illustrating these laws — Fig. 3 shows the operation of the law of regular or specular reflection. In this case the angle of incidence of the light rays is equal to their angle of reflection. This kind of reflection is obtained from mirrored glass, prismatic glass and polished metal surfaces.

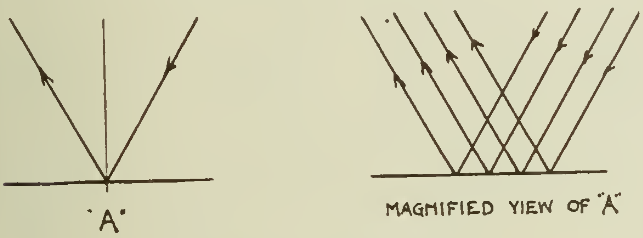
Fig. 4 illustrates the law of spread reflection. Spread reflection is obtained from etched prismatic glass and from rough metallic surfaces. It is to be noted that in this kind of reflection that the maximum intensity of the reflected light is in the same direction as in regular reflection, but a part of the light is scattered slightly out of this line, producing the effect of a spreading beam of light of the same general direction as in regular reflection.

Fig. 5. illustrates the law of diffuse reflection. In the case of diffuse reflection the maximum intensity of reflected light is always normal to the reflecting surface and the light is reflected through an angle of 180°. This holds over a large range in the angle of incidence. If a photometric curve is plotted of the light reflected from a

* Read at a meeting of Montreal Branch, Thursday, January 23rd, 1919.

small surface it will be found that the intensities are represented by a sphere, or considering one plane cutting the point of incidence, by a circle. This distribution of reflected light follows what is known as the cosine law, which is, that the intensity of reflected light at any angle from the normal to the surface is proportional to the cosine of the angle.

Diffuse reflection as ordinarily obtained is caused by reflection from particles beneath the surface. This will be better understood by referring to the magnified



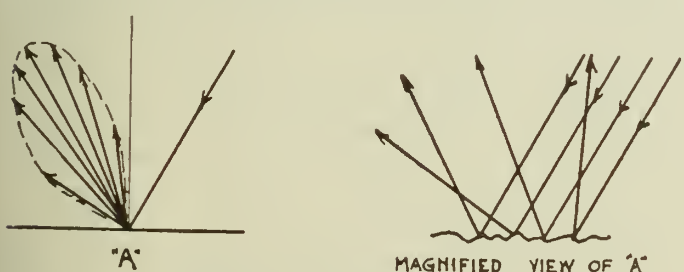
REGULAR REFLECTION

FIG. 3.

view in Fig. 5. The light rays penetrate the material and are reflected back and forth between the minute particles and finally emerge in all directions.

It may appear that diffuse reflection is obtained by surface reflection but if the substance under consideration, which gives diffuse reflection, is examined it will be found otherwise. Taking, for instance, a piece of matt surface paper or blotting paper, which is diffuse reflecting material, it would appear, at first thought, that the reflection of light is from the surface, but holding the paper up to a bright light it is found that it transmits light, which proves that the light is entering the material.

Examples of materials giving diffuse reflection are opal glass, porcelain enamel, paint enamel, also kalsomine



SPREAD REFLECTION

FIG. 4.

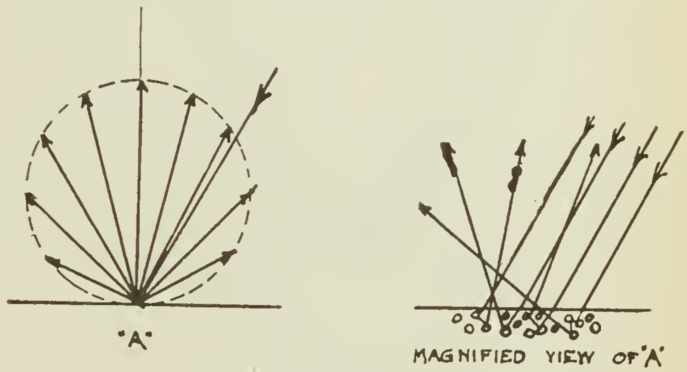
and paint finishes commonly used for walls, ceilings and interior decoration.

The property of diffuse reflection of common interior finishes is a very valuable one from the point of view of interior lighting.

It is possible to obtain combinations of regular and diffuse, spread and diffuse, or regular and spread reflections from the same material. These combinations are illustrated in Fig. 6.

In Fig. 6A is represented the combination of regular and diffuse reflection. The regular component is surface reflection and the diffuse component is sub-surface reflection. This is one of the most important types of reflections met with in practice and is obtained from such materials as porcelain enamel finish, opal glass and paint enamel when the surface has a gloss finish. The component of regularly reflected light, though appearing large, is really comparatively small and unimportant and actually is rarely more than five per cent of the total light reflected.

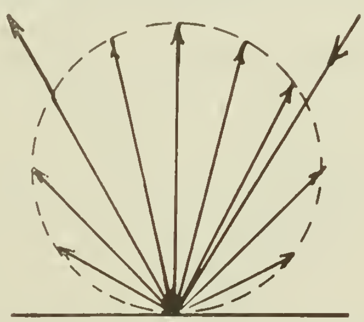
Fig. 6B illustrates the combination of spread and diffuse reflection which is obtained form materials such as porcelain enamel, or opal glass when the finish is rough.



DIFFUSE REFLECTION

FIG. 5.

Fig. 6C shows the combination of regular and spread reflection which is obtained by reflection from two surfaces of a meterial such as the inside and outside of a piece of glass when the outer surface is roughened. Crystal glass roughed outside gives this combination which, in practice, is unimportant as the materials giving it are not satisfactory as reflectors.

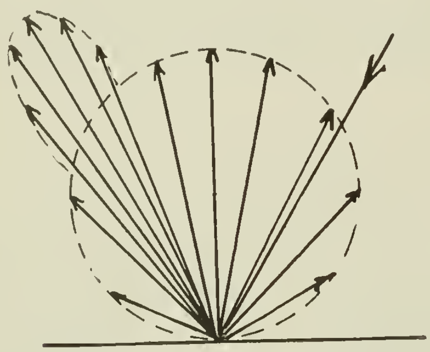


COMBINATION OF REGULAR AND DIFFUSE REFLECTION

FIG. 6A.

Considering the types of reflection from a practical standpoint it is seen that the most accurate control of light is obtained from materials giving regular or specular reflection such as mirrors or polished metal surfaces. This type of material is used in the manufacture of reflectors for searchlights, headlights, etc., where accurate control is required. It is to be noted, however, that this material is not satisfactory for reflectors to be used in general illumination, due to streaks or striations of light resulting from the reproduction of the image of the light source on the illuminated surface. Mirror reflectors having corrugations should not be confused with the above as they give spread reflection.

Surfaces giving spread reflection, such as corrugated mirrors and aluminum paint finish are of great importance and while less accurate in the control of light than those materials giving regular reflection, are sufficiently accurate for most practical requirements in commercial reflectors.

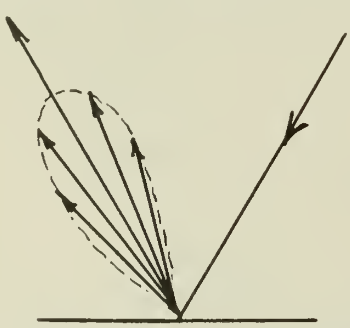


COMBINATION OF SPREAD AND DIFFUSE REFLECTION

FIG. 6B.

With spread reflecting surfaces it is possible to design reflectors whose shape will give all the light distributions required for interior illumination purposes. Striations or streaks on the surface illuminated are eliminated by the use of spread reflecting material in reflectors.

The accurate control of light with diffuse reflecting materials such as porcelain enamel finish and opal glass is difficult. The general direction only of the light can be controlled and reflectors made of this materia' are only useful where a general downward distribution of



COMBINATION OF REGULAR AND SPREAD REFLECTION

FIG. 6C.

light is required. A focussing distribution of light or other extreme distributions are impossible when a diffuse reflecting medium is used. It so happens, however, that the distributions most commonly used in commercial and home lighting fall within the range of those that can be obtained from diffuse reflecting materials.

The prismatic glass reflector belongs to the type of reflector giving spread reflection, and when accurately designed will give a wide range of distributions with considerable accuracy. Fig. 7 is a cross-section of a portion of such a reflector. The light ray passes through the inner surface, where a small portion of it is reflected, the balance is regularly reflected twice from the outer surface and then passes back through the inner surface. Due to the several reflections, the inequalities in the glass

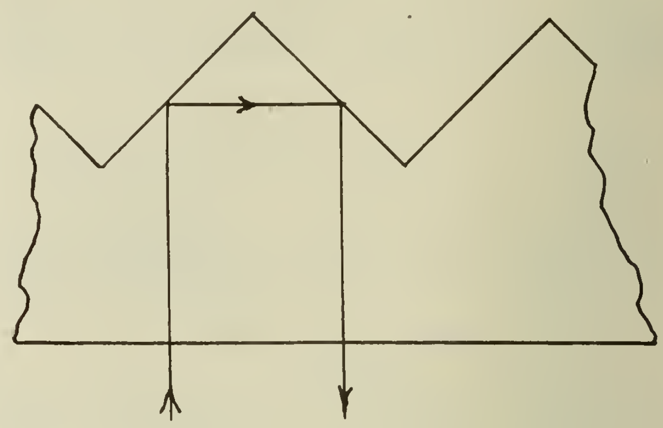
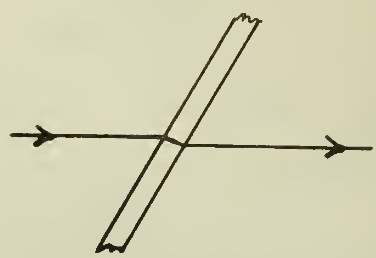


FIG. 7.

cause the rays to be slightly spread from the direct path of regular reflection. This slight spreading has the advantage of eliminating striations without reducing the control of light, which is one of the important advantages of the prismatic reflector. It should be remembered that in order to get the results for which it was designed, a prismatic reflector should be used with the size lamp and lamp position called for by the manufacturer, otherwise a totally different distribution of light may result.

Summarizing the important uses of the different reflecting media it is observed that for the most accurate



REGULAR TRANSMISSION

FIG. 8A.

control of reflected light, regular or specularly reflecting materials are used. Reflectors of this type are not satisfactory for general purposes of industrial illumination unless some provision is made to get rid of the striations produced.

Spread reflection allows of a fair control of light and materials having this characteristic are of great practical use for industrial reflectors. It is possible with spread reflecting surfaces to design shapes of reflectors giving the distributions most widely used in interior illumination.

Diffuse reflecting materials are difficult to control light with and are only useful where a general distribution of light is required.

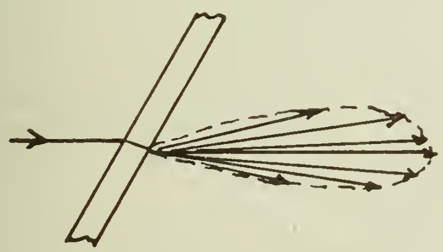
Light Transmission.

The primary law of refraction governs the path of a light ray passing through a material. This law was defined earlier in this paper. When a beam of light, however, passes through and emerges from a medium, the resultant emerging light follows laws very similar to the secondary laws of reflection. For brevity they will be enumerated and illustrated in diagrams only, on account of their similarity to the laws of reflection.

These laws are:—

1. The law of Direct Transmission.
2. The law of Spread Transmission.
3. The law of Diffuse Transmission.

Direct Transmission. Figure 8A, is obtained with clear glass. The light passes through without change in direction except for a slight displacement at each surface due to refraction. A small portion of the light is reflected at both surfaces and absorbed in passing through the medium.



SPREAD TRANSMISSION

FIG. 8 B.

Spread Transmission. Figure 8B, is obtained from materials having an irregular surface such as clear frosted glass and clear glass having a wavy or crinkled surface. The general direction of the emerging light is in same direction as the incident light. The deviation being caused by refraction at the irregular surface.

Diffuse Transmission. Figure 8C, is obtained from opal glass and is caused by the refraction and reflection of the light in passing through the medium. The emerging light follows the cosine law.

It is interesting to note the effect on appearance of globes having different light transmission properties.

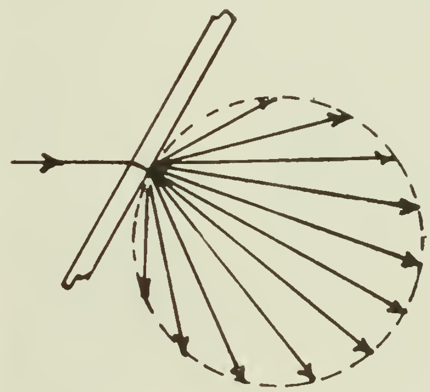
With direct transmission the light source is visible. With spread transmission the light source is seen as a bright spot gradually fading in intensity towards the edges. With perfect diffuse transmission the light source is not distinguishable and the globe appears equally illuminated. It is possible to obtain numerous combinations of the different types of transmission analogous to those obtained in reflection but they will not be touched upon here.

Natural Illumination.

Natural daylight being the most important source of illumination available, it is well to consider briefly its control.

There are numerous different types of window or sheet glass on the market and it is of interest to note their effect on the resultant illumination of a room. First in common use is clear glass, which has direct transmission, i.e. the direction of the light rays after passing through are in the same direction as originally. Between 10 and 20 per cent of the incident light is reflected or absorbed. Objects can be clearly seen through it without material distortion.

Next come the clear sheet glasses having various degrees of spread transmission of light caused by irregular refraction due to their irregular surfaces. The greater the irregularities of surface, the greater the spread of the rays of light. In the use of this type of glass it is to be borne in mind that care must be used in the placing,



DIFFUSE TRANSMISSION

FIG. 8C.

especially where it is exposed to the direct rays of the sun. Most people have experienced the discomfort of facing a window near the eye level, glazed with glass, on which the sun was shining, having a fairly large amount of spread transmission. The glass appears extremely bright due to some of the sun's rays being deflected into the eyes. This property of deflecting some of the rays is extremely useful in increasing the illumination in the part of a room away from the window, but care should be taken to avoid producing a glaring condition.

The ability to see through glass having a spread transmission characteristic depends upon the amount of irregularity in the surface.

Glass having diffuse transmission, such as opal glass, is not used to any great extent for window glass.

Prism glass is frequently used for bending light rays into a new direction where they will be more useful. In the use of prism glass, the angles of the prism must be accurately designed for the particular location, to obtain the results intended.

Artificial Illumination.

From the standpoint of artificial illumination, it is important that the general laws of reflection and transmission be understood as applied to practical problems to enable their proper solution. These laws have been already covered in a general way.

The problems of artificial illumination for industrial purposes may be roughly divided into two general classes:— the lighting of offices and the lighting of workshops. Each one of these has its own particular problems.

In general, good illumination should conform to the following requirements:—

(a) There should be an adequate amount of light coming from the proper direction for the easy performance of the work involved.

(b) Heavy contrasts should be avoided.

(c) Glare should be reduced to a minimum.

The Illuminating Engineering Society specify in their code, which has been adopted by law in numerous States of the U. S., the desirable intensity of artificial illumination for different classes of work as follows:—

Class of work.	Desirable foot-candle intensity.
Storage, passageways, stairways and the like	0.25 to 0.5
Rough manufacturing and other like operations	1.25 to 2.5
Fine manufacturing and other operations of a like character	3.5 to 6.0
Special cases of fine work	10.0 to 15.0

(The foot candle is the illumination produced by a source of 1 candle power at one foot distances. At 2 feet distance the illumination will be one-quarter foot candle as the inverse square law applies.)

The smaller values in the table are minimum intensities, but it will be found, as a rule, that the higher values will be productive of the best results, for daylight conditions, the code states that the figures in the above table should be increased three times for satisfactory conditions on account of the greater intensity of light required in the daytime, due to the physical condition of the eye.

The eye is so constructed that it adapts itself for different intensities of illumination. Out of self protection it adapts itself to the maximum intensity in the field, and it is quite possible, where there is a bright spot in the field, for the eye to be adjusted for this intensity and yet be attempting to see in a less illuminated area, with consequent reduction in powers of vision. This is a common fault in a great many of our old systems of illumination where unshaded lamps are employed. An exaggerated conception of this condition of lighting is illustrated by the automobile headlight in the field of vision of the opposing driver.

Bright reflections from polished surfaces are also conducive of this condition.

Heavy contrasts are produced when local areas are highly illuminated with reference to their surroundings. This condition obtains in the use of shaded lamps close to the work without other general illumination in the room. The glancing from the work to the surroundings causes a large readjustment of the eye, which if continued in will cause eye fatigue and discomfort.

The use of tungsten lamps, particularly the gas filled type, are productive of heavy contrasts. On account of the considerably higher efficiency of these new types of lamps, they have been universally replacing the older types without, in most cases, the necessary change in the equipment.

Modern incandescent lamp filaments must be kept out of the normal field of vision if glare is to be kept down. This can be managed if they are used in proper reflectors and mounted sufficiently high. The consciousness of a bright light source, disappears if it is mounted sufficiently high to subtend at the eye an angle of not less than 25 to 30 degrees with the normal.

Uniformity of illumination has a great bearing upon the ease with which work can be done. This question of uniformity is one which is of great consequence in the design of a lighting system. The direction of the light rays is also very important. There are certain classes of work in which shadows play a great part in assisting to see properly and bring out the proper form and perspective, while in others the elimination of shadows is an advantage. By shadow is not meant dense shade, but simply a grading of the illumination on different parts which is necessary to bring out form or shape without reducing the ability to see distinctly the parts less highly illuminated. In other words, work that requires the distinguishing of length, width and tickness, requires a certain amount of shadow, whereas that done on a plane surface, such as in office work, shadow is not a necessary adjunct.

Absolute uniformity of illumination is productive of monotony and as a rule, should not be the aim of a designer.

The lighting out of doors on an overcast day creates a feeling of depression and lack of interest in ones surroundings, which can be attributed to a great extent to uniformity in the illumination. On the other hand, our interest in things is stimulated on a bright sunshiny day, due to the added beauty and form of our surroundings caused by the high lights and shadows. It is worth noting however that even on a bright day out of doors contrasts between high light and shadow are never very great and seldom exceed ratios of twenty to one.

Glare is the term commonly used to describe the condition obtained when there is a brightness within the field of view of such excessive character as to cause discomfort, annoyance or interference with vision.

The reduction of glare, in lighting, to a minimum, should be kept in mind in the design of lighting systems. Glare is really a condition of intense contrast and may be caused by improperly shaded lamps in the visual field, viewed against a dark background, or reflections of light sources from polished surfaces.

General Types of Lighting.

There are three general types of lighting in use at the present time, namely: Direct lighting, semi-indirect and totally indirect.

In the first, the direct rays from the lamp reach the work. In semi-indirect, part of the light is diffused through a bowl or other shading and diffusing medium and part directed onto the ceiling and re-directed to the work. In totally indirect the light is all directed to the ceiling and re-directed onto the work. Each one of these types of lighting has its particular field of usefulness. The first directs the greatest proportion of the light produced onto the work and is also the most productive of glare. Shadows are sharper and more apparent with direct lighting than with semi-indirect or totally indirect.

In semi-indirect lighting there are two components of light, one from the source diffused through the bowl and the other from the ceiling. The ratio of these two components has a great bearing on the resultant illumination, the shadows produced and the appearance of the fixture.

As a rule, the bowl of a semi-indirect fixture should not transmit too much light, otherwise it will appear very bright and where installed in large rooms with relatively low ceilings will be a cause of glare, also reflections of it on polished surfaces and glossy papers will be troublesome. Where large light sources are used in a semi-indirect fixture, the size of the bowl should be in proportion to the size and intensity of the light source. One of the most common faults of this type of lighting fixture is the over-brightness of the inverted bowl.

Totally indirect lighting fixtures consist of an opaque reflector distributing the light onto the ceiling from which it is redirected into the room. This type of lighting produces the most uniform illumination and freedom from shadows.

As stated before, interior finishes and kalsomine paints are diffusely reflecting media and the maximum intensity of the reflected light is normal to the surface. The advantage of this is at once seen when light falls on the ceiling. In the case of walls, however, it is somewhat of a disadvantage as a considerable proportion of the light is reflected in directions which are not useful.

In order of efficiency of utilization of the light produced, direct lighting comes first, then semi-indirect and last, totally indirect. In considering efficiency of a lighting system, however, the fact should not be overlooked that it is the overall efficiency of the carrying out of an operation that must be considered and that the lighting is simply one item of cost of production which is always a small proportion of the total cost.

Much interesting research work has been done in the last year or two on the effect of illumination on output. At the present time extensive experiments are being carried out by the Illuminating Engineering Department of the Commonwealth Edison Co., of Chicago, along these lines. Transactions Illuminating Engineering Society paper by Wm. A. Durgin, "Productive Intensities" November 1918.

The data they have obtained is most valuable as they have conclusively shown that the production of departments of large manufacturing plants has been increased by at least 15% and in some cases by as much as 100%, by improved illumination. When the cost of bringing about the increase in production is considered it appears as negligible compared with the result.

Analyzing the reasons for increased production under better illumination it is found that more work is turned out by operatives due to reduction of spoilage, improved accuracy, better supervision, reduced eye-strain and brighter and more cheerful surroundings.

Illumination has also a very great influence on accidents and there is cause for assuming that probably 20 per cent of industrial accidents are attributable to lighting. The remedy for this is easy to apply and with the cry of "safety first" being continually heard, there is no reason why lighting should not be included amongst the mechanical safeguards against accident. The proper lighting of a danger point is an effectual way of pointing it out.

ALFRED D. FLINN,
Secretary, United Engineering Council, New York.

In spite of the large amount of advice and data that is appearing every day in technical journals, it is surprising to find that literally thousands of plants are paying very little attention to this advice, when it may mean thousands of dollars in their output with comparatively small expenditure involved for the necessary improvement.

The importance of illumination and its effect on general welfare may be further realized when it is known that many of the United States have adopted codes of illumination for industrial establishments giving extensive powers to inspection boards over systems of illumination and allows them to compel the installation of adequate systems. In our own country, with its short winter days, a large proportion of work is carried out under artificial illumination and consequently the possibility for increasing our efficiency is great.

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOL. II. MARCH 1919 No. 3

Thirty-Third Annual Gathering

Dr. Martin Murphy, venerable past President of *The Institute* gave a general interpretation of the views of all who attended the Thirty-Third Annual Meeting of the engineers of Canada, when with an expression of keen enjoyment, and in that delightful Irish accent of his, he exclaimed; "My! What a grand time we are having!" It was even so; speaking volumes for the social arrangements and for the interesting manner in which the many superior papers and thoughtful discussions were presented.

The universal verdict is that the meeting was the most successful yet held. The happy inspiration to hold a combined Annual General Meeting and a General Professional Meeting was an important determining factor. The presence of several distinguished members of the profession from the United States, all of whom contributed by giving addresses added both to the interest and to the enjoyment as did those of the notable Canadians in public life who contributed to the programme.

Nearly every centre from Sydney, N.S. to Vancouver, B.C. was well represented, the outside attendance being particularly gratifying showing what a keen interest the members took in the meeting.

Apart from these, and not to be overlooked as an important influence was the fine spirit of loyalty and enthusiasm everywhere in evidence, which shows in no uncertain manner that the engineers of Canada are taking an interest in their profession as never before, and that we have an organization, the fabric of which is being woven closer and closer, and which is growing stronger day by day.

For weeks before the meeting, the special committee of the Ottawa Branch commenced working for its success and in a very large measure the credit for the various features that will make the Ottawa meeting one long to be remembered is due to the members of the Ottawa Branch who gave up so much of their time, and so many of their nights to arranging and concluding the details. The thanks of *The Institute* is also due to the men who, although not members, presented meritorious and highly acceptable papers.

The business of the Annual Meeting revealed that *The Institute* is in an active state of development under the new name and the new by-laws. The reports of the Branches show a highly satisfactory condition both as to finances and Branch activities. The meeting endorsed a suggestion regarding changes in the by-laws which have already been submitted to the members and for which a ballot will be issued shortly. The adoption of the beaver as the emblem of *The Institute* was also confirmed, the members badge to be of gold, and silver for associate members, to be produced on a par with the best coinage die-work.

Under new business the most notable feature was a discussion on legislation and the resolution of the meeting in this connection is as follows:—

Whereas it seems that the wishes of the majority of the members and of the Branches of *The Engineering Institute of Canada* are that Provincial Legislation should be obtained to define the status of the engineers throughout Canada.

Whereas the members of this annual meeting are of the opinion that this legislation should be as uniform as possible throughout the provinces.

Be it resolved, that a special Committee be formed, composed of one delegate appointed by each branch to meet at headquarters before the 15th of April, 1919 to draw up such sample legislation as it may deem necessary and advisable in order that the members of *The Institute* throughout the different provinces may ask for legislation on the same uniform basis.

That the Secretary be instructed to call the first meeting of this committee.

That this Committee be authorized to obtain the necessary legal advice on the matter.

That this Committee shall submit the proposed legislation to the Council before the first of May 1919.

That the Council shall then ask by letter ballot, before the first of June 1919, the opinion of all the members of *The Institute* regarding the adoption of the proposed legislation prepared by the said special Committee of *The Institute.*

That the Council be authorized to pay all the expenses of this Committee and of each delegate.

That the Council of *The Institute* shall report the result of the ballot to the branches, and if the vote is favorable to legislation the Council of *The Institute* shall immediately take the necessary measures, in co-operation with the Branches, to have such legislation enacted.

The preliminary details of this resolution have already been carried out by the Council and a meeting of the special Committee called for April 5th.

The attitude of *The Institute* regarding Engineering Standards was shown by the resolution which read:

> Resolved that this meeting endorse the application of the Canadian Engineering Standards Association to the Dominion Government for a grant to partially defray its expenses during the ensuing year, and believe that this Association will be of great service in the industrial development of the Dominion."

The text of this resolution has since been sent to the interested members of the Government.

In the report of the meeting published elsewhere it was found necessary to omit some of the papers which will be published in full in the next issue of *The Journal.*

From the viewpoint of attendance, or based on a standard of technical, professional or social achievement this meeting was an unqualified success, and many who have felt in the past that the meetings of engineers were more or less dry affairs, are now looking forward to the next opportunity of foregathering with their brother engineers and enjoying the benefits of fellowship which such an occasion presents.

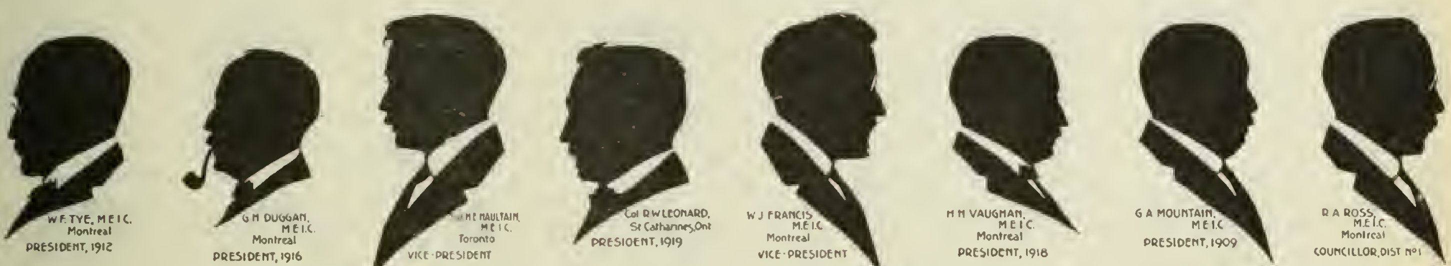
seas, which policy has already been adopted by the Department of Soldiers' Civil Reestablishment, where the work is being very largely done in the various provinces under the direction of and by engineers. The hydro-electric development throughout Canada will absorb some; municipal undertakings in which it is already seen there is some activity, will require others and the industries of Canada, if they can be kept operating at capacity, and it is hoped that before many months they will all be doing so, will require many more.

However, nothing in this connection should be left to chance, but everything that the combined effort of the entire profession can achieve should be done and the machinery without delay set in motion whereby the desired end can be accomplished.

Members are requested to advise the Secretary of all positions available.

Already the President and Council have offered to the Government the services of *The Institute* in any way that may be deemed the most acceptable, and it is expected that definite plans will be worked out in the near future.

As an illustration of how our men at the front view the situation and to what extend they are looking to us



Our Duty and Opportunity

Members of *The Institute* are fast returning from the war zone and while many have their former positions awaiting them, a very large number will need assistance in being placed in suitable positions in civil life. We have been thrilled with what our men have done in the war and we have boasted of their achievements and now that they are returning to be with us once more we cannot be true to our ideals, true to the profession, true to the men who have been away or true to ourselves if we overlook any possible measure by which our gallant brother members may receive every co-operative effort, possible for us to put forth, in aiding them to be suitably placed.

At Headquarters *The Journal* and the facilities of *The Institute* in getting in touch with positions are at their service. Every Branch is being asked by the Council, to take up the responsibility of aiding the men who return to their various branch localities. But this is not enough. Every member of *The Institute,* whether he is in a position to employ engineers or otherwise, should feel a personal responsibility in this connection. We cannot expect the Government to say to us that they have openings for all our returned men. It is expected, however, that the federal government in connection with the resumption of certain public works and in connection with the road problem to be carried on in conjunction with the provincial governments, will require many engineers and there is no doubt that preference will be given to the men who have been over-

to help, is illustrated in a letter received by the President from Col. Macphail, D.S.O., M.E.I.C., which explains itselfs, and which further illustrates the situation.

To the President,
THE ENGINEERING INSTITUTE OF CANADA,
Montreal, Canada.

Belgium, February 2nd, 1919.

Dear Sir:—

The Canadian Government has formed a " Department of Soldiers' Civil Re-establishment " for the purpose of assisting the return to civil occupation, of officers and other ranks of the Canadian forces now overseas. The method consists in filling out a form, giving in detail full particulars of one's occupation in civil life prior to enlistment. This method does not allow the selection best fitted to a professional man. A copy of the form is enclosed.

After four years of active service, without endeavouring to keep in touch with local conditions in Canada, an engineer is not in a financial position to compete with, or capable of competing with those members of the profession who maintained their practice throughout the war. To make this point clear, I will quote a case which has come under my notice, and is representative of scores of others:—

> " In September 1914, my professional practice as a consulting engineer and architect in the city of Saskatoon, Saskatchewan, was worth from 5,000 to 8,000 dollars a year income. I enlisted, expecting the war to last from six months to one year. Now at the end of four years active service, and on receiving information from Canada that conditions in Western Canada will not improve for at least a year, I must, therefore, apply for a position in a new locality."

The Government method of filling out a form and submitting it through the usual channels of communication to the Department of Soldiers' Civil Re-establishment in Canada, will not furnish the required information as to the locality in which an engineer might again continue his profession with prospects and opportunities for advancement. Many members of the profession now serving in France find themselves in this position; they lack the necessary information and the co-operation of engineer and architect associations in Canada, to place them in the best localities and positions to attain their former standard in their profession. A professional man does not like to apply for a position by the " card system " and feels that only by dealing with recognized engineer societies, will he obtain the best results.

If you will place this information before the Council of *The Engineering Institute of Canada,* I feel sure that our organization and connections throughout Canada, combined with organized information bureaus which could be established in the leading centres to furnish information as to prospects in Canada, with reference to employment for returned professional men, would greatly assist in the re-establishment of civil employment. I assure you that we are totally in the dark here in France, and have no information about conditions in Canada.

I am writing you this letter because I have these questions asked me every day, particularly as I am the commanding officer of the Engineer Brigade of the 1st Canadian Division, consisting of 120 officers and 2,500 other ranks; many of the other ranks are graduate, or student engineers.

I am sure that the members of the Council could persuade the Dominion Government to allow *The Engineering Instute of Canada* to handle the re-establishment of all engineers serving with the Canadian forces, and it would be appreciated by all members of the profession serving in France .

It has now become a civil question, and should be handled by a civil organization, and I think the Council should ask the Dominion Government to return immediately to Canada a delegation of officers composed of professional men intending to return to civil occupation, who would bring with them tabulated figures and reports on all members of the profession serving with the Canadian Corps. Sufficient publicity should be given to the organization, in order that all ranks would be fully informed of local conditions in Canada. This delegation would travel across Canada and place the conditions before the local Branches in each Province. You cannot realize the state of mind that men will get into when they are sitting down here in France, waiting for orders to return to Canada to be demobilized, without any information or prospects for the future, and it is only when men employed in the engineering profession have been told that they are being looked after by members of their own profession, that they are satisfied.

All points brought out in the foregoing apply equally to all members of the engineering profession, including mechanical, railway, and structural engineers, contractors, skilled tradesmen, draughtsmen, clerical members of the profession, and, particularly, to the engineer who has completed only two years of his technical school course, prior to his enlistment. They all realize that they must make a new start and continue to take " refresher " courses in order to get back to the standard they attained before enlistment.

Men who have completed, say two years of an engineering course are now majors who have under their command 6 engineer officers and 225 skilled tradesmen. Such men will find it difficult to return to a technical school to mingle with immature boys, and at the same time to be set back a number of years in their profession.

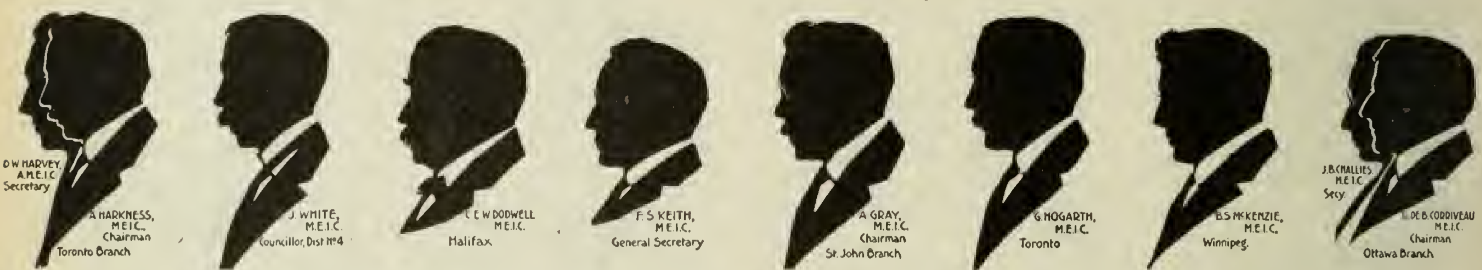
The educational question will involve considerable organization after demobilization, whlch could be instituted throughout Canada by The Engineering Institute arranging with its members to hold night courses, in order that those who return will be able to benefit by the experience gained by these members during our absence in France.

Enclosed are several newspaper clippings showing that Canada is making all preparations for the replacement of labour personnel, but is doing nothing for professional men.

I await your reply in order that I may relieve the minds of many of those who serve in my command, as to their prospects on their return to Canada.

A. Macphail,
Colonel,
Commanding 1st Brigade, C.E.

Headquarters,
1st Brigade, C.E.



A Compliment to The Institute

The eminent engineers from the United States who attended the Annual General and Ottawa Professional Meeting, representing officially the great bodies on the other side, did much to promote the feeling of good will and fellowship between the engineers of the United States and Canada. It was a compliment to *The Institute* to have such men as Alfred D. Flinn, Secretary of the United Engineering Council, Dr. Ira N. Hollis, Past President of the American Society of Mechanical Engineers, and Dr. Comfort A. Adams, President of the American Institute of Electrical Engineers present, and to have them convey the good wishes of their respective organizations to our members.

It is gratifying in the extreme to have these gentlemen all endorse the step which this *Institute* has taken in Canada, to embrace the engineering profession in one organization. The presence officially of members of the profession from across the border and all men prominent in their respective organizations, in Canada, shows that the spirit of unity is growing stronger and stronger.

It is also an evidence that the human element is becoming a greater factor in the affairs of engineers, and it is hoped that this principle will be adopted more and more.

Appreciation from Minister of Militia

Members will be interested in a letter received by Lieut.-Col. Monsarrat from General Mewburn, Minister of Militia, in response to a communication from Col. Monsarrat in which he supplied the Minister with requested information regarding the part taken by our members in the war and in which he also intimated that the Council of *The Institute* was ready to assist the Department of Militia, in any way in connection with the returned soldier problem,

February 21st, 1919.

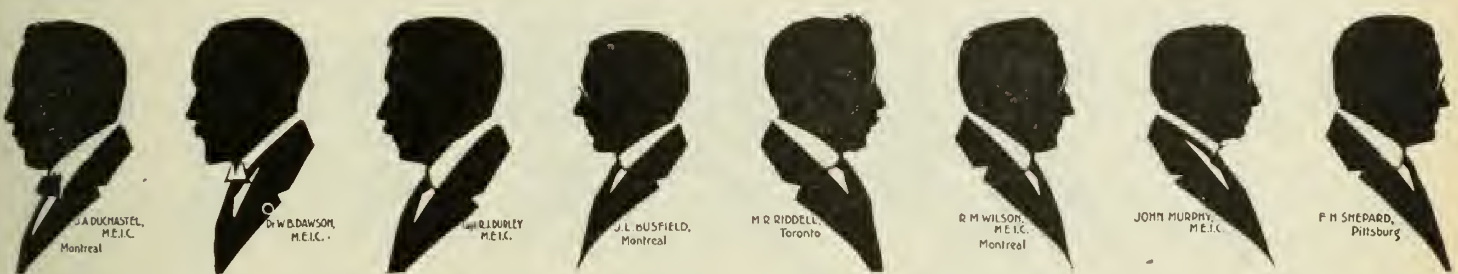
Dear Col. Monsarrat:—

Thank you very much for your letter of the 19th instant, enclosing information regarding the wonderful part taken by the members of *The Engineering Institute of Canada*, in the War.

It is an enviable record, and I am very glad to have the assurance that the Council of *The Institute* will co-operate in the big question of reconstruction.

Yours faithfully,

S. C. Mewburn.



Good Roads and Engineering

Hon. Frank Carvell, Minister of Public Works, made a statement before the members of *The Institute*, their guests and friends at one of the luncheons held during the Ottawa gathering, which although well known to the engineering profession, coming from such a source and at such a time, should be firmly impressed upon the minds of every member of the provincial and federal legislatures in Canada, every alderman and civic official, and should be scattered broadcast so that every citizen of Canada should be well aware of the fact. He stated that *more money had been squandered in Canada during the last forty-five of fifty years in the attempt to build roads, than perhaps in all other public works put together*, the reason being that roads were being built continually by those who knew nothing whatsoever about them. He was confident that *the engineer must be the first as well as the last man on the job*, and only by so doing could any successful road building be accomplished.

There is a satisfaction in knowing that to-day the road building of the various provincial governments is in the hands of qualified engineers who are members of this *Institute*, both as deputy ministers and chief engineers of highways. The good roads movement is one which is impressing upon the minds of the public not only the necessity for good roads but the fact that they should be properly designed, built under proper supervision and maintained by men who have a technical knowledge as to what constitutes a good road. With all that has been written on this subject and all the advice given to rural municipalities from every source, we still find in many rural communities the old mud scraping methods in vogue. This should no longer be tolerated in this new era we are now entering, which, above all is to be one of *economy* and *efficiency*, where these factors are given consideration, the place of the engineer becomes well established.

Students Prizes

For the past seventeen years there has been available, each year, a prize in each of the engineering sections including electrical, mechanical, mining and general, for the best student paper submitted during the prize year, which runs from June to June, in any or all of the four sections named. That is, there are four prizes available every year of twenty-five dollars each, to be won by students for the best paper submitted in the section in which it is desired to compete. Probably due to the fact that this has not been kept prominently in the minds of our student members, there have been a number of years in which no awards were made. During the past three years one award only was given each year. This was not due to poor quality of papers so much as the lack of students papers.

Every student of *The Institute* should be ambitious enough to present a paper in competition for one of these prizes. Such papers may very often be read before the nearest branch and nothing is better calculated to bring the young engineer into prominence and help to establish his position than by the reading of papers before *The Institute.*

Ontario Provincial Division

On Thursday morning, February the 13th, the officers of the Ontario Provincial Division were elected at a meeting of the Executive held at the Chateau Laurier, at the call of Professor Peter Gillespie, M.E.I.C., Chairman pro tem. Both western and eastern Ontario were represented as well as the Branches. After an expression of opinion from each of those present nominations were received resulting in the election of the following officers, the personnel of which ensures that the affairs of the Ontario Provincial Division will be well managed:

Chairman, J. B. Challies, M.E.I.C., Superintendent, Water Powers Branch, Department of the Interior, Ottawa.

Secretary-Treasurer, Geo. Hogarth, M.E.I.C., Chief Engineer, Department of Public Highways, Toronto.

Members of Council for 1919

President.

Lieut.-Col. R. W. Leonard, (M), 50 Ontario Street, St. Catharines, Ont.

Vice-Presidents.

Water J. Francis, (M), 260 St. James Street, Montreal.
Prof. H. E. T. Haultain, (M), Mining Bldg., University of Toronto, Toronto, Ont.

R. F. Hayward, (M), c/o Western Canada Power Co., Ltd., Vancouver, B.C.

D. O. Lewis, (M), P.O. Box 1586, Victoria, B.C.

Past Presidents.

G. H. Duggan, (M), President, Dominion Bridge Co., Montreal.

Col. J. S. Dennis, (M), C.M.G., Chief Commissioner, Colonization & Development Dept., C.P.Ry., Montreal.

H. H. Vaughan, (M), Vice-President and Gen. Mgr., Dominion Bridge Company, Montreal.

M. H. Macleod, (M), Canadian National Railways, Toronto, Ont.

E. G. Matheson, (M), 2909 Alder Street, Vancouver, B.C.

G. A. McCarthy, (M), Dept. of Works, City Hall, Toronto, Ont.

D. H. McDougall, (M), President, Nova Scotia Steel & Coal Co., New Glasgow, N.S.

W. A. McLean, (M), Parliament Buildings, Toronto, Ont.

John Murphy, Electrical Engr., Dept. of Railways and Canals, Ottawa.

Wm. Pearce, (M), Dept. of Natural Resources, C.P. Ry., Calgary, Alta.

F. H. Peters, (M), 513-8th Ave. West, Calgary, Alta.

J. M. Robertson, (M), 101 Board of Trade Bldg., Montreal.

R. A. Ross, (M), 80 St. Francis Xavier St., Montreal.

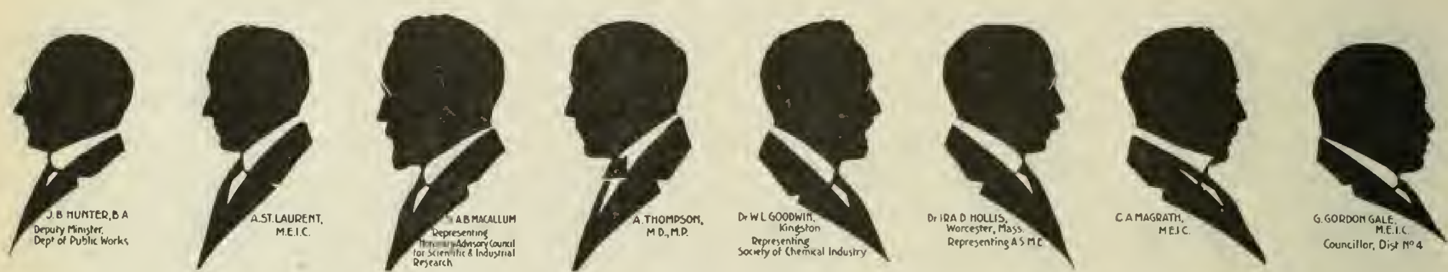
Julian C. Smith, (M), 607 Power Building, Montreal.

J. C. Sullivan, (M), 703 McIntyre Block, Winnipeg, Man.

Arthur Surveyer, (M), 274 Beaver Hall Hill, Montreal.

L. A. Thornton, (M), City Commissioner, Regina, Sask.

James White, (M), Commission of Conservation, Ottawa, Ont.



Councillors.

Brig. Gen., Sir Alex. Bertram, (M), 511 St. Catherine St. West, Montreal.

W. P. Brereton, (M), City Engineer, Winnipeg, Man.

N. E. Brooks, (M), 2 Queen Street, Sherbrooke, Que.

Prof. Ernest Brown, (M), McGill University, Montreal.

A. R. Decary, (M), Supt. Engr., Prov. of Quebec, Public Works of Canada, Quebec.

L. B. Elliot, (M), Box. 957, Edmonton, Alta.

G. Gordon Gale, (M), Hull Electric Co., 117 Main St., Hull, P.Q.

J. E. Gibault, (A.M.), Resident Engineer, Canadian National Railways, Champlain Market Station, Quebec, Que.

Prof. Peter Gillespie, (M), University of Toronto, Toronto, Ont.

Alex. Gray, (M), P.O. Box 1393, St. John, N.B.

Prof. A. R. Greig, (A.M.), University of Saskatchewan, Saskatoon, Sask.

J. H. Kennedy, (M), 1215-11th Ave. West, Vancouver, B.C.

H. Longley, (M), 18 Green Street, Halifax, N.S.

G. D. Mackie, (M), City Commissioner, Moose Jaw, Sask.

R. W. Macintyre, (M), 1049 Pendergast St., Victoria, B.C.

The Reclamation Service

Department of the Interior.

Regulations recently promulgated by the Dominion Government, on the recommendation of the Minister of the Interior, for the drainage of vacant Dominion land in the provinces of Alberta and Saskatchewan, should go far towards effecting the reclamation of large areas of now vacant and comparatively valueless swamp land or land covered by shallow lakes.

The ownership and control of all sources of surface water supply in these provinces, including lakes, marshes, etc., is vested in the Dominion Government, which also owns the unalienated public land, while control of the drainage of land is vested in the provincial governments.

This divided jurisdiction has provoked controversy and has seriously interfered with the reclamation of submerged or swamp land and with the construction of roads and generally has materially retarded the settlement and development of districts which comprise considerable areas of such land.

Agreement has at last been reached between the Dominion and the provinces. The Governments of the provinces of Alberta and Saskatchewan have enacted legislation providing a simple and satisfactory method of sharing the responsibility, cost and benefits of such reclamation as may be found feasible, and the Dominion Government, by an Order-in-Council passed some time ago, approved of this legislation and undertook to supplement it by regulations. The regulations now promulgated prescribe in considerable detail the methods agreed upon for carrying on the work.

Recognizing the importance of reclamation, whether of arid or swampy lands, and the desirability of concentrating all such work under the control of some one organization, a branch of the Department of the Interior has been created, to be known as "The Reclamation Service," for the purpose of supervising and controlling all irrigation and drainage work. E. F. Drake, the executive head of the new branch has been appointed "Director of the Reclamation Service" and will, in future, control all reclamation work of this character.

The new regulations provide for four distinct classes of drainage reclamation as summarized in the following statement:—

Synopsis of Regulations for the Reclamation of Dominion Land by Drainage.

(a) *Small Drainage Projects.*

Where the area to be reclaimed does not exceed 1280 acres and the estimated cost of the works is not more than $2,000, the new regulations provide a simple and satisfactory method of procedure. Adequate provision must be made for the disposal of the water, for the protection of roads and other public works, and for the maintenance of the drains after construction. The work will be carried out under the supervision of the Reclamation Service and the reclaimed land will be disposed of to the applicants on terms to be fixed by the Minister of the Interior. The entire cost of the works will be borne by the applicants.

(b) *Drainage in Connection with Road Construction.*

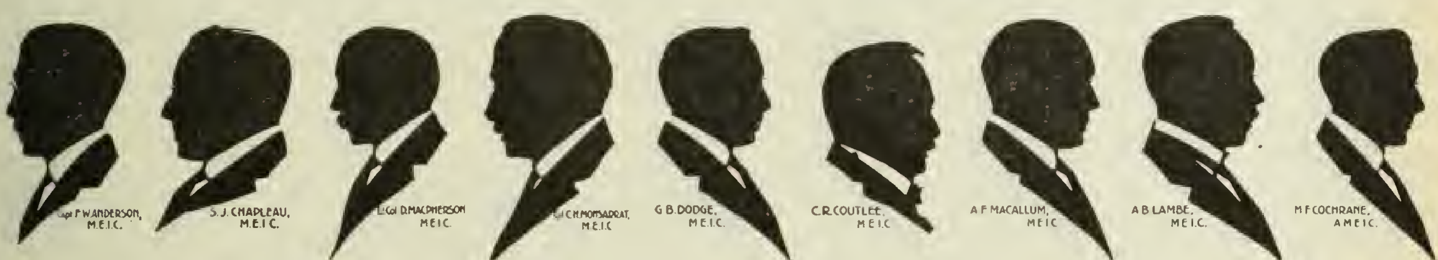
When, in connection with any proposed road work, the Provincial Governments find it desirable to drain swamps of shallow lakes, the Dominion Government will sell to the province, at a nominal price, an area of such swamp land which shall, after reclamation, be sold at public auction. The proceeds of the sale shall be applied towards the cost of the drainage and road work, any surplus being refunded to the Dominion Government. All work of this kind will be carried out by, or under the direction of, the Provincial Government.

(c) *Drainage of Dominion Land in Organized Drainage Districts.*

It has heretofore been impossible to assess any portion of the cost of drainage works upon land owned by the Dominion Government and this has, in many cases, made the cost of drainage prohibitive in districts comprising any considerable area of such land. Under the present arrangement the Dominion Government will sell all such land to the province, at a purely nominal price, subject to the condition that the land shall, after reclamation, be offered for sale at public auction and the proceeds be applied towards the cost of the drainage works. Any surplus remaining after the full cost of the drainage works has been repaid shall be applied towards road and bridge work within the district. All such work will be under the Provincial Drainage Acts.

(d) *Drainage Work Initiated by the Dominion Government.*

Whenever the Dominion Government, as owner of the bulk of the land requiring drainage in any district, desires to reclaim such land it may initiate proceedings under the provincial laws for the organization of a drainage district. All the machinery of the provincial drainage laws is placed at the disposal of the Dominion Government, the surveys and assessments of cost and benefit will be made by an engineer of the Reclamation Service, and, upon the organization of the district, the construction of the works will be carried out by the Reclamation Service. The available Dominion land will, after reclamation, be sold at public auction on terms and conditions to be prescribed by the Minister of the Interior and the proceeds of the sale will be applied towards the cost of the works.



Practical Recognition for the Engineer.

In accordance with the recommendations made by the International Joint Commission for the proper conservation and control of the waters of the Lake of the Woods District, the Dominion Government has, by Order-in-Council, created a Board of Control which will act jointly for the Dominion and Ontario Governments. This Board will be known as the Lake of the Woods Control Board, and consist of four *engineer* members, two appointed by the Dominion, and two by the Province.

The following extract from the Order creating the Board, approved by His Excellency the Governor General on the 13th of January, evidences appreciation by the Government of the necessity for employing engineers for engineering work who should be qualified to be members of *The Engineering Institute of Canada:*—

"The efficient and proper conservation and control of the waters of the Lake of the Woods in the interest of navigation, of water power and of other interests, can best be realized by the creation of a Board of Control representing and acting for the Governments of the Dominion of Canada and the Province of Ontario. This control requires special technical knowledge and careful study, as the unskilful and ignorant manipulation of the same might cause great damage to important interests on both sides of the Interational Boundary. It is, therefore, recommended that a Board, to be known as the Lake of the Woods Control Board, be constituted, to consist of four *qualified civil engineers,* two to represent the Dominion of Canada, and two to represent the Province of Ontario."

The representatives of the Dominion Government on the Board will be W. J. Stewart, M.E.I.C., and J. B. Challies, M.E.I.C. The Provincial Government has appointed H. G. Acres, M.E.I.C., Chief Hydraulic Engineer of the Ontario Hyro-Electric Power Commission, and L. V. Rorke, Engineer of the Department of Lands, Forests & Mines, Toronto.

Power Census

A census and directory of the central electric power stations in Canada, i.e., stations engaged in the sale of electrical energy, just completed, discloses several outstanding features of interest to the engineering profession, particularly those connected with the electrical or hydro-electrical field.

The capital invested in central power stations totals $356,004,168, of which 79.5% is invested in commercial stations and 20.5% in municipal or publicly owned stations. The primary power installation in central electrical stations totals 1,844,571 h.p., of which 1,652,661 h.p. is derived from water, 180,800 from steam and 11,710 from gas or oil. The statistics indicate the outstanding position which water power takes in the central station field, practically 90% of the total primary power being derived from water. This figure is indicative of the extent and availability of the water power resources of the Dominion, and of the remarkable degree to which their adaptability for central electric station work has already been appreciated in principle and realized in practice. The capital cost of central electrical station systems in Canada per primary horse power installed is $193.. This cost includes all actual capital invested in construction and equipment of hydraulic works, power stations, transmission and distribution systems; real estate; cash on hand; current assets; supplies and all other items.

Of special interest is the actual cost of construction of hydro-electric power stations per installed horse power. Omitting all real estate, transmission and distribution equipment, seventy representative hydro-electric stations throughout the Dominion, with an aggregate turbine installation of 745,797 h.p. and a total construction cost of $50,740,458 show an average cost of $69.11 per installed turbine horse power.

The report is to be published in two sections, the statistical section being distributed by the Dominion Bureau of Statistics, while the second section or the Directory is being distributed by the Dominion Water Power Branch. The Directory forms a comprehensive ready reference to the central electric stations of the Dominion, containing in concise form very complete information respecting the stations, including location, officials, history of plant, capital, installation, transmission lines, use of power, accessibility to transportation systems, blocks of power available for sale and further development contemplated.

A further census of the total developed water power in Canada including central electric stations just complete, discloses the fact that a total of 2,305,310 h.p. is at present installed in hydro plants throughout the Dominion. This figure indicates that Canada's utilization of hydro power is even more marked than has been realized. Of the total power installed, some 450,000 h.p. are utilized in the pulp and paper industry.

Silhouettes Ottawa Meeting

To the energy and enterprise of the Ottawa Branch is due an acknowledgement from the Institute for the silhouettes of members in attendance at the Ottawa Meeting and reproduced in this issue. Lack of opportunity prevented securing many others desired.

DISCUSSION

Economy in Ocean Transportation

In Mr. Robinson's paper under the above title as printed in the February number of *The Journal,* the fourth paragraph was inadvertently omitted. This paragraph is important as giving statistics of shipping losses and is as follows:—

The figures recently given out show that the world's total losses of merchant tonnage from the beginning of the war to October, 1918, by enemy action and marine risk, were 15,053,786 gross tons. Of this total the British Merchant losses were 9,031,828 gross tons.

During the same period vessels totalling 10,849,527 tons were constructed and enemy tonnage totalling 2,392,675 was captured, making a net loss of tonnage during the war of 1,811,584 tons.

These figures go to show that the total losses, enormous as they are, have been already largely made up, and that with the great building programme now going on by all nations, the deficiency will probably be made up early in 1919 to the figure at which it stood before the war.

After reading the paper, Mr. Robinson read the following extracts as a discussion of the subject:—

Sir Albert Stanley, President of the British Board of Trade in a speech on Jan. 24th said. There was more shipping available than cargoes, and it was expected that next summer the world tonnage afloat would be equal to the pre-war tonnage". This statement, Mr. Robinson said, appeared since the paper was written and confirmed his own conclusions.

The Engineering News-Record in an editorial urging caution in revising the shipbuilding program, and which appeared since the paper was written said:

"Changes in ship demand came upon the world suddenly with the end of active warfare. A month ago the call was for ships, ships of any kind so long as they were ships—wood, steel or concrete; small or large; economical or wasteful in coal and crew expense — no matter, provided they would float and carry cargo across the seas. Today the demand is for ships that can meet commercial needs and compete on even terms with the rest of the world's fleet".

It is inevitable that shipbuilding should be adjusted to the new demands. The nation's enterprise in building a merchant marine sufficient for all its transportation needs will fail if its ships are not efficient as carriers on the ocean trade route. We must build the best and most serviceable vessels which the naval architect's skill can produce.

No one man, and no small group of men, possesses the foresight needed for safely making far-reaching decisions on future shipping. There are many signs to indicate that, just as life-long shipbuilders have in recent times acquired new views of their art and its possibilities, so the men who carry on the worlds shipping are remodeling their traditions and are arriving at a new knowledge of ships.

It is not the cost of operating a ship that makes freight rates; it is the cost of its idleness. So to reduce the time in port requires much more than mere mechanical fitting of wharf and ship. It means a fresh view of the whole transportation problem, a revised design and operation — from the sources of material up to the hold layout of the ship itself — and an education of the men to the advantages they will gain from the rapid turn-around. That engineers in hitherto unthought of numbers are working on this complex problem indicates a new attitude of mind, which can but result in a successful solution, provided legislators and lay executives have the courage to break the new paths that will be laid out for them."

Sir John Aspinall, in his recent address as President of the Institution of Civil Engineers said:

"Strong comments have been made by some of the recent Government committees upon the want of mechanical appliances at our sea-ports for the loading and unloading of ships, and it cannot be denied that there is a large field for the mechanical engineer in providing up-to-date appliances of a varying kind to suit the trade of each port. Some of the largest ports are said to be the most deficient in handling appliances.

It must however be remembered that the problem of unloading or loading ships is by no means the easy matter which some people suppose, and the very difficulties — not of a mechanical nature —make it the more necessary to have quick and cheap handling of the goods so that every farthing per ton can be saved in manipulation, and quay space, which is always costly, can be rapidly cleared.

All these little points add to the necessity of eliminating hand labor, and doing by quick acting machinery that which is necessary to hurry the vessel away to sea, and thus increase the number of voyages per annum."

CORRESPONDENCE

Technical Co-operation

Editor, *Journal:*—

Permit me to lay before the readers of *The Journal* some ideas suggested by listening to the papers, debates, and addresses of the recent annual meeting in Ottawa. The papers on *Standardization* and *Aeroplanes* brought out very clearly the immense advantage of co-operation in manufactures, as well as in the basis of progress in industries, viz.: research. Individualism is forever discredited as an exclusive method of doing things,—which is not to be interpreted as the destruction of individual initiative,—far from it. It is not only possible to combine the two ideas,—individual effort and co-operation,—but necessary in the interests of efficiency and progress. This applies not only to industries, but also to the organization of those who shape, direct, and advance industries,—the great fraternity of engineers. In all branches of engineering Canada is now at a stage when we may hope to see technically trained men coming into their own. The spirit of appreciation and recognition is abroad, and it only needs wise direction in order to put the engineering profession in the position it should occupy. To this end the obvious thing to do is to secure hearty co-operation of all branches of engineering, civil, mechanical, electrical, mining, chemical, &c. How this is to be done is not altogether an easy problem. There are existing interests to be considered, in the form of societies which have their own ways of doing things, and the constitutions of which may have radical differences. But if these difficulties are faced in a wise, tolerant spirit, they will disappear. I am confident that it is possible to combine all the existing societies into one, for certain purposes,—particularly for two, (1) obtaining protective legislation, and (2) meetings for popular educative work. It was pointed out by one of the speakers that at the meetings of many of the existing technical societies in Canada and the United States, the papers and addresses are taking on more and more of the popular and less of the strictly technical character. They are thus of interest to all. This tendency was well shown in the last Annual Meeting of *The Engineering Institute.* I would suggest the union of all existing technical societies in Canada for these two purposes noted above. To such a union could be safely given the power of regulating the practice of the engineering professions. Its annual meetings would be large gatherings for discussion of the broader aspects of the applications of science to human activities and for the education of the general public. The original societies, viz.: *The Engineering Institute of Canada,* the Canadian Mining Institute, and the Society of Chemical Industry, could continue to meet for the reading of papers and discussion of subjects of a more restricted interest. This, it seems to me, would give us the advantages of both individualism and co-operation. It would at the same time create a strong body of men with interests in common, and ready to act as a unit.

W. L. Goodwin,

Queen's University.

Status of Engineers

Editor, *Journal*:—

I thank you for your courteous reply to my last letter and trust that our Government may eventually deem it advisable to recognize the value of the engineering mind in a manner similar to that which other countries have been and are doing.

I think that during the last four years it has been brought home to us that the status of Canadian engineers is not at all what it should be; if this is due to any defect or inherent weakness, let us start to correct it at once.

Your excellent article on this subject affords food for much thought and in an endeavor to analyze this question it appears to me that we have overlooked or rather failed to take advantage of two powerful forces—the force of "close co-operation" and the force of "educational advertisement." It may be that because these are not static forces the engineering mind refuses to acknowledge that which cannot be accurately measured. Be this as it may, the fact remains that these forces have proven to be of the greatest service to mankind if intelligently applied.

No doubt the conditions under which we engineers serve our apprenticeship have a lot to do with this question—camp life in isolated places is not conducive to that interchange of courtesies and ideas which are necessary in order to truly appreciate the finer qualities and greatness of our fellow members. We are inclined to experience a feeling of wishing to try each other out before extending that trust and welcome which should be a natural sequence of belonging to the same society and, I regret to say it, we are sometimes inclined to criticize each other's works to outsiders without knowing all the details; the immediate work which we may be engaged upon becomes an obsession to the exclusion of everything else,—even the remuneration becomes a secondary consideration; also we are apt to view outsiders and their ideas with a kind of tolerant disapproval, sort of "poor fellows they can't understand" attitude. Of course, very fine and high ideals are bred uuder just such conditions. The work must remain the principal object, therefore it devolves upon us as a body, rather than individually, to obtain easier working conditions so that it will be practicable for every member to attend the annual meetings. Until such time, and as a step towards this condition, would it not be good policy for *The Institute* to take energetic steps to stimulate all members to write more frequently, not only on matters pertaining strictly to engineering, but giving their views on general questions: Government, economics, labor, art, etc. The question of an absolute close corporation of our profession, akin to that of the legal and medical professions, might well be re-discussed.

The second great force, that of educational advertisement, is one which might be given more attention by *The Institute*. The public, as a general rule, seem to have a very vague impression of what even the word "engineer" really means, and of what his work consists. Many of them are inclined to confuse him with an engine-driver or surveyor.

There is an enormous amount of secondary engineering work being undertaken, especially in the Western Provinces, by small private companies or individuals and entrusted to the care of a foreman or ferry-builder; good men perhaps, but not understanding the first principles of economical design, lay-out and operation or the relations they bear to one another. It may sound extravagant, but my observation leads me to believe that nearly as much money is expended in this way as under skilled supervision. Think that it would mean not only to the profession but to national economy if these people would learn to look naturally to technical assistance for even their smallest problems. The fee is a very cold hard fact, whereas the economic loss goes unperceived. There is the rub—we cannot compel these people to utilize our services, but by a judicious educational campaign we may induce them to.

Today educational advertising might almost be called a distinct profession, and just as we engineers expect to be employed on constructional work, so, I think, we might do worse than engage one of this profession to take up our case and advise us, as a body, as to the best methods to pursue in such a campaign. As a suggestion, however, I believe the technical papers are valueless as far as the general public is concerned, and the G. P. is, after all, who we wish to convince.

The daily papers are naturally the most widely read medium and it should not be unduly difficult to induce them to publish interesting articles pertaining to engineering, in say the Sunday supplements. These articles would, however, have to be free from technical detail and written in simple enough terms to be readily comprehended by the lay mind.

An article showing how the engineer figures the economic cost of a structure and how very often the construction cost has the least bearing upon the cost of the finished product, would be interesting and instructive, as would also the facts of the saving upon the Winnipeg aqueduct due to comparative designs and estimates, and so on.

Might it not be a good plan for a start to address a circular letter to each member of *The Institute*, asking their opinions on these matters and urging an immediate reply? Jar them out of the rut a little and get them into the habit of corresponding more freely with headquarters; let them tell their troubles and give them advice and assistance. The individual letter might have this effect where an appeal through *The Journal* would prove fruitless.

Yours very truly,

C. G. Moon.

The Diving Bell

Moncton, N.B., January 29, 1919.

The Editor,
The Journal of The Engineering Institute of Canada,
Montreal, P.Q.

Referring to letter from Mr. Taylor, under date of Jany. 11th with further reference to the mobile caissons used on the harbor works at Halifax and Hamilton, the writer would submit the following for the sake of a higher degree of clearness in connection with the issues originally raised.

The matter at issue in this discussion is resolvable to the following:—

Mr. Taylor, in his first letter, stated that the principle and system of the Halifax Caisson had been anticipated by a device invented and put into operation by him three years previous to the design of the Halifax apparatus and that the Halifax Caisson was virtually merely an infringement of his patents.

In my former letter I stated the case so far as the relative dates are concerned and the letter from Major James MacGregor under date of Dec. 3rd, 1918, already published in *The Journal* adds further corroboration and detail in this connection.

Are the principles and systems of the two devices the same?

The Halifax Caisson in actual work was the same as an ordinary bridge caisson, as Mr. Taylor has observed. In order to move this caisson from place to place in the harbor, it was necessary to float it at a comparatively shallow draft.

The buoyancy chamber was added for this purpose and not to give weight or ballast to the caisson; the caisson would have been heavier in its working load if the buoyancy chamber had not been there.

The function of the ballast chamber on the other hand was to handle the water ballast and to control the caisson in the submerged condition.

These chambers were not convertible or interchangeable in their functions as Mr. Taylor tries to intimate, e.g. in actual operation the caisson could not be sunk by admitting ballast into the buoyancy chamber.

As stated in my last letter, the Halifax caisson, for work on the harbor bottom, had to be submerged or sunk completely below the surface of the water, except the air locks; this necessitated the controlling device which the writer called the "ballast chamber."

The Hamilton caisson, which "actually floated at all times" was designed so that its depth of flotation could be varied for a few feet by the regulation of water ballast. But it was not possible to submerge the device, i.e. to sink it with its deck or roof below the water surface.

If this requirement had entered into its design or operation a new type of problem would have presented itself, viz. the disposition of the water ballast to give stability and a means of controlling the rate of sinking after the deck was submerged.

It would not be sufficient, as Mr. Taylor states, to merely prolong the air shafts so that the lock would remain above the water surface.

Again, in the Hamilton device, the buoyancy chambers were actually used as ballast chambers by elevating the water level in them above the outside water surface. Hence Mr. Taylor rightly calls them convertible ballast and buoyancy chambers.

This principle did not enter into the design or operation of the Halifax machine.

In other words, the Hamilton device was designed to work while afloat with its deck above the water surface. The depth of its draft and working plane was varied by admitting water into compartments or forcing it out as required and weight to resist the air pressure in the working chamber was provided partly by actual water ballast, i.e., water in compartments above the outside water level.

The Halifax caisson was designed for work under its own weight as an ordinary caisson on the foundation bottom. While at work, water ballast, in the sense that Mr. Taylor used it, played no part. The machine was simply under water or submerged except the working chamber and air shafts.

To make the caisson mobile, it was necessary to provide for its flotation, submerging and raising. This was done by the adoption of a special arrangement of compartments or chambers for the handling of water ballast in a special way, i.e. the flotation, submerging and raising of the caisson had to be taken care of by distinctly separate compartments and processes.

The character of the work to be done and the conditions under which the plants were to operate, being quite different, so also the problems of design for the two devices were inherently different and so logically enough the two types of plants were developed.

Yet Mr. Taylor asserts that the "principle and system" of the two devices were the same and that only slight structural modifications were required in order to transform the Hamilton device into a caisson for use at depths up to 55 ft. below the water level. The inference from this statement is that by using the same system of handling water ballast his machine could have been increased in depth so that work could be done at this level with the plant still floating and the difficulties of tidal variation taken care of. This is possible, but the resulting machine would have been very different from the Halifax caisson in construction and operation.

It is difficult to follow Mr. Taylor's argument that, on account of differences in shape of plant and details of operation, the principle of water ballast regulation as applied to sliding gates for dry dock and similar equipment is not essentially the same as that used for the regulation of draft in his floating caisson. At the same time he would brush aside as non-essential the fundamental differences in application and detail of the systems of control by water ballast in the cases of the two devices under consideration.

Re scows carrying construction plant in tidal waters, for Mr. Taylor's information I would cite the case of the scow used on the outer end of the dumping bridge employed in the construction of the breakwater at the Halifax Ocean Terminals by the Cook Construction Co., and Wheaton. This breakwater was built by side dumping from a track carried by a steel span from the construction end of the fill to the scow. The scow, which was a large one, provided tail track for the construction train. The tide variation here was from 5 ft. to 7 ft., and the track on the span was kept approximately level by the operation of the system referred to. This work was begun in 1913.

Mr. Taylor, in the second paragraph of his letter states that my intimation that the means he used for the "*regulation of draft*" in his device were not novel, is incorrect. Then, in the third paragraph he states, Mr. Macdonald asserts that "*any change in draft was impossible.*"

It is evident that Mr. Taylor was writing very hurriedly here. My letter was explicit in this connection as I referred to "regulating or changing the depth of flotation."

As to the first statement, it would be interesting to know wherein Mr. Taylor claims novelty for this method of changing draft and wherein it differs fundamentally from the method used in the case of a sliding gate for a dock or the scow cited above.

Mr. Taylor expresses doubt as to the basis for the writer's statement that the problem of flotational stability *while in the submerged condition was absent in the case of his* (Mr. Taylor's) *design*. Inasmuch as Mr. Taylor's device was designed to *float* at all times and *could not be submerged*, i.e. sunk until the deck was under the water, this condition of its stability *after submergence* would scarcely require extensive calculations.

Again, Mr. Taylor states " Mr. Macdonald says the use of water ballast was not an essential principle of the device used here." This is a misquotation. My statement was " the use of water ballast was not an essential principle of the plant so far as its use as a floating caisson was concerned." In ordinary conditions a heavier scow, or the use of movable kentledge would have answered the purpose of water ballast. In this particular case, the circumstance that the device required an extremely shallow draft in order to get into position made the use of water ballast advantageous, but Mr. Taylor will scarcely argue that this circumstance was a matter of fundamental principle for apparatus of this type. As a matter of fact, it would be necessary for Mr. Taylor to use iron weights or similar ballast in order to work his machine at a depth of 7 ft. (see his original article in the " Engineering News " of April 23, 1914).

However, Mr. Taylor asserts that the *use* of water ballast was a prime necessity when in operation but goes on to say that the writer was in error in stating that the *use* of water ballast was necessary to regulate the draft of machine so that it would pass over the piling and he divulges the secret that it was the *absence* of water ballast which permitted this regulation—and this after Mr. Taylor in several paragraphs of his letter would fain accuse the writer of juggling with terms!

In conclusion, it appears to the writer that between the Halifax and Hamilton caissons, plants of related types but independently evolved to suit their respective requirements, there is no real quarrel.

Mr. Taylor's criticism of the writer's paper and former letter has grown largely out of a misunderstanding or confusion of terms. Perhaps the lack of definite technical terminology for work of this class is somewhat to blame.

Re Mr. Taylor's claims for the invention of the Halifax caisson, or diving bell, by virtue of his design of the apparatus used at Hamilton, it has been the writer's object in this discussion to set out as clearly as possible the fundamental characteristics of the two plants. It is for the profession to pass judgment.

Yours very truly,
J. J. MACDONALD.

Moncton, N.B., Jan. 29, 1919.

Salaries of Engineers

Editor, *Journal:*

The question of salaries paid to engineers has frequently come up of late years. Glaring examples of downright injustice have come to light, such as a university graduate trying to support a wife at a salary of $1200 per annum by doing technical work whilst the pipe fitters, riveters, etc., were making $1800 at skilled labor.

A medical graduate of 1912 said that his practice for 1917 netted him $10,000. This to an engineer, who works much longer hours, and more exacting work, would be the wealth of the Indies. The latest item copied from a Civil Service paper is as follows:—

Civil Service Positions open till February 7th, 1919.

1. Reporter for the House of Commons—salary $2200.
2. Fruit Inspector—salary $2000.
3. HYDROMETRIC ENGINEER—Salary $1500.
4. Legal Clerk—salary $1500.
5. Store keeper at Banff, Alta.—salary $1200.

" C'est à rire."

And how about the Army?

A graduate engineer in 1914 was appointed to a commission as a lieutenant—($2.60 a day). Each time he missed promotion through wounds, etc. (Engineers, by the way get promotion through casualties). A medical graduate at the same time was called a lieutenant but received captain's pay ($3.75, now $4.75) and in one year automatically becomes a Captain. This is the official recognition of the engineer by the State.

The solution is plain—Union and Protection—we, ourselves are to blame for this. How many who were rodmen last year call themselves " engineers " this year? The first step must be " legal protection."

I would be pleased if you could find space for this in your *Journal.*

" SAPPER. "

Legislation

Dear Sir:

In connection with proposed legislation conference at Ottawa it appears to be doubtful whether our Province will be represented by a delegate and I take this means of placing my views on the subject before the members in attendance.

To begin with I am absolutely opposed to any " closed shop " legislation, such as prepared by the Saskatchewan Branch, and thoroughly endorse every word of G. B. McColl's letter regarding same, in January issue of our *Journal*; such legislation embraces the worst features of Trades Unionism and stands for a vicious principle, which is bound to re-act on the dignity and standing of our profession in Canada. That members of a Dominion wide *Institute* should be required to place themselves in the hands of local tribunals, before being allowed to practice anywhere outside their own particular place of residence or Province, is such an utterly parochial and unprofessional method of improving the status of the engineer, as to be classed retrograde in conception—The argument so often advanced " that the surveyors have such legislation," is not a very well chosen one when you find the competent and incompetent equally protected by law, whilst the engineer must rely upon his work and results for protection.

The spirit of the present age is decidedly against special privilege for any class of men and there is no need for us to build a high brick wall around ourselves, but we must have official recognition by the authorities as to what constitutes a qualified engineer and this, of course, involves registration, which will protect the public much more effectually than closed corporation methods. If an engineer cannot stand on his own feet in competition with brother members of the profession, we certainly have no right to bolster him up by Act of Parliament and drag our profession downhill by so doing.

The British Institute owes its great influence and standing throughout the world, not to legislation, but to having achieved recognition through the high standard set to its members; this can be also achieved by our *Institute*, but it will be necessary to take action with Federal and Provincial Governments on the basis outlined in Mr. McColl's letter, which contains a most excellent presentation of our case.

Yours faithfully,
R. W. MACINTYRE.

P.S.—My views as given above are shared by many of our most prominent members in B.C.

Overseas Correspondence

Following are some of the many replies received from our overseas members acknowledging the cigarettes and Xmas Greetings sent them:—

Smokes received. Many thanks for kind message.

Lt.-Col. WALTER H. MOODIE, D.S.O., A.M.E.I.C.,
9th Canadian Railway Troops,
1st Canadian Pioneers,
France.

* * *

Many thanks for the cigarettes which reached me while in hospital in London. Am expecting to be home soon.

Lieut. F. THEO. GNAEDINGER, M.M., Jr., E.I.C.,
1st Battalion,
Can. Railway Troops,
C. E. F.,
France.

* * *

Cigarettes and good wishes received with many thanks, and latter heartily reciprocated. I hope to be back about April, and will indeed be glad to greet you all once more.

Lt.-Col. H. J. LAMB, D.S.O., M.E.I.C.,
The Bath Club,
Dover Street,
London, England.

* * *

Please convey to *The Institute* my grateful thanks for the very handsome parcel of cigarettes received today. I am proud to be the recipient of your greetings, and wish *The Institute* all vigour and prosperity in the coming year.

Major A. M. JACKSON, A.M.E.I.C.,
7th Battalion,
Can. Railway Tps.,
France.

* * *

Many thanks for your splendid parcel of cigarettes, which reached me in good condition and was much appreciated.

Major E. DUNCAN, Jr., E.I.C.,
Canadian Overseas Ry. Constr. Corps,
B.E.F.,
France.

Please accept my very best thanks for the cigarettes so kindly sent me by *The Institute*, and which I very greatly appreciate. Through you may I extend New Year's Greetings to all the members.

Col. T. V. ANDERSON,
D.S.O., Order of St. Anne, A.M.E.I.C.,
Seaford, Sussex,
England.

* * *

The writer has much pleasure in acknowledging receipt of " smokes " together with the seasons greetings from *The Institute*, and wishes you all the compliments of the season.

Major A. R. KETTERSON, A.M.E.I.C.,
1st Battalion,
Canadian Railway Troops,
B.E.F.,
France.

* * *

I beg to acknowledge receipt of cigarettes which followed me since my return from overseas. I wish to convey *The Society* my sincere thanks for the kindness shown me, during the time I was on active service.

Pte. F. G. EARLE, S.E.I.C.,
P.P.C.L.I.,
458–14th Street,
Brandon, Man.

* * *

I wish to thank you very kindly for your good wishes and cigarettes which you sent me for Xmas. It was very kind of *The Institute* to remember us and we all appreciate the interest you take in us.

We expect to leave France before the end of January, and should be in Canada by the end of February or the first of March.

Thanking you again for your remembrance and good wishes.

Yours very sincerely,
Major D. A. GRAHAM, A.M.E.I.C.,
2nd Canadian Rly. Troops,
France.

* * *

Please accept my thanks for the cigarettes which came at a time when there was a shortage and so were doubly welcome.

F. E. LEACH, Lieut.-Col., M.E.I.C.,
Canadian Corps Headquarters.

* * *

Many thanks for the cigarettes which arrived today, the sentiments expressed on the enclosed card are very kind indeed.

The war is over and we hope soon to be home again. At present we are not unhappy being located at Lille which is a very prosperous city of a quarter million population. The people are very kind to us and are pleased to regard the British as their deliverers from four years oppression. Our later advances became more like a parade than the following up of an enemy. Fortunately by that time the Boche had little fight left in him else the civilian demonstrations might have been to our disadvantage for they certainly caused us some delay. Our final real attack on this front was the crossing of the River Scheldt on November 9th. The armistice coming into force on the 11th put a stop to a most successful operation.

Demobilization is going on slowly but surely so in the course of a few months I will be back in Toronto—it really seems too good to be true. The finding of satisfactory civil employment for all the soldiers will be a great problem. I feel confident that the Canadians will deal with this problem in the same marvellous manner and with the same ability that was displayed in munitions and war bonds.

Again thanking *The Institute* for its kindness, I will close.

Capt. E. V. Deverall, M.C., S.E.I.C.,
62nd Field Coy., R.E.,
B.E.F., France.

January 8th, 1919.

* * *

I beg to thank you very much for a parcel containing cigarettes sent by *The Institute.*

Yours very truly,
Edward W. Francis, Lieut., S.E.I.C.

Somerville Hospital,
Oxford, 23-1-19

* * *

I have to thank your *Institute* of Canada for the most welcome Christmas present of cigarettes sent me which arrived safely.

Wishing you and my fellow members all best wishes for 1919, I remain.

Yours very truly,
A. C. J. deLotbiniere, M.E.I.C.,
Major-General.

50 Pall Mall,
London, Eng.
22–1–19

* * *

Your little Christmas gift was appreciated more than I can say, not so much for the sake of the cigarettes as for the warm, friendly spirit in which they were given.

We are all very tired of the army now and are looking forward eagerly to the time when we shall regain our liberty. At present we are doing nothing and many of us object to the needless waste of valuable time, but I suppose we must be patient. However, anything which our *Institute* can do to hasten the return of the boys will be warmly appreciated by those here. It seems to me Canada has done her share and done it well and that she can do nothing more out here. A new army for garrison duty should be enlisted by a volunteer system.

I am looking forward to taking up hydraulic engineering or any other line of civil engineering endeavours. Should you locate a good job not too far away from Montreal for a young McGill graduate, please save it for me.

Wishing you all a very happy New Year, I am,

Most sincerely yours,
W. McG. Gardner, S.E.I.C.,
January 7th, 1919.

* * *

I beg to thank the Council and members of *The Engineering Institute of Canada* for their very kind Christmas gift of cigarettes which duly arrived quite safely and which I very much appreciated. The thought that our old friends in Canada still continue to remember us is very gratifying and I hope before another Christmas comes around I shall have the pleasure of being with you all again. Life out here just now is getting very monotonous and we are all greatly looking forward to the day of demobilization when we can once more settle down to our old occupations.

Again thanking you all for your kind remembrance and good wishes and wishing all the members of *The Engineering Institute of Canada* all happiness and prosperity during the coming year, I remain,

Yours sincerely,

P. R. Warren, M.E.I.C., Major R. E.,
3 P.C., H.Q., France,
8–1–19

* * *

Yesterday I received a packet of cigarettes being your gift to me as a member of *The Institute* overseas. It was with a feeling of surprise and gratefulness that it was received. I can only thank you sincerely for the gift, especially so coming at a time when those luxuries, almost necessities, are hard to obtain.

This battalion—7th C.E.—expects to be in Canada about March when I hope to renew old friendships with *The Institute* at least with its branch in Vancouver. I might say that my address remains the same, P. O. Box 40, New Westminster, B.C.

Trusting *The Institute* will have a prosperous year.

Yours sincerely,
Ken. W. Morton, J.E.I.C., Lieut.,
Belgium, 18th January, 1919.

* * *

Bordon, Hants, Jan. 19th, 1919.

On behalf of *The Institute* please accept my hearty thanks for the parcel of smokes which caught up to me today. I started on the homeward journey on December 22nd, but it is a short road that has no halts in it. However, I hope to start on the last lap soon.

Cigarettes are hard to get here, so the ones sent are very acceptable, and the kind thoughts expressed on the card much appreciated.

Yours very sincerely,
Major S. C. Wilcox, A.M.E.I.C.,
12th Battalion,
Canadian Railway Troops.

* * *

Dear Mr. Keith:

Many thanks for your kindly letter of congratulations and good wishes which I greatly appreciate.

The C. B. came to me as a surprise but it was a pleasure to think that the little I had been able to do during the last year, whilst attached to the Imperial Army as a chief engineer, had been considered by them worthy of an award.

Please accept my thanks also for the cigarettes and tobacco you were so kind to send me. Most acceptable they were.

With all good wishes to yourself and our good friends the members of *The Institute,* believe me.

Yours sincerely,
Chas. J. Armstrong, C.B., C.M.G., M.E.I.C.,
Brig.-Gen.

Sir:

Please accept my best appreciation of the kind gift of "Smokes" received from your Institute.

They arrived at a time when all smokes here were at a premium so I can assure you they were doubly welcome.

Might I extend to the members of *The Institute* my best wishes for the ensuing year.

Yours most sincerely,
W. A. Adam, M.C., M.E.I.C.,
Capt., 6th Bn. C.E.

* * *

I beg to acknowledge with thanks, the receipt of cigarettes forwarded to me.

Geo. F. Alberga,
No. 2 Can. Construction Co.,
24th Jan., 1919. Rly. Camp, North Wales.

* * *

Many thanks for your kind gift which reached me to-day, it having gone to France and then back here.

I am in the Second Western General Hospital, Manchester, England, and was wounded on October 16th, in the leg, near the ankle, when constructing a bridge on the broad gauge railway, five miles East of Cambrai.

Yours very truly,
J. B. Wilkinson,
Can. Rly. Troops.

* * *

Received with many thanks.

G. R. Turner, J.E.I.C.,
Major,
C.E.

* * *

Many thanks for the cigarettes and good wishes. Your hopes have been fulfilled and it is all over now. I hope we shall soon be back in Canada and that I shall have the pleasure of meeting you.

Sincerely,
G. H. Kohl, J.E.I.C.

* * *

Thanks very much for 200 Players. Hope to be back in Montreal by early summer.

A. C. Oxley, A.M.E.I.C.,
Lt., Can. Eng.

* * *

I wish to convey my sincerest thanks to you for your splendid gift and good wishes.

J. E. Pringle, S.M.E.I.C.,
No. 10 Field Company,
2nd Q.V.O. Sappers and Miners,
B.E.F.

* * *

The cigarettes were much appreciated coming at a time when there was a very great shortage of supplies.

Many thanks for same.

J. C. Craig, A.M.E.I.C.,
Major, C.R.T.

* * *

With many thanks receipt is acknowledged and we are glad to think that we may be returning soon.

T .E. Price, A.M.E.I.C.,
Lieut.,
5th Can. Rly. Troops.

REPORT OF COUNCIL MEETING

The regular monthly meeting of the Council was held at the rooms of *The Institute*, 176 Mansfield Street, on Friday, February 21st, at 3.30 p.m.

Present: Lieut.-Col. R. W. Leonard, President, in the chair; H. E. T. Haultain, H. H. Vaughan, John Murphy, Ernest Brown, Julian C. Smith, Arthur Surveyer, J. E. Gibault, W. A. McLean, R. A. Ross, Walter J. Francis, A. R. Decary and G. Gordon Gale.

Committees: After the reading of the minutes of last meeting the following committees were constituted:—

Executive Committee of the Council: Lieut.-Col. R. W. Leonard, Chairman; Walter J. Francis, Vice-Chairman; J. M. Robertson, Brig.-Gen. Sir Alex. Bertram, Julian C. Smith, Ernest Brown, Arthur Surveyer.

Finance Committee: J. M. Robertson, Chairman; H. H. Vaughan, R. A. Ross, G. H. Duggan, Brig,-Gen. Sir Alex. Bertram.

Library and House Committee: Brig.-Gen. Sir Alex. Bertram, Chairman; O. O. Lefebvre, S. F. Rutherford, Frederick, B. Brown, R. deL. French.

Papers Committee: Julian C. Smith, Chairman; G. W. Craig, (Calgary Branch); Walter J. Francis, (Montreal); E. R. Gray, (Hamilton); W. Young, (Victoria); H. S. Carpenter, (Saskatchewan); C. C. Kirby, (St. John); F. A. Bowman, (Halifax); A. R. Decary, (Quebec); R. deB. Corriveau, (Ottawa); A. L. Harkness, (Toronto); J. W. LeB. Ross, (Sault Ste. Marie); W. P. Brereton, (Manitoba); A. W. Haddow, (Edmonton); E. G. Matheson, (Vancouver).

Publications Committee: Ernest Brown, Chairman; Peter Gillespie, W. Chase Thomson, J. A. Shaw, Edgar Stansfield.

By-Laws Committee: Ernest Brown, Chairman; Walter J. Francis, H. E. T. Haultain.

Gzowski Medal and Students Prize: H. H. Vaughan, Chairman.

Honor Roll Committee: Lieut.-Col. C. N. Monsarrat, Col. A. E. Dubuc, C.M.G. D.S.O., Fraser S. Keith, and a member from each branch.

Nominating Committee: District No. 1, H. M. Mackay, Chairman; A. E. Doucet; District No. 2, Alex. Fraser; District No. 3, Capt. J. L. Allan; District No. 4, A. A. Dion; District No. 5, Geo. Hogarth, H. U. Hart; District No. 6, Guy C. Dunn; District No. 7, O. W. Smith; District No. 8, A. W. Haddow, Sam G. Porter; District No. 9, Newton J. Ker, E. G. Marriott.

Steel Bridge Specifications: P. B. Motley, Chairman; C. N. Monsarrat, H. B. Stuart, H. P. Borden, F. P. Shearwood, G. H. Duggan, Allan E. Johnson, E. G. W. Montgomery, H. A. Icke, W. Chase Thomson, W. A. Bowden, J. G. Legrand, Geo. W. Craig, F. T. Cole, M. A. Lyons, A. H. Harkness, H. F. Estrup.

Roads and Pavements: W. A. McLean, Chairman; W. P. Brereton, J. Duchastel, J. E. Griffith, G. Henry, E. A. James, A. F. Macallum, A. J. MacPherson, P. E. Mercier, W. P. Near, G. C. Powell, C. H. Rust, F. W. W. Doane, Alex. Fraser.

Steam Boiler Specifications: L. M. Arkley, Chairman; W. G. Chace, F. G. Clark, R. J. Durley, D. W. Robb, H. H. Vaughan, Logan M. Waterous.

Ernest Marceau was re-appointed Treasurer, and Fraser S. Keith, Secretary.

Ballot re Changes in By-laws: It was resolved that the Secretary send out a ballot calling for a vote on the changes in the by-laws, to be accompanied by a short letter explaining the changes. H. H. Vaughan and Ernest Brown were appointed a committee to edit the letter.

Legislation: The resolution on legislation passed at the Annual Meeting was presented as follows:—

Moved by J. M. Leamy, seconded by C. C. Kirby:

Whereas it seems that the wishes of the majority of the members and of the Branches of *The Engineering Institute of Canada* are that Provincial Legislation should be obtained to define the status of the Engineers throughout Canada:

Whereas the members of this annual meeting are of the opinion that this legislation should be as uniform as possible throughout the provinces;

Be it resolved, that a special committee be formed, composed of one delegate appointed by each branch to meet at headquarters before the 15th of April, 1919, to draw up such ample legislation as it may deem necessary and advisable in order that the members of *The Institute* throughout the different provinces may ask for legislation on the same uniform basis;

That the Secretary be instructed to call the first meeting of this committee;

That this Committee be authorized to obtain the necessary legal advice on the matter.

That this committee shall submit the proposed legislation to the Council before the 1st of May 1919.

That the Council shall then ask by letter ballot, before the 1st of June, 1919, the opinion of all the members of *The Institute* regarding the adoption of the proposed legislation prepared by the said special committee of *The Institute;*

That the Council be authorized to pay all the expenses of this committee and of each delegate;

That the Council of *The Institute* shall report the result of the ballot to the branches, and if the vote is favorable to legislation the Council of *The Institute* shall immediately take the necessary measures in co-operation with the branches, to have such legislation enacted.

The Secretary was instructed to advise all the branches to make an immediate appointment and to call a meeting of this committee at headquarters on April 5th, explaining that it was advisable to do as much work as possible in advance.

Resolutions of thanks: A committee was appointed consisting of Messrs. Vaughan and Francis to co-operate with the Secretary in drafting resolutions.

Budget for 1919: The Secretary was instructed to submit a budget covering the current year, to the Finance Committee at an early date.

Civil Service Salaries: The Committee reported progress dealing with the question of making recommendation to the Government regarding the increased salaries for engineers employed in Government service.

Soldiers Civil Re-establishment: President Leonard presented a letter which he recommended sending the Hon. Gideon Robertson, Minister of Labour, Sir James Lougheed, Chairman of the Soldiers Civil Re-establishment, and Hon. J. A. Calder, Chairman of the Repatriation Committee, offering the support of *The Institute* to this movement. The letter was approved. It was resolved that H. H. Vaughan, G. Gordon Gale and Fraser S. Keith, be appointed a Committee to interview the above named, at a date to be arranged. It was further resolved that all branches be asked to appoint committees to assist in the Soldiers' Civil Re-establishment.

It was resolved that all men not at present employed should have free use of the advertising pages of *The Journal.*

Retiring President H. H. Vaughan agreed to prepare an article on Repatriation for "Back to Mufti" the Government paper on repatriation.

City Improvement League: A letter from the Executive Secretary of the City Improvement League of Montreal was referred to the Montreal Branch.

Post Office Privileges: It was resolved that a record be made of the fact that the Post Office privilages are being granted for *The Journal.* H. H. Vaughan and the Secretary were appointed a committee to draft a second circular letter to the members.

Memorial to the Government: It was resolved that a copy of the memorial read by the Secretary be submitted to all members of the Council, with a request for its consideration and approval.

Western Professional Meeting: Approval was given to the holding of the Western Professional Meeting during the coming summer, at Edmonton.

Detrimental Legislation: A letter from the Quebec Branch pointing out that the enginemen of Quebec were applying for an Act to call themselves "The Engineers of Quebec." Approval was given of the action of the Quebec Branch and authorization to take the necessary steps to oppose the bill of the enginemen of Quebec Province.

New Branches: It was resolved that the Secretary be authorized to attend proposed meetings to establish new branches at Peterboro and Niagara Falls.

Windsor Branch: Approval was given to the establishment of a branch at Windsor, in view of the request received as follows:

Windsor, Ont.,
January 17th, 1919.

Fraser S. Keith Esq.,
Secretary Engineering Institute of Canada,
Montreal, Que.

Dear Sir:—

The undersigned corporate members resident in the Border Cities (which include Sandwich East, Ford, Walkerville, Windsor, Sandwich West, Sandwich and Ojibway) being desirous of establishing a branch of *The Institute* to be known as The Border

Cities Branch, request that you issue the necessary orders for that purpose. The area to include a radius of twenty-five miles from the Windsor Post Office.

Thanking you, we are, F. C. McMath, Willard Pope, Geo. E. Roehm, F. S. Kester, G. C. Williams, John A. W. Brown, A. J. Riddell, Owen McKay Norris Knowles, J. S. Nelles, H. Thorn, R. A. Carlyle A. E. Eastman, David Molitor, Ernest C. Kerrigan, V. R. Heffler, A. H. Aldinger, L. T. Bray, Ernest G. Henderson, M. E. Brian. Alfred J. Stevens.

It was decided, however, that the name "Border Cities Branch" was not desirable and the Secretary was instructed to write requesting that a local geographical name be given.

Assisting Engineering Standards Committee: A request from H. H. Vaughan, Vice-President of the Canadian Engineering Standards Association, was presented, asking for a subscription of $200. from *The Institute*. It was unanimously resolved that this be granted.

President's Address: It was moved by Julian C. Smith, seconded by A. Surveyer, that the presidential address of H. H. Vaughan be printed in special form and issued to the members of *The Institute*, Members of Parliament, both Provincial and Federal, and other leading citizens of the Dominion, and that Mr. Francis and two others be a committee with the Secretary to attend to this matter, with power to act.

The meeting then adjourned to Tuesday, February 25th, at eight o'clock.

Adjourned Meeting

The adjourned Meeting of Council was held on Tuesday, February 25th, at 8.15 p.m. a which a large amount of important business was transacted, including the adoption of Standards stationery, acceptance of the tender for steel engraved certificates, further action on *The Institute* emblem and a large number of personal matters.

Classifications: Classifications were made for a ballot returnable at the March meeting of Council.

Ballot: The ballot was canvassed and the following elections and transfers effected:—

Members.

Thomas Buchanan Campbell, of the Pas, Man. Division engineer and bridge engineer, Hudson Bay Ry. for Dept. Railways & Canals; Frederick Arthur Gaby of Toronto, B.A.Sc. M.E., E.E., chief engineer Hydro-Electric Commission, Toronto; John Girdlestone Glassco, B.Sc., M.Sc., of Winnipeg, Man. manager of City of Winnipeg hydro-electric system; Charles Hawkins Marrs (C.E., Toronto), of Hamilton, Ont., assistant engineer of the Hamilton Bridge Works, in charge of all designs and estimates and work in the field; Frederick Blair Reid, B.A.Sc., supervisor of levelling with Geodetic Survey of Canada.

Associate Members.

John Worthy Battershill Jr. of East Kildonan, Man., municipal engineer for rural municipality of East Kildonan, Man; Henry Carle Dyson Briercliff, B.Sc., of Winnipeg, previous to enlishment was designing, drafting and mechanical engineer at Vulcan Iron Works, Winnipeg, since 1918 with R.A.F., Toronto; Charles Frederick Cameron of Winnipeg, B.A., B.C.E., asst. engineer on track laying demonstrator in physics, University of Manitoba. Charles James Swaffield Orton of Westcliff-on-Sea, Eng., Deputy Asst. Director, Naval Gun Mounting Section, Admiralty; Earle Bedford Patterson of Winnipeg, engineer Manitoba Hydro-metric Survey; H. W. Perkins, prior to enlistment was transitman with Hydro-Electric Power Comm. on Hydro-radial projects. Since 1917 has been on Active Service with the C.E.F. Joseph Dufferin Peters of Moose Jaw, Sask. Supt. Light & Power Dept. City Power Plant, Moose Jaw, Sask; Thomas Edward Powers, Lt.-Col., D.S.O. B.A. Time officer administering R.C.E. and tech. branches in connection with C.E. embracing engineers, Signal Railway Troops and Forestry Corps; Edward A. Ryan, B.Sc. of Westmount, general consulting work with R. J. Durley; Bernard Schachere, B.Sc. of Ottawa, calculator with board of engineers, Quebec Bridge, now with Dept. of Rys. & Canals, Ottawa.

Associates.

John Frederick Samuel Pinder-Moss (Honors Nottingham. Coll., Eng.) of Edmonton, with Dept. of Railways & Canals, and G.T.P. Ry. Edmonton.

Transferred from Associate Member to Member.

George Harrison Burbidge, B.Sc., B.A. of Winnipeg, Man., dist. engineer Dept. Public Works, Can., Dist. of Manitoba; Georges Henri Cagnat of Edmonton, dist. engineer Dept. of Public Works, Edmonton; William Alexander Duff of Moncton, N.B. (S.P.S., Toronto), asst. chief engineer and engineer of bridges Canadian Government Railways Moncton, N.B.; Claude Henry Rogers, B.A.Sc. of Peterboro, Ont., field engineer in charge of work of Forward Tramways 1st Army B.E.F. France. Prior to enlistment in 1915 was general manager of the Peterboro Canoe Co.

Transferred from Junior to Associate Member.

Trevor Eardley-Wilmot, B.Sc. of Montreal, cable engineer with Northern Electric Co.; James Mellon Menzies, B.A.Sc. Captain, officer commanding 108th Chinese Labour Corp's.; France, J. N. E. Romeo Morrissette of Three Rivers, principal asst. district engineer, Public Works Department, Three Rivers.

Transferred from Student to Associate Member.

Barthelemy Rocher, C.E., B.A.Sc. of Quebec, assisting the engineer in charge of District No. 3, Roads Department, City of Montreal.

Transferred from Student to Junior Member.

John Alfred Creasor, B.Sc. of Owen Sound, Staff Capt., 3rd Bde. C.E. Prior to enlishment was asst. superintendent with Kennedy Bros. Montreal; Lieut. William Russell Way, B.Sc. of Montreal, asst. electrical engineer, operating dept., Shawinigan Water & Power Co., Montreal.

BRANCH NEWS

Ottawa Branch

J. B. Challies, M.E.I.C., Sec'y.-Treas.

Good Roads

The Eastern Ontario Good Roads Association met in Convention in Ottawa on February 4th and 5th. This Convention attained the dignity of an inauguration of a great movement towards highway improvement, for Cabinet Ministers from both the Dominion and Provincial Governments attended and gave definite assurance of the respective Government's intention to provide for highway construction on a carefully thought out, systematic and adequate scale.

A. W. Campbell, M.E.I.C. ("Good Roads" Campbell), dealt with the constructive policy of road-making, its effect on the community, the country and its position with regard to the ultimate progress and prosperity of the nation.

The great success of the convention has given the good roads movement such a splendid forward impulse, that it can now be reasonably assured that good roads will soon be one of the actualities of Canadian conditions.

Surveyors Broaden Their Field

The twelfth Annual Meeting of the Association of Dominion Land Surveyors was held at Ottawa on Jan. 29th, 30th and 31st. J. N. Wallace of Calgary, President, in his opening remarks dwelt on the need for a stronger professional spirit among surveyors. The following papers were presented:—Land Settlement, by F. W. Rice; Land Classification, L. Brenot; Aeroplane in Surveying, R. F. Clarke, M.C.; Soil Survey, W. A. Johnston; Roads, A. H. Hawkins; Assessment Survey of Farm Lands, R. W. Cautley; Town Planning, T. Adams; and Honours to Dominion Land Surveyors in the War, E. M. Dennis. The new constitution and by-laws, adopted after lively discussion, place the Association on a broader basis and secure to every member no matter in what part of Canada he may reside, an equal voice in the affairs of the Association.

J. R. Akins, St. Catharines, was elected President for 1919; F. V. Seibert, Edmonton, Vice-President; and F. D. Henderson, Ottawa, Secretary.

Nailacrete

In the last issue of *The Journal*, reference was made to an important discovery by E. Viens, Director of the Public Works Laboratory for Testing Materials, one of the Affiliates of the Ottawa Branch.

As the general adaptability and the commercial value of Nailacrete has been thoroughly well proven by its general use in the new Parliament Buildings at Ottawa, the discovery is of great interest to engineers generally. The following general facts about Nailacrete, hitherto unpublished, have been obtained from Mr. Viens for the information of *The Institute.*

Nailacrete is a composite building material, the binding constituent of which is Portland Cement. The proportions of Portland Cement to the ingredients can be varied within a comparatively wide range, producing a material of various strength, depending on the purpose for which the material is to be applied in the building industry.

Properties

Nailacrete is fireproof, waterproof (when so required) resilient, light in weight as compared with concrete (Nailacrete weighing from 70 lbs. to 100 lbs. per cubic foot, depending on the formula used, as against concrete weighting from 140 lbs. to 155 lbs. per cubic foot). It has no expansion or contraction under ordinary building conditions; that is of such a texture that nails, screws or tacks can be driven therein at any time, except when an extraordinary strong material is desired; in which case, after the material has developed its full strength, it would be necessary to drill holes.

Strength in pounds per square inch

Tensile	Transverse	Compressive
70 to 600	100 to 500	400 to 2500

depending on the formula used.

Should there arise a case where strength alone was required, and not the property of taking in nails or screws greater strength than that given above could be developed.

Force Required to pull nail

Material	Size of Nail	Depth Driven	Pounds
Bass-wood........	2 inch	1.5 inch	47
Spruce...........	"	"	47
Pine..............	"	"	77
Hemlock.........	"	"	153
Ash...............	"	"	223
Birch.............	"	"	263
Red Oak.........	"	"	336
Maple............	"	"	430
Nailacrete........	"	"	50 to 480

depending on the formula used.

Volume

The volume of one ton of Nailacrete in the plastic state varies somewhat with the formula used. With the formula used for the manufacture of the Nailacrete as placed in the New Parliament Buildings, Ottawa, one ton produced 28.63 cubic feet of the material laid in place.

Usages

Nailacrete may be applied over concrete slabs, clay tile, or other material, as a basis to which a wooden floor may be nailed. It may be used with a reinforcement (in light construction) instead of concrete, tile or other material to which a wooden floor may be nailed. It may be used with a reinforcement, or on metal lath, as a roofing material to which a metal, shingle or other kinds of roofing may be nailed or fastened. It may be used as a plaster for walls and ceilings. Further, it may be used as a flooring in itself by treating the surface with a hardener, a filler, paint, varnish or wax, or on the finished surface of same, linoleum may be laid and glued if necessary.

Application

The material may be deposited in place in a plastic state similar to the way in which concrete is laid, or it may be moulded into any shape and put into position.

Calgary Branch

C. M. Arnold, M.E.I.C., Sec'y.-Treas.

At a meeting of the Executive Committee of the Calgary Branch, held on December 13th, the following committees were appointed: Applications and Credentials, F. H. Peters, A. S. Dawson, A. S. Chapman, B. L. Thorne, F. W. Alexander; Finance, G. W. Craig, A. S. Dawson, C. M. Arnold; Membership, Wm. Pearce, P. M. Sauder, W. J. Gale, J. S. Tempest, M. H. Marshall, S. K. Pearce, E. L. Miles; Legislation, F. H. Peters, Wm. Pearce, G. N. Houston.

On January 15th Eugene Coste gave an address on Petroleums and Coals, and on January 29th the subject introduced by Dr. T. H. Blow was Technical and Scientific Education.

A general meeting of the Branch was held in the Board of Trade Rooms on the evening of Wednesday, Jan. 29th, 1919. The meeting was preceded by an address by Dr. T. H. Blow, M.L.A., on Technical and Scientific Education. The speaker declared himself to be somewhat diffident in addressing a body of engineers upon such a subject but as it was one in which he took considerable interest he would like to place some of his views before the meeting. He advocated the establishment of a university for Southern Alberta, the logical situation for which was in the vicinity of Calgary. The speaker was warmly applauded upon the conclusion of his address.

Messrs. Craig, Houston and Arnold were appointed as a committee to draft a resolution to the Minister of Education in reference to the early establishment of a School of Technology in Calgary. It was decided to submit this resolution to the Alberta Division at the Annual Meeting Feb. 1st.

The meeting came to order at 10.45 p.m. and the Secretary read the minutes of the last meeting and executive meetings held since. These were approved and signed by the Chairman G. W. Craig. Mr. Houston read the report of the Legislative Committee and gave a resumé of the reasons which had led to the decision not to present the Act dealing with the profession of engineering at the coming session of the Alberta Legislature.

Mr. Craig corroborated Mr. Houston's statements and stated that the Edmonton Branch had adopted a similar report.

Mr. Marshall moved the adoption of the report and the approval of the action taken by the Executive and the Committee on legislation. Seconded by Mr. Chapman and carried.

The Secretary read a letter from Manitoba Branch suggesting that we send a delegate to Ottawa to attend the adjourned Annual Meeting in the interest of the legislation movement. The Saskatchewan Branch had also written that they were sending a delegate. Mr. Craig suggested that as Mr. Pearce was in, and would probably be in Ottawa at that time, that we ask him to be our delegate. As it was stated that Mr. Peters might be present at this meeting it was decided to ask both gentlemen to act as delegates.

Messrs. Marshall, Gale and Miles were appointed as a Committee to arrange a Ladies' night, which it was decided to hold on Mr. Craig's suggestion. The meeting adjourned at 11 p.m.

Quebec Branch

J. A. Buteau, A.M.E.I.C., Sec'y.-Treas.

On Monday, January 20th, members of the Quebec Branch met to hear a lecture by Professor M. Koetz of the Technical Schools of Quebec, on the subject of the manufacture of artificial colours. This meeting was held under the auspices of the L'Ecole Polytechnique.

Toronto Branch

W. S. Harvey, A.M.E.I.C, Sec'y.-Treas.

The public spiritedness of our Branch is illustrated in the recent action of the Toronto Branch Executive in appointing a Committee for the purpose of reviewing and discussing the Toronto Building By-Laws. The subject of Building By-Laws is one of paramount interest to engineers and their advice is necessary.

The committee consists of A. H. Harkness, M.E.I.C., Chairman, Prof. Peter Gillespie, M.E.I.C., and Geo. Clark, M.E.I.C.

Discussion on By-Laws.

Following the Annual Meeting, the Toronto Branch has lost no time in getting its members together to discuss important questions concerning *The Institute.* Under date of February 24th a letter was sent to all the members, signed by A. H. Harkness, chairman, and W. S. Harvey, secretary-treasurer, as follows:—

Dear Sir,

An open Meeting of the Branch will be held in the Rooms of *The Institute*, at the Engineers' Club, 96 King Street West, at 7.45 p.m., on Friday, February 28th, 1919.

A few short papers will be read by members of the Branch on the subject, "*What the Institute Can do,*" to be followed by discussion.

This meeting promises to be of great interest to all engineers, as the discussion will bear on the economic and social status of the profession, and suggestions are invited as to the necessary steps to be taken to bring about an improvement.

The Legislation Committee of the Council, and a Special Committee of the Montreal Branch have prepared a set of Branch By-laws, with the object of having uniform By-laws for all Branches. A committee appointed by the Executive of the Toronto Branch, has examined these proposed By-laws and has suggested several amendments.

A copy of the proposed By-laws, with the suggested amendments printed in a parallel column is enclosed.

If time permits the By-laws will be submitted to the meeting for discussion before being forwarded to the Council at Montreal.

Attached to this circular is a copy of the Branch by-lays, approved by Council under of December 17th, and in parallel column amendments suggested by the committee appointed by the executive of the Toronto Branch. Several branches have already sent in suggestions, so that, as a result of all the work being done in this connection, it is confidently expected that an ideal set of by-laws will result.

Halifax Branch

K. H. Smith, A.M.E.I.C., Sec'y.-Treas.

The First Annual Meeting of the Halifax Branch was held on Wednesday, January 15. As the business to be transacted was not large, a luncheon meeting was arranged as it is found most convenient for the greater number of the members to attend a meeting at such a time.

The chief business was ascertaining and announcing the result of the ballot for officers. The new Executive Committee is as follows:—F. A. Bowman, Chairman; K. H. Smith, Secretary-Treasurer; J. L. Allan, L. H. Wheaton, A. G. Robb, W. P. Morrison and A. F. Dyer.

Subsequently a meeting of the newly-elected Executive Committee was held for organization purposes and a general discussion of the work for the coming year. One special feature discussed was the question of making the regular meetings of the branch, supper meetings. It was felt that such meetings would be most convenient for the majority of the members and would, therefore, result in increased attendance. They would also largely increase the opportunity for social intercourse between members which is highly desirable. This idea can be carried out very conveniently in Halifax where first class facilities exist for meetings of this kind.

The regular monthly meeting of the Halifax Branch was held on Thursday evening, February 20th, at 6 p.m. While supper and luncheon meetings have previously been held by the local branch for special purposes, this was the first of the regular meetings to be of such type. The results secured however, both from the standpoint of attendance, social intercourse and general interest, highly justified this type of meeting. Hon. E. H. Armstrong, Commissioner of Works and Mines whose department until recently embraced the roads of the province was present as a guest of *The Institute.*

The early part of the meeting was devoted to a paper read by Capt. T. S. Scott, M.E.I.C. on Roads. This paper was unique for its combination of technical and literary qualities. The manner in which it was read added a great deal to its interest.

The reading of Capt. Scott's paper was followed by a most interesting discussion participated in by Hon. Mr. Armstrong, F. W. W. Doane, City Engineer, R. McColl and others. The discussion brought out some of the special difficulties in building roads in Nova Scotia and also the fact that the economic side of road building must be given consideration. That is to say, that in a particular case such a road should be built as will be warranted by the amount of the traffic to be served. It appeared from the discussion that for a large part of the country, all that is warranted or in fact, all that can be expected with any reasonable expenditure of money, is an improved type of earth road with proper provision for maintenance of the same. Hon. Mr. Armstrong pointed out the beneficial influence which engineers as a whole could exercise by directing public opinion along rational lines in this matter. A formal vote of thanks moved and seconded by Messrs. Dodwell and Doane respectively was tendered to Capt. Scott.

The latter part of the meeting after several guests present had retired, was devoted to general business and a report from C. E. W. Dodwell, Branch delegate of the annual meeting at Ottawa.

Hamilton Branch

H. B. Dwight, A.M.E.I.C., Sec'y.-Treas.

A meeting of the Hamilton Branch of *The Engineering Institute of Canada* was held in the Recital Hall of the Conservatory of Music on January 30th, 1919, the attendance being about two hundred. The speaker of the evening was E. L. Cousins, chief engineer and general manager of the Toronto Harbour Commission, who gave a lecture illustrated by a large collection of lantern slides, on the development of Toronto Harbour during the past four years. Since the formation of the Toronto Harbour Commission in 1914, nearly one thousand acres of marsh land have been reclaimed and made suitable for factory sites, the facilities for shipping have been largely increased, and several miles of sheltered lagoons for pleasure boating and many acres of park lands, have been provided. Mr. Cousins pointed out that similar results could be obtained at Hamilton with fewer natural difficulties.

A. C. Garden, of the Hamilton Harbour Board, gave a short talk on Hamilton Harbour. He stated that by the time the new Welland Canal was completed, the development of Hamilton Harbour would be accomplished sufficiently to accommodate the large vessels which would then be admitted to Lake Ontario from the upper Lakes.

J. M. Eastwood gave a description of reclamation work and the building of shipping terminals which had been carried out in Hamilton Harbour a few years ago.

E. R. Gray, city engineer and chairman of the Hamilton Branch of *the Institute* presided at the meeting. A vote of thanks to Mr. Cousins was moved by J. W. Tyrrell and J. A. McFarlane.

On February 10th, Dr. F. B. Jewett, chief engineer of the Western Electric Company, will give a lecture on Industrial and Scientific Research.

On February 10th a very instructive and interesting lecture on Industrial and Scientific Research was given by Lt.-Col. F. B. Jewett, Ph.D., Chief Engineer, Western Electric Co., New York, and Vice-President, American Institute of Electrical Engineers, at a meeting of the Hamilton Branch of *The Engineering Institute of Canada,* in the Royal Connaught Hotel. The lecture room was filled to capacity, and the numerous questions which were asked Dr. Jewett at the close of the lecture showed the keen interest taken by the audience.

Dr. Jewett first gave a discussion of the large problems of starting up and developing research work for manufacturing concerns in general. Very few companies are large enough to establish complete research departments, as the Bell Telephone Co. of the United States, and some other companies, have done. However, the smaller companies should not be deprived of the benefits of having their problems worked out by modern scientific research methods, and some co-operative research organization should be developed. In this the universities, the government, and the manufacturing interests should take part, various methods by which they could do so being discussed by Dr. Jewett.

One of the greatest difficulties encountered in carrying on research work on a large scale is the lack of thoroughly trained scientific investigators. Although Dr. Jewett expressed himself as being a firm believer in the great results to be obtained from properly conducted scientific research, he repeated a note of warning against attempting to build up research organizations without thoroughly educated and experienced research workers. He considered that such organizations should not be built up too rapidly, but should have a normal rate of growth, and he also gave warning against taking from the universities the men who are training future investigators.

Dr. Jewett then showed an interesting collection of slides, illustrating the results of the work of his organization. The long distance telephone line from New York to San Francisco, the multiplex telephone, the wireless telephone as used on war ships, destroyers, aeroplanes, and other remarkable developments in telephone work were described.

A vote of thanks to Dr. Jewett was moved by H. U. Hart, chief engineer of the Canadian Westinghouse Co.

Dr. Jewett addressed the Canadian Manufacturers' Association earlier in the day on the subject of research, and his visit is expected to be productive of valuable results in the campaign for increased research work in Canada.

Manitoba Branch

Geo. L. Guy, M.E.I.C., Sec'y.-Treas.

Luncheon was held at the Fort Garry Hotel on February 1st. After the lunch an address on "Present Practice on Carbonizing and Briquetting of Coal" was given by R. de L. French, M.E.I.C., which was listened to with interest by the members.

On Wednesday, February 5th, a meeting was held in the Engineering Building, Manitoba University, and a paper was read by J. G. Sullivan, M.E.I.C., entitled, Can the Standard Measure of Value be Improved. Mr. Sullivan took for his subject the present unscientific standard of value of the gold dollar, and suggested the use of a multiple standard. The paper created considerable interest and discussion. There were present at the meeting many of the prominent bankers and members of the legal profession, among whom was Isaac Campbell, K.C., who took part in the discussion.

A Committee was appointed to have an illuminated address prepared to be presented, at a dinner, to Capt. C. N. Mitchell, V.C., M.C., upon his return to Winnipeg. Capt. Mitchell, who is an Associate Member of *The Institute*, was well known in the city and active in the Manitoba Branch before his enlistment with the overseas forces.

In view of the unrest and dissatisfaction among the returned soldiers taking the vocational training course in Winnipeg a Committee of four was appointed to look into the question and report to the Branch, so that the Branch can make recommendation, if necessary, to improve the present method of training.

The ballot for members of the Executive Committee was counted: G. C. Dunn, M.E.I.C., W. M. Scott, M.E.I.C., and J. G. Sullivan, M.E.I.C., being elected. G. C. Dunn, M.E.I.C., was eleced as representative of the local branch on the Nominating Committee.

A good representation of the local members is expected at the Annual General Meeting in Ottawa on February 11, 12 and 13. In addition to J. M. Leamy, M.E.I.C., and G. C. Dunn, M.E.I.C., several other members have stated their intention of being present. It is hoped that some appreciable progress will be made on the proposed legislation for engineers.

St. John Branch

A. R. Crookshank, M.E.I.C., Sec'y.-Treas.

The regular monthly meeting of the St. John Branch was held February 20th.

After reading the minutes of the annual meeting, scrutineers were appointed to examine the ballots returned in the vote on the by-laws as revised by the Executive Committee to conform as closely as possible to the standard by-laws of *The Institute*. They reported that the necessary two-thirds vote had been cast in approval of the new code, which was then declared to be carried by the Chairman.

A discussion on the resolution of December 7th last of the Quebec Branch then took place, and on motion it was decided to endorse their action. This resolution calls upon the Council to request the Government to issue instructions to their Commissions and Departments to only appoint members of *The Engineering Institute*, or graduates from recognized engineering universities to fill all engineering positions and thus protect the public and raise the standing of *The Institute* and of the profession.

The Chairman then gave a verbal report of the meeting of the legislation committee, held at Ottawa during the annual meeting of *The Institute*, February 11-13, to which he was a delegate from this Branch. He explained the action taken, and read the resolution, which was adopted by the meeting and prensented at the annual meeting, which called upon *The Institute* to constitute a special committee to be composed of one delegate appointed by each Branch to meet at headquarters before April 15th, to draw up such sample draft of act as it may deem necessary and advisable in order that the members of *The Institute* throughout the different Provinces may ask for legislation on the same uniform basis, to the end that it may be submitted to Council by the 1st of May, and to the membership for ballot by June 1st. Mr. Kirby was appointed delegate with power to send a substitute if unable to attend himself.

The Chairman gave a general outline of the Ottawa meetings and mentioned particularly the effort being made by the Committee of *The Institute* to endeavor to secure proper remuneration for the engineers in the Civil Service.

A very interesting talk was then given by C. O. Foss, M.E.I.C., Chief Engineer of the St. John & Quebec Railway on "Reminiscences of the early days of Railway Location" a synopsis of which is as follows:—

The first railroad in the United States was built from Boston to Lowell in the early forties, was about twenty-five miles in length, and followed the general line of the Canal. This road, like most of the early railroads was built without an engineer, the technical adviser being a Harvard professor. He placed a rough quarried stone post under the ends of each tie. These soon had to be removed as the rails and wheels became badly racked.

The road was extended from Lowell to Nashua, about sixteen miles, and later on to Concord, the objective being to reach the White Mountains for handling tourist traffic. Previous means of locomotion to the now famous resorts in the mountains, were by means of carriers, a man named Crawford having carried many persons on his back.

About this time a company was formed, which erected a stone house on top of Mount Washington. The location was so exposed that it was necessary to fasten the roof on with chains. A bridle path was built over the mountains from the Crawford House to Mount Washington, which at that time was the only means of communication. In 1866 one Sylvester Marsh of Littleton perfected the rack road to the top of Mount Washington, which was then the first of its kind in the world. The speaker gave a description of the construction and operation of the road, outlining the safety devices used to guard against accidents, and stated that it is believed no fatal accidents had over occurred.

For some years tourists coached the twenty-five miles from Littleton to the base of the Mountains, until in 1872 a turnpike road was built to the Fabyan House, then a large hotel of some four hundred rooms. In 1874 the speaker had his first experience in locating a railroad, from the Fabyan House to the base of the Mountain. Later both sides of the Valley were carefully cross sectioned and contoured, and in 1875 a final location made to within a half mile of the rack road, the question then being whether to extend the line to the rack road up the Mountain or to bring the rack road down. The latter course was finally decided upon. Track laying was commenced in 1876, the method being fully explained, with many amusing incidents of getting engines off tracks and so forth.

The maximum grade on this line was five per cent, and the weight of the engines twenty tons.

An interesting account was given of the United States Signal Station on top of Mount Washington, where two men remained throughout the winter.

The meeting closed after a discussion on the definition of the term "engineer," and each member of the Branch is asked to hand in his definition of the word at the next meeting.

Montreal Branch

Frederick B. Brown, M.E.I.C., Sec'y.-Treas.

Nothing of unusual importance has transpired since our Annual General Meeting. The weekly meetings are still being held, three having taken place since the last issue of *The Journal;* on February 6th, "Some Problems in Ocean Transportation," by A. W. Robinson, M.E.I.C., and motion pictures; on February 20th, Construction of Canadian Northern Railway Tunnel, Montreal, an excellent paper by J. L. Busfiled, A.M.E.I.C., showing the construction and electrification of the tunnel, which attracted a great deal of attention, there being an audience of over two hundred, and on February 27th a paper by R. M. Wilson, M.E.I.C., on The Effect of Ice on Hydro-Electric Plants, an illustrated paper giving the results of operation, and of specially conducted observations on ice action. A discussion on this paper took place at the Ottawa General Professional Meeting but was cut short owing to lack of time and its continuation at this meeting produced some lively and timely comments. Many prominent hydraulic engineers and hydraulicians were present at the meeting and took part in the discussion, making a valuable contribution to the literature of the hydro-electric branch of engineering.

The executive is meeting every week; the subject of legislation is taking up a great deal of time, being very carefully considered.

PERSONALS

J. R. W. Ambrose, M.E.I.C., Member of Council, has been honored with the presidency of the Engineers Club in Toronto.

Major W. T. Wilson, A.M.E.I.C., and officers of the 256th Tunnelling Company, R.E., in a handsome greeting card received, extend their good wishes to the members of *The Institute.*

E. W. Oliver, M.E.I.C.,Toronto, has received recognition from the Dominion Government in receiving the appointment to the important position of Superintendent of the Toronto Niagara & St. Catherines electric railway.

Capt. H. R. Carscallen, A.M.E.I.C., arrived in Canada about the middle of January. Capt. Carscallen went to the front in the early days of the war and saw a great deal of active service. He was seriously wounded resulting in the loss of one of his legs.

Brig.-General Andrew G. L. McNaughton, A.M. E.I.C., of Montreal, commanding the Canadian Corps Heavy Artillery, sends his thanks to members for remembering him at Christmas and expresses his appreciation for the cigarettes which he received.

Capt. G. A. Bennet, J.E.I.C., 3rd Batt., Canadian Engineers, acknowledged his parcel of tobacco from Cologne, Germany. He says: Your parcel received yesterday for which I thank you very much. Players are always gratefully received. Boche cigarettes are "napoo." Hope to visit *The Institute* in a few months in Montreal.

H. T. Routly, A.M.E.I.C. honor graduate of the University of Toronto, has received the appointment from the Ontario Government of construction engineer of the Ontario Provincial Highways, to carry out the contract work of road development now under way by the Province of Ontario.

Lieut. A. H. Milne, B.Sc., (McGill, 1917), J., E.I.C. returned from England to his home in Montreal on January 23rd, having landed at Halifax on the "Empress of Britain" on the previous day. Before enlisting with the Canadian Engineers Lieut. Milne was with the Dominion Bridge Company, at Lachine, Que.

Lieut. Frederick O. Mills, R.N. A.M.E.I.C. has returned from active service, and while enroute to his home in Vancouver called at headquarters office. Lieut. Mills was engaged with the Motor Patrol of the British Navy, and was stationed on the "Adriatic" at the time of the famous scrimmage with the Austrian fleet. Before going overseas he was with the Greater Vancouver Sewerage and Water Board, and returns to resume his former position.

Major E. C. Goldie, A.M.E.I.C., Canadian Engineers, who went to the front with the 1st Canadian Contingent, sent a greeting card from the Canadian Corps Headquarters, Belgium, extending good wishes for Christmas and the New Year and expressing his thanks for the parcel of cigarettes. His card embodies the crest of the Canadian Engineers of which the beaver is the central figure, the body of the crest being the words "Canadian Engineers," surmounted by a crown and surrounded by a wreath of maple leaves.

John W. Roland, M.E.I.C., has been appointed chief engineer of the Nova Scotia Highway Board in succession to W. G. Yorston, M.E.I.C., who retires on account of ill health. Mr. Roland is a Nova Scotian. He was for a time on the engineering staff of the Panama Canal and on the completion of that work, held a professorial chair in the Nova Scotia Technical College, later becoming chief engineer for Foley Bros., Welch, Stewart & Fauquier, in the construction of the Halifax Ocean Terminals. Mr. Roland is an active member of the Halifax Branch of *The Institute* and is interested in all matters concerning the public welfare.

Col. C. H. Mitchell, C.M.G., D.S.O., Croix de Guerre, M.E.I.C. whose cable of greetings was read at the Annual Meeting at Ottawa, from London, has been appointed Dean of the Faculty of Applied Science and Engineering at Toronto University. It has been known for some time that this post has been kept open for Col. Mitchell but the official announcement has just been made by President Falconer. Col. Mitchell's hosts of friends in *The Institute* will receive this announcement with feelings of gratification and pleasure, for the work he has accomplished during the war has firmly established his position to a high place in the engineering profession.

Capt. Hobart R. Carscallen, M.C., A.M.E.I.C. Capt. Gerald M. Hamilton, B.A.Sc., M.C., A.M.E.I.C. Among the list of soldiers who were decorated with the Military Cross for conspicuous services, according to a despatch from London dated February 6th, the above are of particular interest to members of *The Institute*. Capt. Carscallen, M.C., is an associate member of *The Institute* and comes from Calgary, Alta. Capt. Hamilton is also an associate member, having been admitted in 1917 while on active service. His home is in Toronto, Ont.

Capt. W. Cornwallis Bate, M.C., A.E.I.C., has been awarded a bar to his Military cross for work done at Amiens. Unfortunately in the engagement at which Captain Bate was awarded this further honor, he was severely wounded in the head and right arm. He is expected to return to Canada shortly.

Greetings from Germany

Lieut.-Col. Harry F. Meurling, M.C., M.E.I.C., has forwarded to the Secretary, greetings from the officers of the 2nd Canadian Motor Machine Gun Brigade, from Bonn, Germany, where the Brigade was established under his command at that time. These greetings are contained in a handsomely printed menu and toast list of the Christmas dinner held by the officers' mess. It is evident that there was no lack of real Christmas food and the toast list and musical programme was of a high order.

Since this greeting card was received it is a pleasure to announce that Lieut.-Col. Meurling has also been awarded the Croix de Guerre.

Capt. Mitchell Wins V.C.

Capt. Coulson Norman Mitchell, V.C., M.C., A.M.E.I.C. The following citation from the London Gazette of February 3rd, contains details of how Capt. C. N. Mitchell, M.C., won the Victoria Cross:

Captain Coulson Norman Mitchell, M.C., Fourth Battalion, Canadian Engineers, for most conspicuous bravery and devotion to duty on the night of Oct. 8-9, 1918. At Canal Lescault, northeast of Cambrai, he led a small party ahead of the first wave of infantry, in order to examine various bridges on the line of approach, and if possible to prevent their demolition. On reaching the canal, he found the bridge already blown up. Under a heavy barrage, he crossed to the next bridge where he cut a number of lead wires. Then, in total darkness, unaware of the position and strength of the enemy bridgehead, he dashed across the main bridge over the canal bridge. This he found to be heavily charged for demolition.

Whilst Captain Mitchell, assisted by his non-com., was cutting the wires, the enemy attempted to rush the bridge in order to blow up the charges, whereupon he at once dashed to the assistance of his sentry who had been wounded. He killed three of the enemy, captured twelve, and maintained the bridgehead until reinforced. Then under a heavy fire, he continued the task of cutting the wire, removing charges which he well knew might at any moment have been fired by the enemy. It was entirely due to his valor and decisive action that this important bridge across the canal was saved from destruction.

Capt. Mitchell has been connected with The Institute since April 1911 and was transferred to associate membership in November 1917, while overseas. His home address is 310 Furby Street, Winnipeg.

OBITUARIES

Richard L. Newman, M.E.I.C.

Word has reached Montreal of the death from influenza of Richard L. Newman, at West Point, Virginia, on January 28th, 1919. The late Mr. Newman was born at Weymouth, England, July 15th, 1865, and received his training in the British Navy. He, however, later severed his connection with the Navy, and has been a resident of Canada and United States since 1890, following the profession of naval architect and consulting engineer, at one time designing and supervising the construction of vessels for the Marine and Fisheries Dept. Mr. Newman has also supervised the construction of ships in different parts of the world, having been in Russia in this capacity in 1916. At the time of his death he was supervising the construction of ships in the United States for the United States Emergency Fleet. He was elected a full member of *The Institute* in August 1914.

Mr. Newman is survived by his wife and two daughters.

Norman M. Thornton, M.E.I.C.

As we go to press just word is received of the death of Norman M. Thornton, M.E.I.C., of Edmonton, Alberta. Mr. Thornton was chairman of the Edmonton Branch for 1918 and had been re-elected for the current year.. Further particulars will be given in the April number.

A British firm of Boiler makers wish to be placed in touch with members of *The Institute* who would be interested in taking delivery of English build stationary boilers and erect same.

EMPLOYMENT BUREAU

Situations Vacant

Electrical Engineer.

Electrical Engineer required who has had sufficient experience to design the layout of a power plant and supervise the installation of machinery. Salary $250.00. Apply Box No. 28.

Municipal Engineer.

Competent municipal engineer with experience in building municipal streets and capable of taking care of public utilities, water and sewerage systems. Salary from $2,400 to $3,000. Apply Box No. 29.

Municipal Assistant.

General Foreman for Municipal work. Must be experienced in construction and maintenance of sewers and pavements. Preference will be given to men having been on Active Service. State experience, salary expected and reference. Box No. 31.

Mechanical Draughtsman.

Mechanical draftsman for large industrial plant, must be thoroughly competent with technical and executive ability. In replying state if strictly temperate, age, experience, education, and salary expected. Married man between 28 and 38 preferred. Address Box No. 30.

Engineer Agents Wanted.

Agents to represent a high class specialty manufactured by a firm in United States, for the selling of which technical knowledge is advantageous. Any reliable distributing concern or agency handling engineering specialties may apply for this Agency by addressing to Box No. 27.

Timber Scaler.

A timber scaler for the New Westminster Timber Agency, Department of the Interior, at a salary of $2,000 per annum. Candidates must hold a scaler's license from the British Columbia Government and must have had experience in the measurement of timber. Address Wm. Foran, Secretary, Civil Service Commission of Canada, Ottawa, Ont.

General Secretary Wanted.

For the new Association of Canadian Building, and Construction Industries. Preference will be given to young men, who have had engineering education, and construction experience. Good salary to the right man. Headquarters will be at Ottawa. Must be good organizer. Send Applications to President of the Association, 65 Victoria St., Montreal.

Astrophysical Observer.

An observer for the Dominion Astrophysical Observatory at Victoria, B.C., Department of the Interior, at salary of $1,700 per annum. Candidates must be graduates in Arts of a recognized university and must have taken an honour course in Astronomy and Mathematics. They should have practical experience in observational and measuring work in some observatory. Address Wm. Foran, Secretary, Civil Service Commission of Canada, Ottawa, Ont.

Engineering Clerk.

An assistant clerk of works in the Department of Public Works at Regina, at a salary of $1,500 per annu m Candidates must be fairly well educated. They must be competent mechanics with a few years experience in supervising building construction. They must be capable of preparing sketch plans and descriptions, also estimates of repairs and alterations to buildings. Address, Wm. Foran, Secretary, Civil Service Commission of Canada, Ottawa, Ont.

Town Engineer.

An Ontario town requires a town engineer capable of planning a system of good roads, specifying the composition of the roads, estimating costs, and supervising construction. Applicants should state education and experience both regarding roads and other municipal work, giving dates and places, references and salary expected. Address Box No. 32.

Immigratiou Commissioner.

A Commissioner of Immigration for the Western District, Department of Immigration and Colonization, at a salary of $2,500 per annum. The office of the Commissioner shall be in Winnipeg. The appointee must be capable of assuming responsibility for the direction, control and supervision of all Immigration employees within his territory and for the transaction of all official business arising from the Immigration Act. Candidates must have a good general education, a knowledge of business, together with executive ability and personality. They should produce credentials as to their general experience and qualifications for the position.

Application forms must be filed in the office of the Civil Service Commission not later than the 18th day of March. Application forms may be obtained from the Postmasters at Vancouver and Kamloops or the Secretary of the Civil Service Commission, Ottawa.

By order of the Commission,

W. Foran,
Secretary.

New Welland Canal Staff.

Applications will be received from persons qualified to fill the following positions on the construction staff of the New Welland Canal; Assistant engineers, instrument men, levellers, rodmen, draughtsmen, inspectors, time-keepers, accountants, store-keepers and chauffeurs. Applicants should apply in writing, on their own paper, to the Secretary of the Civil Service Commission not later then Saturday, March the 8th. Applicants should give full particulars as to name, address, age, qualifications, experience and previous employment, and should furnish the names of three reputable citizens as referees as to qualifications and character.

Application forms must be filed in the office of the Civil Service Commission not later than the 18th day of March. Application forms may be obtained from the Postmasters at Vancouver and Kamloops or the Secretary of the Civil Service Commission, Ottawa.

By order of the Commission,

W. Foran,

Secretary.

Ottawa, 13th February, 1919.

Preliminary Notice of Application for Admission and for Transfer

20th February, 1919.

The By-Laws now provide that the Council of the Society shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in March, 1919.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BALDWIN—ROBERT ARCHER, of Toronto, Ont. Born at Ottawa, Ont., Jan. 10th, 1875. Educ., Ottawa Coll. Inst. and private tuition, etc. 1895-97, with the topog. surveys dept., as rodman, dftsman, etc.; 1897-99, with Chas. E. Goad, Toronto and Montreal, dftsman and suveyor; 1899-1900, with G.T.R., as dftsman and asst. supervisor of bridges and bldgs.; 1900-01, dftsman, transitman, asst. to bridge engr., Algoma Central Ry.; Sept. 1901–May 1904, with N.Y. Central Ry., as follows: 1901-02, transitman; 1902-03, asst. supervisor of tracks; 1903-04, asst. engr. (L. S. & M. D.); 1904-05, ch. dftsman and in chg. of constrn., Wabash Ry., St. Louis, Mo.; with Mackenzie, Mann & Co., as follows: 1905-07, asst. engr.; 1907-11, ch. dftsman; 1911-12, dsgning engr.; 1912-13, div. engr. on constrn.; 1913-14, dist. engr., Toronto-Ottawa line and on surveys, also C. N. R. engr.; 1914-16, engr., 1914-16, engr. maintenance of way, and since March 1916 to date, asst. engr., C.N.R.

References: A. F. Stewart, T. W. White, F. D. Anthony, G. A. McCarthy, E. L. Cousins.

BARNES—FRANCIS MOUNTFORT, of St. John, N.B. Born at Bristol, Eng., Feb. 13th, 1887. Educ., Colston's School, Bristol, Eng., 1904. (1909, certificate prelim. exams. D.L.S.). 1904-07, articled pupil in surveying and munic. eng.; 1907-10, dftsman, water and sewerage dept., St. John, N.B.; 1910-12, dftsman, leveller, instrumentman, C. P. R.; 1913-14, dftsman, C. G. Ry., Moncton, N.B., and instru'man and res. engr., C. N. O. Ry.; 1914 to date, asst. engr., D. P. W., St. John, N.B.

References: A. Gray, A. R. Crookshank, C. L. Wetmore, W. M. Wilkie, G. N. Hatfield.

BLACK—JOHN R., of Sault Ste. Marie, Ont. Born at Duttou, Ont., Dec. 24th, 1881. Educ., private study, and Correspondence School. 1903-05, with G.T.P. Ry., as rodman on survey and topog.; 1905-07, instrumentman on constrn., N.T.C.Ry.; 1907-10, res. engr., N.T.C.Ry.; 1910-12, with A.C. & H.B.Ry., first as res. engr., later as div. engr. in responsible chg. of constrn.; 1912-14, engr. in direct chg. of constrn. of substructure of swing bridge over Little Current Channel and constrn. of freight and passenger terminals, for A.E.Ry.; Feb. 1914 to present date, sr. asst. engr., D.P.W. Sault Ste. Marie, Ont.; has been engaged in dsgning and constrn. of wharves, warehouses, etc., and in direct chg. of dredging works.

References: J. A. Heaman, H. L. Bucke, J. W. LeB. Ross, W. J. Fuller, B. E. Barnhill.

CREIGHTON—CHARLES SYDNEY, of Dartmouth, N.S. Born at Dartmouth, Aug. 15th, 1890. Educ., B.Sc. (C.E.), N. S. Tech. Coll., 1913. 1908 (4 mos.), bridge assembling; 1909-11, leveller, etc., on railway location; 1912 (4 mos.), railway constrn., as rock measurer; 18 mos., shopwork, assembling and drafting on steel constrn.; 4 yrs., officer in chg. of works for eastern sub. command of 3rd div. of Halifax Fortress, and at present time, transitman for R. W. McKenzie, Crown Land Surveyor.

References: W. P. Morrison, W. A. Hendry, J. L. Allen, J. F. Pringle, T. S. Scott, L. G. Van Tuyl.

CUTHBERT—ALLAN DAVID WATT, of New Glasgow, N.S. Born at Glasgow, Scot., May 5th, 1885. Educ., 3 yr. course in C.E., Glasgow and West of Scot. Tech. Coll. 1900-05, apprentice; 1905-07, asst. engr., on constrn., Danibrick Eng. Works; 1907-08, asst. engr. on constrn., Montreal L. H. & P. Co., Montreal; 1909-10, asst. engr. with Can. Gen. Development Co.; 1910-12, transitman in chg., C. P. R. Place Viger improvements; 1912-15, sr. transitman Montreal Terminals, C. P. R.; 1915-16, transitman in chg. bridge replacements, Sydney sub-div., C.G.Ry.; 1916 to date, sr. transitman, Can. Nat. Rys.

References: C. B. Brown, R. M. Wilson, S. B. McConnell, C. C. Kirby, R. Montgomerie, A. N. Jones, M. A. Fullington.

DAVIDSON—JAMES McNAUGHTON, of Winnipeg, Man. Born at Glasgow, Scotland, June 4th, 1878. Educ., private tuition and 1 yr. Dalhousie Coll. Rodman and instr'man, G. T. Ry. 2 yrs.; transitman 1 yr.; res. engr., on constrn., Man. and Sask., 4 yrs.; and 2 yrs. through B.C.; 1 yr. res. engr., in chg. of rip-rapping with G. T. Ry., along Fraser River, B.C., and since 3 yrs., res. engr., at Winnipeg, for Can. Nat. Rys.

References: G. C. Dunn, J. A. Heaman, H. A. K. Drury, A. W. Smith, W. Burns A. V. Redmond.

HALLOCK—BYRON, of Winnipeg, Man. Born at Forest, Ont., March 29th, 1876. Educ., public and business schools. 1901-03, rodman, leveller and transitman; 1905, in chg. of all surveying and field operations; 1907, in chg. of all field eng. and inspection of constrn.; 1915 to date, ch. field engr., and supt. of constrn., under city, engr. of Winnipeg.

References: H. N. Ruttan, W. P. Brereton, W. Aldridge, S. Wilkins, G. Guy.

HAYCOCK—RICHARD LAFONTAINE, of Ottawa, Ont. Born at Ottawa, Dec. 22nd, 1874. Educ., B.Sc. (M.E.), McGill Univ., 1897. While at college and up to 1901 worked in Can. Atlantic Ry. shops; 1901-02, with C. P. R., Winnipeg, in constrn. dept.; 1902-03, with Dom. Iron & Steel Co., Sydney, N.S., in drafting office, then asst. to mech. supt., on constrn. work, etc.; 1903-06, with Lackawanna Steel Co., Buffalo, N.Y., in chg. of mill maintenance; constrn., etc.; later in eng. dept., in chg. of roll. stock, hydraulic machinery, etc.; May 1906-1910, in eng. dept. of Internat. Marine Signal Co., Ottawa, in chg. of drafting office; then installing buoys, etc., in Brazil; 1910-14, member of firm Cauchon & Haycock, Consulting Engineers, Ottawa; 1914-16, acting waterworks engr., Ottawa; 1916-18, with Algoma Steel Corp., Sault Ste. Marie, Ont., as supt. of transportation, etc.; Sept. 1918 to present time, with Gen. Supply Co., Ottawa, doing mech. eng. work.

References. A. St-Laurent, R. deB. Corriveau, G. A. Mountain, J. Murphy, G. Grant, N. Cauchon, C. R. Coutlee, J. B. McRae.

HOGG—ROBERT LEWIS, of Campbellton, N.B. Born at Barrington Passage, N.B., April 10th, 1886. Educ., high school. 1906, rodman, etc., N. Y. C. & H. R. R.; 1906-07, instr'man and concrete inspector; 1907-08, leveller on B. & A. Ry., Boston; 1908-09, asst. supt. and gen. labor foreman, with C. A. Dodge Co., contractors; 1909-10, inspector of concrete, etc., with St. M. Ry.; 1910-11 (8 mos.), dftsman and res. engr., with N. T. C. Ry., at Mouche Lake, Que.; 1911-12 (6 mos.), member of firm Habicht & Hogg, engrs. and architects, at Springfield, Mass.; 1912 (3 mos.), estimator on location for K. V. Ry., B.C.; April 1912-Sept. 1914, res. engr. on constrn. with K. V. Ry.; June 1917 to date, transitman on constrn., Internat. Ry., Moffat, N.B.

References: R. A. Black, A. L. McCulloch, A. E. Doucet, J. L. Wilson.

JACOBS—LIONEL LESLIE, of Sault Ste. Marie, Ont. Born at London, Eng., March 1st, 1884. Educ., high school, 1898; city of London School (science), 1900; Swanley Coll. (scholarship), 1903; Goldsmiths Coll., 1910, did not complete course for B.Sc. degree, on account of being sent to Canada. 1908-10, with Dom. Tar & Chemical Co., London, Eng.; 1910-15, complete installation of tar distilling plant at Soo, for Dom. Tar & Chem. Co., latterly as works mgr.; installation of Benzol Extraction & Refrigerating plant for Toronto Chem. Co., Soo, and crude naphthalene plant for Dom. Tar & Chem. Co.; 1916-17, supt. and oven engr., for Algoma Steel Corp., in chg. of extensive repairs; 1917, to date, purchasing agent, Algoma Steel Corp., Sault Ste. Marie.

References: B. E. Barnhill, L. R. Brown, F. F. Griffin, C. H. E. Rounthwaite, N. L. Somers, W. S. Wilson, J. W. LeB. Ross, R. S. McCormick, J. S. H. Wurtele.

JAMES—ATLEE, of Wymark, Sask. Born at Oberlin, Kan., July 2nd, 1891. Educ., matric., St. John's Coll., Winnipeg. 1906-12, rodman, leveller, transitman, instrumentman, etc., C. P. R.; 1913-14, res. engr., C. P. R., Wpg.; 1915-16, instr'man, Connaught Tunnel Glacier, B.C., and at the present time, transitman on C. P. R. location party.

References: J. G. Sullivan; W. A. James, M. McKenzie, C. L. Bates, J. R. C. Macredie.

KYLE—DAVID, of Sault Ste. Marie, Ont. Born at Dalry, Scotland, Jan. 29th 1885. Educ., assoc. (M.E.), Royal Tech. Coll., Glasgow, Scot. (1906, passed exam' for A.M., I.C.E. (London).) 1911-12, mech. supt., Algoma Steel Corp.; 1912-14' asst. gen. supt.; at present time, vice-pres., in chg. of operations, Algoma Steel Corp. '

References: J. W. leB. Ross, R. S. McCormick, J. S. H. Wurtele, A. G. Tweedie, L. R. Brown.

LANDRY—JOSEPH HONORE, of Montreal, Que. Born at Maskinonge, Que., Feb. 27th, 1889. Educ., B. A., 1909, B.Sc. (C.E.), 1913, Laval Univ. Vacation, 1911, on survey with U. P. Boucher; 1913 (2 mos.), asst. engr., Outremont; 1913–May 1917, asst. engr., D. P. W., Canada, Montreal dist.; 1917-18, inspector, Dept. of Naval Service, on constrn. of trawlers; 1918 to date, sr. asst. engr., P. W. D.

References: J. L. Dansereau, A. E. Dubuc, U. P. Boucher, P. E. Mercier, S. A. Baulne, L. A. Desy, C. C. Leluau, A. Frigon.

LANZON—SILVIO A., of Toronto, Ont. Born at Valletta, Malta, March 4th, 1885. Educ., School of Eng., Malta Univ., 1906., licensed surveyor and architect for the Island of Malta. Jr. dftsman, rodman, leveller, Dry Docks, Naval Yards, Malta; dftsman, instrumentman and ch. of party, C. N. R.; 2 yrs. ch. of party, asst. engr., etc., Welland Ship Canal, St. Catharines, Ont.; 1912-13, right of way dept., C. N. R.; 1913-16, asst. engr. of constrn., Welland Ship Canal, work including laying out lines for cuts and fills, water-tight banks and foundations of structures, supervision of all materials used, pile driving, mixing and placing of concrete, etc.; at the present time, dftsman, Toronto Harbor Comm.

References:—F. F. Clarke, J. L. Weller, W. H. Sullivan, E. G. Cameron, A. Bradt, G. F. Clark.

MACDERMOT—SIDNEY GUY, of Montreal. Born at Jamaica, B.W.I., Jan. 27th, 1885. Educ., B.Sc., McGill Univ., 1905. 1905-12, asst. to elec. engr., C.P.R.; 1912-16, elec. contracting; 1916 to date, sup. in chg., mgr. mech. and elec. depts., Can. Johns Manville Co. (Montreal branch).

References: J. M. Robertson, R. S. Kelsch, F. S. Keith, E. Brown, L. A. Herdt, J. A. Shaw.

MORRIS—WILLIAM ROBERT CARNAC, of Vernon, B.C. Born at Madras, B.I. Educ., Eastbourne Coll., and private tuition (M.I.C.E.) Articled pupil to Sir Douglas Fox and Partners, 3 yrs.; asst. engr., to Sir D. Fox, on railway, parliamentary and reclamation work in British Isles, 5 yrs.; res. engr. on Interoceanic Ry., of Mexico; engr. in chg. of section of Galway & Clifden Ry., Ireland, also of Liverpool Overhead Ry. tunnel for the Construction Co.; engr. in chg. of section of Great Cen. Ry.; 1898-1903, engr. in chg. of Soudbury Tunnel,and G. N. P. & B. R. R., for S. Pearson & Son; 1903-06, engr. in chg., for the London County Council, eng. dept., of the Holborn to Strand improvements; 1907-09, private practice in B.C.; 1910-15, acting dist. engr., for the water branch, lands dept., of B.C.; 1915 to date, on munition inspection in Montreal, Imperial Min. of Munitions.

References: J. M. R. Fairbairn, P. B. Motley, W. M. Young, R. J. Durley, P. W. St. George, E. Wragge.

PATTERSON—HARRY W., of Windsor, Ont. Born at Merritton, Ont., Feb. 22nd, 1891. Educ., London Coll., I. C. S. (C. E. course). 1907-08, apprenticed rodman, instrumentman, etc.; 1908-10, with F. W. Farncombe, London, on sub-div., surveys, paving, etc.; 1910-11, rodman, etc., with C. P. R. Guelph; 6 mos., with Ont. div., C. P. R., on yard surveys, bridge replacements, etc.; 3 mos., Tavistock Water Works, on constrn., reservoir, etc.; 1912-13, on layout and constrn. of underground conduits with Detroit-Edis on Illuminating Co.; Feb. 1913, to date, with Owen McKay on sub-divs., surveys, prelim. and constrn. of city and township paving etc., in Walkerville, Ford and Sandwich.

References: O. McKay, F. C. McMath, G. E. Roehm, F. H. Kester, M. E. Brian, O. Rolfson.

RICKETTS—SYDNEY FRANK, of Winnipeg, Man. Born at London, Eng., Jan. 28th, 1883. Educ., E. E. course, Finsbury Tech. Coll., London, Eng., and evenings, Regent Street Polytechnic (A.M.I.E.E., England). 1900-03, shift engr., in chg. sub. stations, London United Elec. Tramways Ltd.; 1904-09, res. engr., China Light & Power Co. Ltd., Canton, S. China, supervision of all work in connection with erection and operation of steam plants, etc.; later exec. mgr., in Hong Kong, head office of above company; 1909-11, organized and managed machinery dept. for Shewan James Co., gen. importers and exporters; 1911-18, gen. supt., North Arm, S. S. Co., Vancouver, management and supervision refitting of steamers; 1912-16, in chg. of constrn. work, new power plant, City of Moose Jaw, Sask.; 1916-17, joint responsibility for Can. Gen. Elec. sub-contract on T. C. Ry., elec. work, etc., asst. mech. supt., Ross Rifle Co. (on economical research work), Quebec, Nov. 1917, sales engr., Can. Gen. Elec. Co., Toronto; 1917 to date, apparatus sales engr. and asst. mgr., C. G. E., Winnipeg dist.

References: E. V. Caton, J. M. Leamy, G. L. Guy, E. Brydone-Jack, W. P. Brereton.

ROSS—KENNETH GEORGE, of Sault Ste. Marie, Ont. Born at Toronto, Ont., Aug. 2nd, 1884. Educ., S. P. S., Toronto Univ., O. L. S. Is member of firm Lang & Ross, Soo, Ont., work including road constrn., railway constrn. contracts, power lines, highways bridges, etc. Has recently returned from overseas.

References: C. H. Rogers, E. L. Cousins, A. L. MacLennan, W. Chipman, J. W. LeB. Ross, R. E. Chadwick, R. S. McCormick, A. H. Greenlees, A. E. Beck.

SCHOFIELD—STEWART, of Winnipeg, Man. Born at Monaghan, Ireland, Aug. 25th, 1887. Educ., matric., Man. Univ. (B.C.L.S. Ass'n.). 1905-08, with C. P. R., as rodman, dftsman; 1909, dftsman on r. r. location, P. G. E. Ry.; 1909-13, asst. to B. C. land surveyor, in chg. of party; 1913-15, asst. engr., C. N. R., in chg. of layout and erection of round houses, water supply and sewers, etc., at Calgary and Lucerne, B.C.; 1918 to date, valuation engr., Can. Nat. Ry.

References: T. Lees, A. V. Redmond, T. Turnbull, T. White, W. T, Moodie.

SHERRIN—PHILLIP, of Ottawa, Ont. Born at Chelmsford, Eng., Jan. 4th, 1873. Educ., St. Edmunds Coll., Ware, Eng., and Coll. Feldkirch, Austria. 1890, served articles with his father as architect; 1894, with Carron Iron Works, Scotland; 1896, with C. P. Kendall & Co., heating engrs., of London, Eng., dsgning, laying out, buying; 1898, engr. on Queen Gold Mine, Rhodesia, until Boer War; returned to England and took position as agent and engr. with A. J. Kellett, contractor; 1903, built furniture works, buying all materials, installed power house, gas plant, etc.; 1905, with Moran & Son, as agt. and engr. on Midhurst Sewerage Scheme, later res. engr. with Willcox & Raikes, of Birmingham and London; 1910, mgr. of North British Plumbing Co., carrying out the sanitary work of the Houses of Parliament, The Law Courts, etc.; 1912, in chg. of staff in Russia, completing drainage and sanitary work for Prince B. G. Narischkine; returned to England and accepted position as engr. with Moran & Stapleton; 1914, with Dept. of Interior, and at the present time supervising engr., tech. plant, Dept. of Nat. Resources, Intelligence Branch, Ottawa.

References: G. G. Gale, J. Murphy, J. Blizard, J. B. McRae, N. Cauchon.

SMITH—WILLIAM NELSON, of Winnipeg, Man. Born at Brattleboro, Vt.; June 5th, 1868. Educ., M.E., Cornell Univ., 1890. 1894-97, elec. engr., in chg. of constrn., maintenance power plants, and roll. stock, New Orleans Traction Co.; 1899-1911, elec. traction engr., dsgn. elec. ry. layouts, etc., with Can. Westinghouse Kerr Co., N.Y.; 1912, consl. engr., with Wash. & Old Dom. Ry., Washington, D.C.; 1914, consl. engr., S. F. & O. Ry.; 1915, consl. engr., Fort Pitt Bridge Works; 1916-18, efficiency engr., Amer. Agric. Chem. Co., Boston, improving steam power plants; 1918, estimating for elec. power transmission, with S. E. Junkins & Co., Vancouver; 1918 to present time, consl. elec. engr., Wpg. Elec. Ry., Winnipeg.

References: S. E. Junkins, T. K. Thomson, E. J. Beugler, W. M. Scott, G. L. Guy.

TAIT—ERNEST LEROY, of New Westminster, B.C. Born at Duart, Ont., Dec. 6th, 1881. Educ., undergrad., Toronto Univ. 1902, field dfting, N. T. C. Ry.; 1903-05, level and transit man; 1905, instrumentman on gen. constrn., C. P. R., gen. track work; 1906, drafting and levelman on location of spiral tunnels; 1906-08, levelman and dftsman, on B. C. Elec. Ry., in chg. of constrn. and maintenance of way; May 1918 to date, acting engr. of constrn. and way.

References: F. S. Easton, C. G. Moon, J. McHugh, J. H. Devey, J. H. Kilmer, F. Silverton.

TULLY—ARTHUR PHILIP HOLDEN, of New Glasgow, N.S. Born at Kentville, N.S., April 25th, 1886. Educ., 3 yr. course in eng. at Univ. St. Francois Xavier. 1908-12, dftsman, N. T. C. Ry., St. John; 1912-18, with C. P. R., as follows: 1912-14, bridge inspector in chg. of constrn. of Bear River, Windsor and Weymouth Bridges, also on North Mountain Ry.; 1916-17, bridge and bldg. inspector; May 1917-1918, sr. transitman; May 1918 to present time with C. G. Rys., as transitman, etc.

References: C. O. Foss, H. Longley, G. G. Hare, C. C. Kirby, R. Montgomerie, B. Ripley, J. L. F. Millar.

TYRELL—JAMES W., of Hamilton, Ont. Born at Weston, Ont., May 10th, 1863. Educ., 3 yrs., S. P. S. General practice for 36 yrs. (Was formerly a Member of *The Institute*.)

References: E. R. Gray, A. F. Macallum, W. F. Tye, N. Cauchon, R. W. Leonard.

VENNEY, LEONARD THOMAS, of Windsor, Ont. Born at Brockville, Ont., Feb. 29th, 1888. Educ. B.A.Sc., Univ. of Tor., 1911; D. L. S.; 1907, (6 mos.), asst. on exploration work in mining district, Northern Ontario; 1908-9, field dftsman, H. B. Ry.; 1910 (7 mos.), dftsman & inst'man in chg. of residencys Nos. 35 and 36, N. T. Ry.; 1911-12, in chg. of 20 miles of constrn., Algoma Central Ry.; 1912-13, asst. to F. M. Eagleson, Winchester Ont.; 1913-15, on D. L. Surveys; 1915-16, mine surveyor with Hollinger Gold Mine, Timmins, Ont.; 1916-17, with Aluminum Co. of America, on constrn. of town and plant at Badin, N.C.; on constrn. of Yadkin Narrows Dam and investigations for Yadkin Falls Dam; 1917 to date, with Can. Steel Cor., Ojibway, Ont., on estimates and design of sewers, water supply system, etc.

References: A. E. Eastman, C. B. Thorne, H. Thorne, R. S. McCormick, P, Gillespie, J. Armstrong, J. S. Nelles.

WALCOTT—WILLIAM DANIEL, of Toronto, Ont. Born at Lucea, Jamaica, May 31st, 1887. Educ., B.A.Sc., Toronto Univ., 1912. 1909 (5 mos.), asst. chemist, Can. Iron Corp., Midland; 1910, shop work, etc., Can. Foundry, Toronto ;1911 (5 mos)., dftsman, C. N. R., Winnipeg; 1912, structural dftsman, Dom. Bridge Co., Montreal; 1912-13 (9 mos.), dftsman, Can. Foundry, Toronto; 1913 (3 mos.), topog. on survey, Hydro Elec. Power Comm.; 1913-14 (6 mos.), estimator, roadways dept., Toronto; 1914-15, read locating engr., and dept. surveyor, D. P. W., Jamaica; 1915 (7 mos.), res. engr. on canal constrn.; Jan. 1916-July 1917, with C. E. F.; 1917-18, constrn. engr., Standard Chem. Iron & Lumber Co., Toronto; July-Dec. 1918, estimator, Can. Aeroplanes Ltd.; Dec. 1918 to date, asst. laboratory engr., Hydro Elec. Power Comm., Toronto.

References: E. B. Merrill, M. A. Stewart, J. H. Curzon, P. Gillespie, R. B. Young

WARING—JAMES ATKINSON WILLIS, of St. John, N.B. Born at St. John, N.B., Jan. 3rd, 1875. Educ., grammar school. 1891-94, apprentice machinist and architect; 1894-95, marine engr., B.W.I. Govt.; 1895-97, machinist, C. P. R.; 1898-1900, rodman and dftsman, C. P. R., St. John, N.B.; 1900, machinist, Westgarth Furness Co., and Blair's Ship Yard, England; 1901 to date, dftsman, res. engr. and asst. engr., C. P. R., St. John.

References: J. H. Barber, C. L. Wetmore, C. C. Kirby, G. G. Murdoch, G. S. Baxter.

WHEATLEY—JAMES HOWARD, of Westmount, Que. Born at Troy, N.Y., July 1st, 1890. Educ., B.Sc. (M.E.), McGill Univ., 1912. Machine shop training in Montreal plants of Steel Co. of Canada; several months with Robt. W. Hunt & Co., as inspector, supervising mfr. of railway and gen. industrial equipment; with Northern Elec. Co., 1912-15, in the cable eng. dept., including the design and mfr. of elec. power, telegraph, signal cable and wires, etc.; Feb. 1916-July 1918, with British Munitions Co., Verdun, Que., organizing and in chg. of eng. dept., including design of gauges, jigs, etc.; later factory supt. in chg. of production, etc.; From July 1918 with C. E. F., and at the present time is not employed.

References: H. M. Lamb, E. Brown, C. M. McKergow, H. M. Goodman, A. R. Roberts, J. S. Cameron, C. Warnock.

WHITMAN—CLYDE OLIVER, of Sault Ste. Marie, Ont. Born at New Albany, N.S. May 14th, 1889. Educ., 2 yrs., app. science, Acadia Univ., 1917. Aug. 1910-Sept. 1914, maintenance dept., C. P. R., as stenographer and clerk; 9 mos. in res. engr's. office and doing gen. rodman's work; summer 1916, on eng. staff, Cape Split Development Co., instrumentman, keeping records of tides, etc.; 1915 (6 mos.), on field eng. staff, Algoma Steel Corp., Sault Ste. Marie, as rodman; Oct. 1917, to date, instrumentman on maintenance and constrn.

References: W. W. Benny, L. M. Jones, J. Bowie, H. W. Harris, B. E. Barnhill, N. L. Somers, L. R. Brown.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

CRAIG—JOHN CORMACK (Major), D.S.O., of Vancouver, B.C. Born at Aberdeen, Scotland, July 10th, 1874. Educ., Robt. Gordon Coll., 1890-93, apprentice, Hall Russell & Co., shipbldrs., and engrs.; 1894-1900, apprentice and gen. asst. to city engr., Aberdeen; 1900-03, asst. res. engr; 1903-05, asst. engr., under J. W. D. Bradley, London, Eng., in chg. of reconstrn. of sewers, etc.; 1905-08, res. engr., P. W. D., on constrn.; 1908-13, res. engr., in chg. of harbor extension works, etc.; 1914 (4 mos.), dftsman, P. C. E. Ry., Vancouver; Oct. 1915-1916, capt., front line trenches, tunnelling roads, light railways, etc.; 1916 to 1918, Major, ch. engr. and 2nd in command of Railway Troops; 1918 to present time, asst. director of constrn., light ry. section (awarded D.S.O. and 3 times mentioned in despatches).

References: G. R. G. Conway, P. R. Warren, J. Callaghan, A. D. Creer, R. F. Leslie.

CRAIG—JOHN DAVIDSON, of Ottawa, Ont. Born at Kingston, Ont., Jan. 30th, 1876. Educ., B.A., 1897, B.Sc. (mining), 1900, Queen's Univ., D.L.S. Summer 1899, assayer's asst., Greenwood, B.C.; 1901, articled pupil, D.L.S.; 1900-02, on staff of surveyor-general, Ottawa, drafting, gen. tech. office work, etc.; 1904, inspector of contracts, Dom. Land Surveys, Man. and Sask.; 1905, attache, representing Can. Boundary Comm. on U. S. party, Alaska survey; 1906-08, on survey of boundary between Alaska and B.C.; 1909-13, in chg. for Canada, of survey of boundary between Alaska and the Yukon; 1914-17, asst. supt., geodetic survey; 1918 to date, engr. with the Internat. Boundary Comm., Ottawa.

References: J. J. McArthur, C. A. Bigger, C. R. Coutlee, J. B. Challies, S. J. Chapleau, G. B. Dodge, H. B. R. Craig.

DRYSDALE—WILLIAM FLOCKHART, of Paris, France. Born at St. Andrews East, Que., July 16th, 1881. Educ., private tuition, B.Sc., McGill Univ. 1904. 1899-1904, apprentice with G. T. P. Ry.; 1904-05, dsgn. and calculating locomotives for American Locomotive Co., Schenectady; 1905-06, cost estimating engr., Am. Locomo. Co., N. Y. C.; 1906-08, asst. to ch. engr., on elec. locomo. and trucks, shop machinery and power; 1908-11, power engr. of all plants of Am. Loco. Co.; 1911-14, mech. engr. and asst. supt. of motor power, Ferrocaril de Costa Rica, C. A., and Northern Ry. of Costa Rica; dsgning and erecting re-inforced concrete bldgs., for United Fruit Co., in Costa Rica; special observation car, new loco. and car shops, etc.; 1914-15, asst. to works mgr., Steel Co. of Canada; 1915-16, asst. to vice-pres., Am. Loco. Sales Corp., N. Y.; July 1916 to date, special engr., representative in Europe, having chg. of all contracts and erection of loco. for France and Italy.

References: F. S. Keith, F. A. McKay, F. B. Brown, A. Roberts, H. H. Vaughan, H. M. Jaquays.

ELLIOT—LAURIE BENJAMIN, of Edmonton, Alta. Born at Dartmouth, N.S., May 16th, 1883. Educ., B.Sc., Dalhousie Univ., 1903, private study and I. C. S. 1903-04, 2nd asst. engr., city engr's office, Halifax, N.S.; 1904-09, with T. C. Ry., as rodman, leveller, transitman, res. engr.; 1909, engr. in chg. of party, C. P. R. irrigation dept.; 1909-10, asst. engr., P. W. D., Calgary; 1910-12, acting dist. engr., P. W. D., Canada, Calgary; 1912-to date, dist. engr., P. W. D., Edmonton.

References: J. L. Coté, D. Donaldson, A. T. Fraser, R. J. Gibb, A. W. Haddow.

MOORE—ERNEST VIVIAN, of Montreal. Born at Peterboro, Ont. July 23rd, 1878. Educ., B.Sc., McGill Univ., 1900. 1901-03, asst. engr., Dept. of Railways & Canals, on Port Colborne Entrance improvements; 1904-05, research work connected with mfr. of peat fuel; 1916-17, built and managed plant of the Joliette Steel Co.; Sept. 1917-Jan. 1918, consl. engr., Montreal; Feb. 1918 to date, consl. engr., Peat Committee of the Ont. and Dom. Govts., in full chg. of investigations.

References: R. A. Ross, B. F. Haanel, F. S. Keith, F. B. Brown, J. M. R. Fairbairn.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

DALZIEL—WILLIAM, of Montreal. Born at Summerside, P.E.I., Aug. 1st, 1885. Educ., B.Sc., Queen's Univ., 1913., accounting and commercial law. Was with accounting, eng. and commercial firms for 9 yrs.; 1 yr. machine shop work and 1 yr. mech. dftsman; engr. in chg. of constrn. and hydraulic power plants under Henry Holgate; 1915-16, efficiency and constrn. engr., Ross Rifle Co.; Jan.-July 1916, asst. inspector of ammunition, Imperial Ministry of Munitions; July-Nov. 1916, dist. inspec. of ammunition, Montreal dist ; 1916-18, inspec. of shell components, etc., Nov. 1918 to present time, mech. supt., Caron Bros., Longue Pointe.

References: H. Holgate, H. H. Vaughan, R. J. Durley, J. L. Allison, H. M. Jaquays, S. F. Rutherford.

McLAREN—WALTER CORNING, of Toronto, Ont. Born at Buckingham, Que., Feb. 15th, 1887. Educ., McMaster Univ. 1906-07, topo. N. T. C. Ry.; 1908-09, rodman on constrn., G. T. P. Ry.; 1909, instrumentman on constrn.; 1911-13, res. engr., C. N. P. Ry.; 1913-14, instru'man, K. V. Ry.; 1916, instru'man, on Toronto Harbor, with T. Stewart Constrn. Co.; 1917, inspector, reinforced concrete subway, C. P. Ry.; 1918 to date, dftsman, estimating, res. engr., C. N. R. and H. & S. F. Ry., Toronto.

References: A. F. Stewart, H. T. Hazen, J. R. MacKenzie, S. H. Sykes, R. Ferguson.

OLIVER—STUART ERSKINE, of Quebec. Born at Quebec, Feb. 23rd, 1888. Educ., B.Sc. (C.E.), McGill Univ., 1911., Q. L. S., 1914. Summers 1906-10, rodman, and leveller on prelim. and locative surveys, C. N. R., T. C. and Que. Ry. Light & Power Co.; 1911-12 (9 mos.) transitman and ch. of party on surveys Q. E. Ry.; 1912-13 (7 mos.) ch. of party, C. & G. T. Ry.; 1913-14, with Evans & Oliver, consl. engrs. and land surveyors; 1915, res. engr., transmission line constrn., Laurentian Power Co,. 1916 (3 mos.), surveys for same company; 1916 to date, res. engr., Que. & Sag. Ry., on constrn.

References: E. A. Evans, J. Ruddick, S. S. Oliver, E. S. Holloway, A. Dick, W. Lefebvre.

PERRIE—WILLIAM WALLACE, of Hamilton, Ont. Born at Hamilton, Ont., June 3rd, 1894. Educ., private tuition, high school and I. C. S. (C.E.)., O. L. S., 1917. Since April 1913, with MacKay, MacKay & Webster, Hamilton, as follows: 3 yrs., apprentice; 1914 (6 mos.), field engr., on sewer constrn., London, Ont.; since 1914, has been in chg. of gen. county and township eng. work and surveying, including dsgn. and constrn of roads, bridges, etc.; and at the present time is carrying on gen. civil eng. and surveying practice with MacKay, Mackay & Perrie.

References: E. H. Darling, F. W. Paulin, W. B. Ford, J. Taylor, J. B. Nicholson, E. R. Gray.

FOR TRANSFER FROM ASSOCIATE TO HIGHER GRADE

GRUNSKY—HERMAN WASHINGTON, of Ottawa, Ont. Born at Stockton, Cal., Jan. 16th, 1873. Educ., A. B. Standford Univ., 1899, LL.B., Harvard Law School, 1903, passed exam. given by the U. S. Dept. of Agric. (Irrigation Branch), as Irrigation Engineer. 1910-12, in chg. of irrigation investigations (U. S. Dept. of Agric.), Oregon; 1912, directed duty-of-water investig'ns, in Deschutes River Basin; also directed preparation of special reports on irrigation in Oregon for the Div. of Irrigation, Washington, D. C.; reported under Dr. Fortier, on arid parts of B.C., to the B.C. lands dept.; 1912-13, in chg. of prep. of annual report of B.C. water rights Branch; 1912-14, specialized on water power administrative problems in B.C., being major-author of the B.C. water rental regulations, including tech. features. Since 1914, legal adviser on water power matters, Dept. of Interior, Ottawa, covering eng. and economic aspects.

References: R. A. Ross, J. B. Challies, H. G. Acres, A. Amos, F. H. Peters.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

BOISSEAU—LOUIS JOSEPH GUSTAVE, of Montreal. Born at Montreal, Oct. 29th, 1892. Educ., B.A.Sc., Ecole Poly., 1916. 1913 (vacation), on constrn. of roads; 1915, on survey of Quebec harbor, in chg. of soundings; since June 1916, with Quebec Streams Comm., as follows: 1916, transitman and ch. of party on survey of Lake Kenogami; 1917, in complete chg. of survey near Great Lake Jacques-Cartier; later was engaged in gauging of rivers, and at the present time, superviser of constrn. of Lake Burle storage dam.

References: O. Lefebvre, A. Surveyer, A. O. Bourbonnais, H. Massue, L. Hurtubise.

LECLAIR—WILLIAM JAMES (Capt.), of Ottawa, Ont. Born at Ottawa, Aug. 24th, 1891. Educ., matric. for McGill Univ., 1 yr. Queen's Univ., and C.E. course in S. P. S. Was for several yrs. in the water power development and power house constrn. of the Bronson Co., Ottawa Power Co., and Ottawa Elec. Co., at Ottawa; 6 yrs. in the P. W. D., of Can., latterly as asst. engr. in chg. of work; for the past 3 yrs., Tech. officer in the Can. Forestry Corps, in Britain and France.

References: C. R. Coutlee, S. B. Johnson, J. B. McRae, J. Murphy, A. McDougall.

McNEICE—LEONARD G., of Wallaceburg, Ont. Born at Draper Township, Ont., May 31st. 1890. Educ., B.Sc., Queen's Univ., 1913. 6 mos. apprentice on Dom. land surveys; 1913-14, transitman on A. & H.B.Ry.; 1914-16, asst. with Chipman & Power, Toronto; 1916, to present time, mgr. of Wallaceburg Hydro-Elec. System, water works supt. and town engr., Wallaceburg.

References: W. Chipman, J. A. McPhail, L. Malcolm, G. H. Power, E. M. Proctor.

SCOTT—EDWIN HARRY, of Toronto, Ont. Born at Belmont, Ont., May, 28th, 1889. Educ., B.A.Sc., Toronto Univ., 1915. With Algoma Steel Corp.; 1910 (3 mos.), rodman, inspector, etc.; 1911, rodman on constrn., C. N. R.; 1911 (3 mos.) with A. C. Ry., as instr'man and inspector; 1914, location rodman, C. N. R.; Sept.-Oct. 1915, ballasting instr'man, etc., C. N. R.; 1915-18, on active service; and at the present time with Can. Nat. Rys., as instr'man.

References: A. F. Stewart, H. K. Wicksteed, P. Gillespie, C. R. Young, T. R. Louden.

THORN—GEORGE OLIVER, of Saskatoon, Sask. Born at Bristol, Eng., Dec. 12th, 1886. Educ., B.Sc. (C.E.), Sask. Univ., 1916. 1906-10, mason on bldg. constrn.; 1912, in city engr's dept., Saskatoon; 1913, inspector of sidewalks, sewer and water mains; 1914 (7 mos.), inspector, testing cement and gravel and in chg. of pouring of concrete; since May 1916, lieut. in Can. Engrs., at present awaiting discharge.

References: A. R. Greig, G. T. Clark, H. McI. Weir, J. E. Underwood. W. M. Stewart.

WILLIAMS—JACK NORTHMORE, of Paris, Ont. Born at Burlington, Ont., July 29th, 1892. Educ., B.A.Sc., Toronto Univ., 1915. With Tyrrell & Mackay, engr. and surveyors, Hamilton, 15 mos., as rodman, instrumentman, etc.; later with C. N. R., as rodman on constrn. (5 mos.); asst. dsgnr. and inspector with Frank Barber, consl. engr., Toronto (6 mos.); later engr. with Wells & Gray, engrs. and contrs., Toronto; 1915-18, with C. E. F. on active service; at present time, principal asst. engr. on constrn. of Paris dam for the Foundation Co. Ltd., Montrea

References: F. Barber, R. E. Chadwick, P. Gillespie, J. Rankin, F. W. Paulin,

ENGINEERING INDEX

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RAILROAD ENGINEERING

ELECTRIC RAILWAYS

Braking, Regenerative. Brake System with Recuperation of Energy for Vehicles Operates by Single-Phase Commutator Motors (Système de freinage avec récupération d'énergie pour véhicules actionnés par moteurs monophasés à collecteur). Behn-Eschenburg. Revue Générale de l'Electricité, vol. 4 no. 23, Dec. 7, 1918, pp. 877-881 5 figs. Description and theory of system adopted at Oerlikon Construction Works for the St. Gothard locomotives, which permits operation of brakes with recuperation, at all loads and speeds. A coil of known reactance is only apparatus added to normal installation of motor. Also abstracted in Elecn., vol. 81, no. 2118, Dec. 20, 1918, pp. 708-710, 4 figs.

Coasting Clock. The Electric Coasting Clock. Ry. & Locomotive Eng., vol. 32, no. 1, Jan. 1919, pp. 22-23, 3 figs. Instruments which records actual number of minutes an electric train is operated without use of power or brakes.

Government Ownership. Public Ownership the Obvious Policy for Electric Railways, Richard McCullough. Elec. News, vol. 28, no. 1, Jan. 1, 1919, pp. 27-28, Analysis of present situation; advantages of public ownership to public and investor Paper before Elec. Ry. Assn.

Locomotives. Oscillations of Electric Locomotives (Oscillations des locomotives électriques), P. Leboucher. Revue Générale de l'Electricité, vol. 4, No. 24, Dec' 1918, pp. 914-930, 35 figs. Mathematical analysis of forces developed in members when continuous torque is transmitted by a crank The different dispositions, adopted in electric locomotives of this class are considered separately. Writer shows that the combination of crank and connecting rod gives rise to serious vibrations of chassis; he advocates suppression of this mode of transmission on electric locomotives.

Motor-Generator Sets. Performance of Motor-Generator Sets for the Chicago Milwaukee & St. Paul Ry., F. T. Hague. Elec. Jl., vol. 16, no. 2, Feb. 1919, pp. 47-52, 11 figs. Power-factor curves of synchronous motor, temperature curves at full load, and 1.5 load, and direct current short-circuit test at 9.25 load. Special reference is made to commutating machinery of large units.

Track Circuits. The influence of Zinc Ties on Track Circuits, Ry. Age, vol. 66, no. 5, Jan. 31, 1919, pp. 305-306. Report of discussion at the convention of Ry. Signal Assn.

Leakage Resistance of Electric Railway Roadbeds, E. R. Shepard. Elec. Ry. Jl., vol. 53, no. 4, Jan. 25, 1919, pp. 172-178, 7 figs. Results of tests covering a period of more than three years made upon railway tracks in Washington, D. C., and upon short sections of experimental track on the Bureau of Standard grounds.

ELECTRIFICATION

Advantages. Railroad Electrification Facts and Factors, A. J. Manson. Ry. Elec. Engr., vol. 10, no. 1, Jan. 1919, pp. 3-4, 1 fig. Reason for adoption of electric motive power and advantages obtained from its use.

C. M. & St. P. Chicago, Milwaukee and St. Paul Electrification in Washington W. A. Scott, Elec. Rev., vol 74, no. 1, Jan. 4, 1919, pp. 1618, 1 fig. Principal features of power feeder and trolley lines, substation and locomotive equipment.

France. The Partial Electrification of the French Southern Railway (électrification partielle des chemins de fer de la Compagnie d'Orléans). Génie Civil, vol. 74, no. 1, Jan. 4, 1919, pp. 4-9, 4 figs. Program of the Paris & Orleans R. R. Conference before the Société d'Encouragement pour l'Industrie Nationale.

South Africa. S. A. R. Annual Report. S. A. Min. Jl. & Eng. Rec. vol. 28, pt 1, no. 1416, Nov. 16, 1918, pp. 227-228. Electrification and control of shipping in South African Railways. From report of general manager of railways and harbors.

Western States. Transportation and Western Power problems, John H. Lewis, Jl. Elec., vol. 42. no. 1, Jan. 1, 1919, pp. 14-15. Suggestions in regard to railway electrification and development of navigable streams.

EQUIPMENT

Cinder-Handling Plant. A New Type of Locomotive Cinder-Handling Plant. Ry. Age, vcl. 66, no. 5, Jan.31, 1919, pp.319-320. 2 figs. Description of a plant for the Pittsburg and Lake Erie at Hasleton Yard, Youngstown, O., which includes an inclined hoistway to a storage bin.

Coaling Station. New Philadelphia and Reading Coaling Station. Ry. Rev vol. 64, no. 5, Feb. 1, 1919, pp. 174-176, 6 figs. Plant arranged to handle both anthracite and bituminous; elaborate sand-handling features; general description of what is believed to be the largest concrete coaling station in the world.

FOREIGN

British. British Railways Under War Conditions. Engineer, vol. 126, no. 3283, Nov. 29, 1918, pp. 454-455, Railwaymen with the colors. (Tenth Article).

Government Ownership, British. Nationalization of British Railways. Ry. Gaz., vol. 29, no. 24, Dec. 13, 1918, pp. 671-674, 1 fig. Factors bearing on policy of railroad Government ownership; discussion of basis for arriving at price which will be fair alike to state and shareholders.

Peru. Peru and Its Principal Railways, Clayton Sedgwick Cooper, Ry. Rev., vol. 64, nos. 1 & 2, Jan. 4 and 11, 1919, pp. 1-5, 6 figs. and pp. 61-65, 8 figs. Geography and history of railway construction in Andes.

LOCOMOTIVES

British Express. The New Express Engines of the London & South-Western Railway. Ry. Gaz., vol. 29, no. 14, Dec. 13, 1918, pp. 662-669, 13 figs. Sectional drawings, photographic illustrations, general dimensions and data of 4-6-o passenger locomotives recently completed at Eastleigh Works.

Diesel-Electric. Diesel-Electric Locomotives (Automotrices Diesel-électriques). Bulletin Technique de la Suisse Romande, year 44, nos. 14, 15, 16 and 17, July 13 and 27, Aug. 10 and 24, 1918, pp. 129-132, 137-140, 145-149 and 157-158, 13 figs. Extensive descriptions of mechanical arrangement and electrical schemes. A Diesel engine operates a d. c. dynamo; current from the dynamo feeds traction motors; Ward-Léonard system followed. Abstract in Revue Générale de l'Electricité, vol. 4, no. 23, Dec. 7, 1918, pp. 891-896, 6 figs.

Feedwater Heating. Locomotive Feed Water Heating. H. S. Vincent. Ry. Mech. Eng., vol. 93, no. 1, Jan. 1919, pp. 44-47, 4 figs. Discussion of exhaust-steam and waste-gas methods of pre-heating for locomotive boilers. (Second article.)

Fireboxes. A New Departure in Firebox Construction. Ry. Rev., vol. 64, no. 2, Jan. 11, 1919, pp.. 47-51, 5 figs. Means of taking advantage of pricniple of radiant heat transfer.

Lubricators. Force Feed Lubricator. Ry. & Locomotive Eng., vol. 32, no. 1, Jan. 1919, pp. 11-12, 1 fig. Records obtained with Schlacks system of forced-feed lubrication as applied to locomotives.

Mallet. The U. S. Standard Light Mallet Type Locomotive. Ry. Age, vol. 66, no. 5, Jan. 31, 1919, pp. 290-292, 4 figs. 2-6-6-2 wheel arrangement with weight on drivers of 358,000 lb. and tractive effort, compound, of 80,000 lb.. Description with principal data and drawings.

Mallet Type Locomotive for Utah Railway. Ry. Rev., vol. 64, no. 3, Jan. 18, 1919, pp. 85-86, 1 fig. Description with principal data of articulated compound built for heavy freight and pusher service.

Mountain Type. Mountain Type Locomotives for the Atchison, Topeka & Santa Fe. Ry. & Locomotive Eng., vol. 32, no. 1, Jan. 1919, pp. 3-4, 1 fig. Particulars of 4-8-2 type recently completed at Baldwin Locomotive Works.

New Zealand Narrow Gage. Express Locomotives for 3-ft., 6-in. Gauge. Engineering, vol. 106, no. 2760, Nov. 22, 1918, pp. 576-579, 31 figs. Principal data, drawings of details, test results and general description of certain locomotives on New Zealand Government Railways.

Pennsylvania 2-10-2. Heaviest 2-10-2 Type Built for Pennsylvania Lines. Ry. Age, vol. 66, no. 4, Jan. 24, 1919, pp. 249-251, 4 figs. Principal data, drawings and description.

Rock Island 2-10-2. Rock Island 2-10-2 Locomotive. Ry. Mech. Eng., vol. 93, no. 1, Jan. 1919, pp. 41-43, 5 figs. New designs cf cab and spark arrester; grease lubrication used on crossheads and trailer.

Stokers. New Locomotive Stoker Tested Out on Erie. Ry. Age, vol. 66, no. 3, Jan. 17, 1919, pp. 202-204, 4 figs. Mechanical distribution of coal; maintains light fire and reduces cinder and standby losses.

The Elvin Mechanical Stoker for Locomotives. Ry. Rev., vol. 64, no. 4, Jan. 25, 1919, pp. 132-134, 4 figs. Imporatnt features are minimum power requirements and a mechanical means of fuel distribution.

Switches, Geared. Lima Locomotive in Switching Service With the Tennessee Coal, Iron and Railway Company. Ry. and Locomotive Eng., vol. 32, no. 1, Jan. 1919, pp. 10-11, 2 figs. Service given by geared locomotive switching; its special advantages.

Tenders. Canadian Pacific Railway Locomotive Tenders. Can. Ry. & Marine World, no. 251, Jan. 1919, pp. 11-12, 4 figs. Coal container with slope and bottom sheets independent of tank. Coal automatically delivers itself at shovel sheet without coal passer.

Thermic Siphons. Chicago, Milwaukee & St. Paul Railway Test of Locomotive equipped with the Nicholson Termic Syphous. Ry. & Locomotive Eng., vol. 32, no. 1, Jan. 1919, pp. 7-9, 1 fig. Principal dimensions, data and performances of two engines. Firebox of one as equipped with Nicholson thermic syphons supporting brick arch; other had ordinary type of arch supported on four 3-in. arch tubes.

Tires. Shrinkage of Locomotive Tires. Ry. Gaz., vol. 29, no. 25, Dec. 20, 1918, pp. 703-704, 1 fig. Methods adopted at Doncaster Works for determining tire shrinkage and for checking allowance for tires.

U. S. Standard. Two More Standard Locomotives. Ry. Mech. Eng., vol. 93, no. 1, Jan. 1919. pp. 25-30, 12 figs. Heavy 4-8-4 and light 2-10-2 types are well proportioned and have essentially same boiler.

Standard 2-10-2 and 2-8-2 Type Locomotives, Ry. Rev., vol. 64, no. 1, Jan. 4, 1919. pp. 7-12, 9 figs. Principal data and drawings with general description. Two government standard engines whose boilers come nearest interchangeability.

New Locomotives if Standard Design. Boiler Maker, vol. 19, no. 1, Jan. 1919, pp. 1-2, 4 figs. Dimensions of four locomotives recently delivered to U. S. R. R. Administration. Totals of boiler-heating surfaces vary from 1891 to 1285 sq. ft.

NEW CONSTRUCTION

Avlona-Monastir. Avlona-Monastir Railroad Project (Projecto del ferrocarril Avlona-Moaastir). Revista de Obras Publicas, year 66, no. 2257. Dec. 26,1918, pp. 645-647, 2 figs. General plan for consolidation of various lines into Trans-Balkan Italian System with ferry boat service across Otranto Canal. From Giornale del Genio Civile.

Kalka-Simla. The Kalka-Simla Railway and Rolling Stock. Engineer, vol. 126, no. 3283, Nov. 29, 1918, pp. 455-458, 18 figs. General illustrated description of railway and of rolling stock.

Katanga. The Katanga Railway. Engineer, vol. 126, no. 3285, Dec. 13, 1918, pp. 501-504, 17 figs. Description of its construction, some engineering features and equipment.

OPERATION AND MANAGEMENT

British. British Railways Under War Conditions. Engineer, vol. 126, no. 3286, Dec. 20, 1918, pp. 528-529. Twelfth article. The dispatch of the expeditionary force.

British Railways Under War Conditions. Engineer, vol.127, no. 3289, Jan. 10, 1919, pp. 38-39. Fourteenth article. The first six months.

Freight Handling. Proper Methods of Handling Freight, E. P. Nowlin. Ry. Rev., Vol. 64, no. 1, Jan. 4, 1919, pp. 5-6. Introducing scheme of reorganization whereby to reduce loss and damage expense.

French. French Railroads-During the War (Los ferrocarriles franceses durante la guerra) Boletin de Minas, vol. 10, nos. 7-9, Sept. 30, 1918, pp. 106-110. Organization and operation. Executive direction of each road in hands of a commission composed of a military officer and a technical expert. From documents published by Chamber of Commerce, Paris, June, 1918.

Post-War Conditions. The Railway Situation Created by the War. (La crisis ferroviaria antes de la guerra y situacion creada por esta). Revista de Obras Publicas, year 66, no. 2246, Oct. 10, 1918, pp. 509-514. Points out critical financial condition of railways in Spain and generally throughout the world, shown by constantly diminishing scale of profits due to rising expenses for fuel labor and materials. Financial results obtained by railway working in France England and Germany for period 1901-1911 are given in tabular form.

Supervision. Supervision, L. L. Wilkes. Ry. Club of Pittsburg, vol. 18, no. 1, Dec. 19, 1918, pp. 6-17 and (discussion) pp. 17-26. Duties of railroad supervisors; qualifications required to fill positions completely; suggestions to supervisors in regard to efficiency in discharge of their functions.

U. S. Railroad Administration. The Federal Railroad Administration of the United States, W. M. Acworth. Ry. Gaz., vol. 29, no. 24, Dec. 13, 1918, pp. 651-660. Historical account of conditions in the railroads during the years of the war, specially since the Government took over their operation. Compiled from newspapers, unofficial reports, private correspondence, and public documents

PERMANENT WAY AND BUILDINGS

Landslip. A Railway Landslip. Times, Eng. Supp., no. 530, Dec. 1918, p. 253, Incidents attending movement of wall at Wembley on Great Central Ry.; method of reconstruction.

Montreal Tunnel. The Canadian Northern Railway's Montreal Tunnel from an Economic Point of View, H. K. Wickstead. Can. Ry. & Marine World, no. 251, Jan. 1919, pp. 1-5, 1 fig. Economical considerations which decided on selection of tunnel route at Montreal with general reference to economic aspect of tunnel construction in railway lines.

Spikes. Screw-Spikes versus Dog-Spikes. Indian, Eng., vol. 64, no. 16. 17, 18, 19 and 20, Oct. 19, 26, Nov. 2, 9, 16, 1918, pp. 223-224, 237-238, 251-252, 265-266, 279-280. Reports of experience on Indian Railways of comparative efficiency of dog-spikes and screw-spikes for hard and soft wood sleepers. Following points are touched: holding power, gage keeping, creep holding, ease of maintenance and estimated comparative costs, relative advantages in construction, and relative cracking effect on sleepers. (To be continued).

Water Tanks. Concrete Railway Water Tanks. Ry. Gaz., vol. 29, no. 26, Dec. 27, 1918, p. 728, 2 figs. Details of type commonly used for settling basins.

RAILS

Corrugation. Rail Corrugation. Ry. Gaz., vol. 29, no. 26, Dec. 27, 1918, pp. 725-728 3 figs. Wheel tire is provided with groove. the corners of which present angular cutting edge or edges. This form is said to prevent tendency of rails to develop corrugation.

ROLLING STOCK

Couplers. Development and Construction of Standard Couplers. Ry. & Locomotive Eng. vol. 32, no. 1, Jan. 1919, pp. 5-6, 4 figs. Review of work done by committees of Master Car Builders' and Master Mechanics' Assns. to standardize various parts and contour of couple.

Northern Pacific Box Cars. Northern Pacific Builds Box Cars. Ry Mech. Eng. vol. 93, no. 1, Jan. 1919, pp. 37-40, 7 figs. Interesting design of underframe and end on cars being constructed in company shops.

Timber. Use of Treated Timber in Car Construction. Ry. Age, vol. 66, no. 5. Jan. 31, 1919, pp. 295-298, Influence of decay on life of wooden car parts, methods of treating and results secured. From a report presented at the convention of the Am. Wood Preservers' Assn.

Trucks. Car Trucks. L. Brown. Can. Ry. Club, vol. 17, no. 9, Dec. 1918, pp. 17-28 and (discussion) 28-35, 1 fig. Manufacture and mounting of wheels; uses of Master Car Builder's standard mounting; preparation of journal beatings and dust guards; requirements of bolsters; location of brakes.

SAFETY AND SIGNALING SYSTEMS

Car Repairmen. To Prevent Injuries to Car Repairers, H. W Johnston. Official Proc. Car Foremen's Assn., Chicago, vol 14, no. 3, Dec. 1918, pp. 13-25, 4 figs. Records of accidents on N. Y. C. R. R. show that accidents are minimized by careful observation of practices of employees and thoughtful instruction of new men as to hazards peculiar to work; hence responsibility for accidents is placed on foremen.

Grade Crossings. The Prevention of Accidents at Grade Crossings, C. L. Addison, Am. City, vol. 20, no. 1, Jan. 1919, pp. 7-10, 1 fig. Plan of the Grade-crossing publicity campaign conducted by Long Island R. R. Co. means of grade-crossing protection.

SHOPS

Balboa Shops. War Time Work at Balboa Shops, Panama Canal. R. D. Gatewood. Am. Mach., vol. 50, no. 5, Jan. 30, 1919, pp. 191-194, 11 figs. A brief description of some of the great variety of work being done at the Balboa Shops.

Supervision. Efficient Supervision of Railroad Shops, Frank McManamy. Boiler Maker, vol. 19, no.1, Jan. 1919, pp. 4-5. Locomotive mileage increased by speedy repair work at roundhouse; essential of adequate supervision; responsibility of executives.

Welding. Arc Welding in Railroad Shops, B. C. Tracy. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 887-898, 20 figs. Describes more important applications of electric welding in making locomotive repairs.

West Burlington Shops. West Burlington Shops of the C. B. & Q. Ry. Mech. Eng., vol. 93, no. 1, Jan. 1919, pp. 5-16, 21 figs. Equipment and operation of new erecting and machine shop, blacksmith shop and power plant.

SPECIAL LINES

Narrow-Gage Railroads. Narrow-Gage Railroads (Chemins de fer à voie étroite G. Mangin. Génie Civil, vol. 73, no. 26, Dec. 1918, pp. 504-510, 32 figs. Material used in construction of German strategical military railways. Gage 23.6 in. (69 cm.). Data taken from inspection of evacuated areas. Organization of road construction given from official documents left in field by retreating Germans. Supplements article in Génie Civil, vol. 72, no. 14, Apr. 6, 1918, p. 229.

TERMINALS

Cleveland Union Station. Union Depot Project for Cleveland, W. E. Pease. Jl. Cleveland, Eng. Soc., vol. 11, no. 3, Nov. 1918, pp. 179-185 and (discussion) pp. 185-191. Studies of traffic movements undertaken at New York preliminary to designing some of its terminals; application to conditions in Cleveland.

Erie. New Car Barn and Trainsmen's Room at Erie. H. P. Amthor. Elec. Traction, vol. 15, no. 1, Jan. 15, 1919, pp. 15-19, 4 figs Description of terminal of Buffalo and Lake Erie Traction Co., giving details of construction, type of skylight, pit construction and method of fastening rails to pit piers.

Richborough. The Richborough Transportation Depot and Train Ferry Terminus. Engineer, vol. 127, no. 3289, Jan. 10, 1919, pp. 31-34, 9 figs. Construction; railway facilities; traffic organization; signalling arrangements; rolling stock; barge and train ferry services.

St. John, N. B. The Railway Terminals, etc., at St. John, N. B., C. C. Kirby, Can. Ry. & Marine World no. 251, Jan. 1919, pp. 9-11, 1 fig. Problem of their future extension to meet developmnet of port.

Sebastopol, Cal. New Passenger Depot at Sebastopol, California. Elec. Traction, vol. 15, no. 1, Jan. 15, 1919, pp. 19-21, 2 figs. Layout of station of central point where railrod radiates in three directions.

TRAMWAYS

Emergency Work. Some Emergency Special Work Construction. Thomas B. McMarth. Elec. Ry. Jl., vol. 53, no. 3, Jan. 18, 1919, pp. 145-146, 4 figs. Indianapolis company utilizes acetylene cutting and thermit welding in building up curve crosses.

FARES. Is the Zone System the Fare Solution? Thos. Conway Jr. Elec. News, vol. 27, no. 24, Dec. 15, 1918, pp. 29-31. Comparison of fare collection and regulation systems used in U. S. Paper before Am. Elec. Ry. Assn. Also in Street Ry. Bul. vol. 18, no. 12, Dec. 1918, pp. 519-521.

FRANCHISES. Features of Service-at-Cost Plan Franchise. Elec. News, vol. 28, no. 1, Jan. 1, 1919, pp. 29-30. Ordinance containing following principal provisions; General Transfer system; complete control of service and operation by city; right of city to reroute; authority of council to order extensions and establish new and addtional routes; and franchise tax to be paid to city.

MOTORS, HIGH-POWER. High Power Motors in Tramway Service (Sur l'emploi de moteurs puissants par les tramways), Lucien Pahin. Industrie Electrique, year 27, no. 636, Dec. 25, 1918, pp. 464-467, 6 figs. Equipment of 95-hp. Westinghouse Motors used by the Compagnie de Chemins de fer de Paris.

SKIP-STOPS. Skip-Stop Proves Safety Measure. Electric Traction, vol. 15, no. 1, Jan. 15, 1919, pp. 4-6, 3 figs. Diagrams showing reduction in hazard of collisions and boarding and alighting with skip-stop operation, prepared fron records of Detroit United Railway.

TESTS. Car Equipment Service Tests Determine Fitness of Apparatus, C. W. Squier, Elec. Ry. Jl., vol. 53, no. 3, Jan. 18, 1919, pp. 128-133, 12 figs. Method of making operating tests and heat runs; how sections of track can be best laid out to represent actual service requirements; organization necessary for proper test force; results obtained in specific case.

TRACK CONSTRUCTION. Removing Old Paving for New Track Construction, C. W. Geiger. Elec. Traction, vol. 15, no. 1, Jan. 15, 1919, pp. 30-31, 8 figs. To cut through asphalt a flange was heated and shrunk onto roller of a heavy steam-roller; flange was then sharpened so as to cut down through asphalt when roller was run over it.

METALLURGY

ALUMINUM

ALLOYS. Aluminum and Its Light Alloys—IV, Paul D. Merica. Metal Rec & Electroplater, vol. 4, no. 11, Dec. 1918, pp. 384-386, Importances of these light-weight metals for motor and aircraft construction; metallography of commercial aluminum; chemical and physical properties at high and low temperatures; tensile properties of zinc-aluminum alloys. (To be continued.)

ANALYSIS. The Analysis of Aluminum Alloys and Metallic Aluminum, J. J. Fox, E. W. Skelton and F. R. Ennos, Jl. Soc. Chem. Indus., vol. 37, no. 24, Dec. 31, 1918, pp. 328T-333T. Methods writers have found suitable for general-work. Reagents used are a 10 per cent. solution of pure sodium hydroxide, and nitro-sulphuric acid made by mixing 300 cc concentrated sulphuric acid with 300 cc of water: cooling and adding 200 cc of pure nitric acid.
Analysis of hard Aluminum Alloys (Analyse des alliages durs d'aluminum) A. Travers, Chimie & Industrie, vol. 1, no. 7, Dec. 1, 1918, pp. 708-711. Methods in use at Creusot Works for quantitative analysis of zinc, aluminum. magnesium and copper in light alloys.

DUST, INFLAMMABILITY. The Inflammability of Aluminum Dust, Alan Leighton, Department of Interior, Bur. of Mines, Tech. Paper 152, 15 pp. Review of available literature; experimental work; properties affecting explosibility precautions to be observed.

METALLOGRAPHY. The Metallography of Aluminum, Robert J. Anderson, Jl. Franklin Inst., vol. 187, no. 1, Jan. 1919, pp. 147, 65 figs. Discussion of amorphous theory and plastic deformation; observations on grain-growth phenomena; micrographs of various forms of aluminum, cast, worked, and annealed; annealing and recrystallization of aluminum which has undergone plastic deformation; experimental investigation of exaggerated grain growth in aluminum; process of polishing and etching aluminum microsections preparatory to microscopic examination.

BLAST FURNACES

CAR DUMPER. Movable Car Dumper with Rotary Cradle, A. F. Case. Blast Furnace vol. 7, no.1, Jan. 1919, pp. 60-61, 2 figs. Machine located near storage yard for handling ore and limestone at blast-furnace plant. Said to be capable of unloading 30 to 35 cars an hour.

GAS OPERATION. Blast Furnace Plant Blows in First Stack, Blast Furnace, vol 7, no. 1, Jan. 1919, pp. 50-56, 6 figs. Installation of combined blast-furnace gas and chain grate stokers firing on heavy mill loads. Gas cleaning design to keep both stoves and washer clean and in operation throughout entire blast.

POTASH. Potash Content of Blast Furnace Charges, N. H. Gellert. Iron Age, vol. 103, no. 6, Feb. 6, 1919, pp. 355-356. Alabama iron ores and foreign manganese ores contain the most; potash in the burden of American furnaces.

SLAG. Widening Demand for Blast Furnace Slag, Clarence E. Wright. Iron Age, vol. 103, no. 4, Jan. 23, 1919, pp.241-243, 5 figs. Uses to which it has been put; a possible $20,000,000 income to industry.

THICKENER. Dorr Thickener in Blast-Furnace Field. Iron Age, vol. 103, no. 2, Jan. 9. 1919, pp. 112-115, 3 figs. Used in clarification of washer discharge water, it eleminates troublesome problems and yields valuable product; simplicity of operation.

COPPER

BORON DEOXIDIZER. The Boronic Deoxiding of Copper, James Scott, Foundry Trade Jl., vol. 20, no. 203, Nov. 1918, pp. 598-599, 3 figs. Experimental research of proceedure followed by boronic compounds when acting on copper and its alloys.

BRONZE HEAT TREATMENT. Effect of Heat Treatment on Bronze, F. F. Hausen and O. A. Knight. Iron Age, vol. 103, no. 6, Feb. 6, 1919, pp. 347-349, 12 figs. Characteristics disclosed by Brinell hardness tests and photomicropraghs; quenching and drawing give greater hardness than quenching alone.

BRONZE INCLUSIONS. Nonmetallic inclusions in Bronze and Brass, C. F. Comstock, Foundry, vol. 47, no. 318, Feb. 1919, pp. 79-83, 21 figs. From a paper presented at the October meeting of the Institute of Metals Division of the Am. Inst. of Min. Engrs.

HEAP-LEACHING. Metallurgy of Copper, Arthur L. Walker. Eng. & Min. Jl., vol. 107, no. 2, Jan. 11, 1919, pp. 90-92. Heap-leaching experiments being conducted in south-western copper centers; Anaconda fume-dust collector.

FLOTATION

FLOTATION MACHINES. The Flotation Process, A. W. Allen. Eng. & Min. Jl., vol. 107, no. 2, Jan. 11, 1919, pp. 97-100. New flotation machines; progress in selective flotation; development of Galena flotation: separate treatment of colloids.

IRON AND STEEL

CASE-HARDENING. Ancient and Modern Carbonizing Methods. Theodore G. Selleck, Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 7-12, 4 figs. Discusses use of compounds for case-hardening and describes improved methods. Uniform results secured by pre-heating.

CHROME STEEL. Physical Qualities of High Chrome Steel, L. R. Seidell and G. J. Horvitz. Iron Age,vol. 103, no. 5. Jan. 30, 1919, pp. 291-294, 4 figs. Relation between hardness and double carbides in solution; critical temperatures; maximum tensile strength and ductility.

DENSITY. Specific Density of Steel, H. E. Roerr. Irom Age, vol. 103, no. 3, Jan. 16, 1919. p. 184, 1 fig. Extent to which forging compresses or consolidated metal. From paper for Feb. meeting of Am. Inst. of Min. Engrs. New York.

FURNACES. Pulverized Coal for Metallurgical Furnaces. Charles E. Longenecker. Iron Age, vol. 103, no. 6, Feb. 6. 1919, pp. 351-352, 1 fig. Greater efficiency claimed for furnaces of correct design; continuous service more certain; average combustion figures for different furnace types.

GERMANY. The Future of the German Iron Industry. H. Müngesheimer. Cassier's Eng. Monthly, vol. 54, no. 6, Dec. 1918, pp. 340-341. Opinion of General Director of Gelsenkirchen Steel and Iron Works.

HEAT TREATMENT AND GRAIN SIZE. Grain Limits in Heat Treated Alloy Steels R. S. Archer. Iron Age, vol. 103, no. 6, Feb. 1919, pp. 266-367, 12 figs. New etching process which defines the crystals, boundaries and assists in detecting fiaulty heat treatment. From a paper to be presented at the February meetng of the American Institute of Mining Engineers, New York.

HIGH-SPEED STEEL. Durability of High Speed Steels, R. Poliakoff. Iron Age, vol. 103, no. 5, Jan. 30, 1919, pp. 295-296, 2 figs. Russian cutting tests with nine brands; chemical composition and requirements; results compared with Taylor's conclusions.

HOT DEFORMATION ON STEEL. Influence of Hot Deformation on Steel. George Charpy. Am. Drop Forger vol. 4, no. 12, Dec. 1918, pp.482-488, 3 figs. Technical discussion on effect of rolling and forging on structure of steel; data concerning changes on exterior and interior of forgings. From paper presented before Iron & Steel Institute.

LITERATURE FOR 1918. Review of Iron and Steel Literature for 1918, E. H. McClelland Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 73-75. Classified list of important books, serials and trade publictions.

MOLYBDENUM STEEL. Molybdenum Steel Versus Gun Erosion. Masatosi Okôchi, Massaichi Majima and Naoshi Sato. Jl. College of Eng., Tokyo Imperial Univ., vol 9, no. 5, Oct. 15, 1918, pp. 153-195, 50 figs. Experimental determination of modulus elasticity, modulus of rigidity, Brinell hardness number thermal dilatation, thermal conductivity and magnetization at high temperatures of specimens of gun steel, nickel steel, nickel-molybdenum steel and tungsten steel.

PHOSPHORUS. Effect of Phosphorous in Soft Acid and Basic Open Hearth Steels, J. S. Unger. Proc. Steel Treating Research Soc., vol. 2, no. 1, 1919, pp. 11-23, 11 figs. None of the steels used in the experiments showed the brittleness under cold working, due to phosphorus. Results of various mechanical tests, cold bending of rivets under hammer, upsetting in making large-headed nails or rivets, or fabrication on barrels, automobile parts, and cream separator bowls, indicated increase of hardness with increase of phosphorus.
Phosphorus in Malleable Cast Iron. J. H. Teng. Iron & Steel Can. vol..1 no. 11, Dec. 1918. pp, 445-453, 7 figs. Effects of proportions of phosphorus varying from 0.05 to 0.5 per cent. on mechanical properties of malleable cast iron. Writer concludes that ill effects become marked at 0.2 per cent. Paper presented before Iron & Steel Inst., Sept. 1918.

ROLLING AND GRAIN SIZE. The Grain size in Steel as Influenced by Rolling. W. G. Dauncey. Monthly Bul. Can. Min. Inst., no. 82, Feb. 1919, pp. 164-166, 4 figs. Photomicrographs of portion of rolled basic steel bar.

STEEL FAILURE. The Cause and Mechanism of Steel Failures. Z. W. Zimmerschied. Proc. Steel Treating Research Soc., vol. 2, no. 1, 1919, pp. 24-25 and 28-29. Analysis of Reasons for usual failures of automobile parts.

STEEL INDUSTRY IN 1918.. General Review of Steel Industry in 1918. B. E. V. Luty. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 62-65. Quantity and character of output; alignment of belligerents; labor and wages; necessity of labor saving machinery.

TESTS. Tension, Impact and Repeated Impact Test of Mild and Hard Steels, Tsuruzo Matsumura. Memoirs College of Eng., Kyoto Imperial Univ., vol 2, no. 2, July 1918, pp. 63.69, 16 figs. Experiments on six flat bars varying in percentage of carbon from 0.102 to 0.65, to detect cause of unexplained fractures.

OCCLUDED GASES

REACTIONS. Notes on the Occlusion of Gases in Metals. Alfred W. Porter. Chem. Engr., vol. 26, no. 13, Dec. 1918, pp. 499-500, 1 fig. Phases of reactions between gases and metals as determined by various experimenters.

ALLOYS, FERROUS

PRODUCTION. Ferroalloys Production Stimulated Iron Trade Rev., vol. 64, no. 1, Jan. 2, 1919, pp. 118-120. Imports and domestic production of manganese alloys; imports of manganese ore; stimulation in production of spiegeleisen.

1918. Ferro-Alloys in 1918, Robert J. Anderson. Eng. & Minl Jl. vol 107, no. 2, Jan. 11, 1919. pp. 83-86. Technical advances in metallurgical processes.

NON-FERROUS ALLOYS

STELLITE. Stellite—Its Manufacture and Uses. Can. Mfr., vol. 39, no. 1. Jan. 1919, pp. 77-78, 2 fig. How it is manufactured at Deloro, Ont.

WELDING. Behaviour of Non-Ferrous Metals Under Oxy-Acetylene Torch—11, J. F. Springer. Metal Rec. & Electroplater, vol. 4, no. 11, Dec. 1918, pp. 381-383. How copper alloys are welded; process when working with magnesium nickel, silver, gold, lead, tin and zinc.

ZINC ALLOYS. Zinc Alloys instead of Copper Alloys. Iron Age, vol. 103, no. 3, Jan. 16, 1919, p. 175. French experiments on certain combinations of zinc, aluminum and copper as cast, rolled or drawn under a press.

AERONAUTICS

AEROPLANE PARTS.

STARTERS. The Bijur Airplane Engie Starter. Aviation, vol. 6, no. 1, Feb. 1, 1919, pp. 33-34, 3 figs. Characteristics of starter designed with minimum weight and low current consumption combined with maximum of cranking power to break a stiff engine. It is used particularly on seasplanes.

Bijur Starters for Seaplanes and Blimps. Automotive Industries, vol. 40, no. 2, Jan. 9, 1919, p. 51, 3 figs. Fitted to Liberty Engines at propeller end iand crank engine through double-reduction gear with Bijur automatic screw shift.

AEROSTATICS

AIRSHIP POSSIBILITIES. The Case for the Airship, W. Lockwood Marsh. Aviation vol. 5, no. 11, Jan. 1, 1919. pp. 697-699. Salient features and adaptability of lighter-than-air and of heavier-than-air craft.

Future of the Helium Airship, Ladislas d'Orcy. Aviation, vol. 5, no. 11, Jan. 1, 1919. pp. 695-697, 2 figs. How helium was produced; military aspects of discovery.

AIRCRAFT PRODUCTION

NAVAL AIRCRAFT FACTORY. The Naval Aircraft Factory. Aviation, vol. 6, no. 1, Feb. 1, 1919, pp. 28-30, 7 figs. Site, dimensions and internal organization; naval flying boats.

The Naval Aircraft Factory. Mech. Eng., vol. 41. no. 2, Feb. 1919, pp. 142-146, 14 figs. Organization of staff and working force; employment of women; operation of the various departments; features of standardized seaplane manufacture at the plant.

APPLICATIONS

AMERICAN VIEW. The Opportunity of Aviation. William B. Stout. Jl. Soc. Automotive Engrs., vol. 4, no. 1, Jan. 1919, pp. 39-41 and (discussion) pp. 41-42. Difficulties to be overcome; engine development in the war; problem of landing; cost of production.

BRITISH VIEW. Lord Weir on the Future of Flying. Flight, vol. 11, no. 1, Jan. 2, 1919, pp. 16017. Measures upon which development of operational side of air transport depends and part the State is to play in this development.

COMMERCIAL AERONAUTICS. Problems of Commercial Aeronautics, G. Lepere. Aviation, vol. 5, no. 11, Jan. 1, 1919, p. 694. Commercial uses of existing military planes; present possibilities of design.

Commercial Transport by Airplane. Aviation, vol. 6, no. 1, Feb. 1, 1919, pp. 31-32; Aeronautics, vol. 15, nos. 270 and 271, Dec. 18 and 25, 1918, pp. 577-592 and 603-638; Flight, vol. 10, nos. 50, 51, 52 and vol. 11, no. 1, Dec. 12, 19, 25, 1918 and Jan. 2, 1919, pp. 1413-1418,, 1443-1445, 1465-1470, and 22-27. Report of special committee on law and policy; interim report of special committee on technical and practical questions of aerial transport; memorandum on experimental air service; business questions relating to aircraft industry and aerial services; labor; research and export education.

DYNAMICS

AEROFOIL SECTIONS. Selecting Aerofoil Sections for Speed Range, V. E. Clark, Aviation, vol. 6, no. 1, Feb. 1, 1919, pp. 20-22, 2 figs. Charts for selecting approximately best aerofoil section for speed range and to estimate speed performance to be expected in a given airplane.

CALCULATION OF PERFORMANCE. Performance of Aeroplanes, W. L. Cowley. Flight, vol. 11, no. 1, Jan. 2, 1919, pp. 13-15, 7 figs. Mathematical relations between horse power, rate of climb and turning circle; conditions under which circular flight may be extended with greatest rapidity.

FLATTENING-OUT OF AEROPLANES. Flattening out of Aeroplanes after Steep Glides Genjiro Hamabe. Memoirs College of Eng., Kyoto Imperial Univ., vol. 2, no. 1, June 1819, pp. 7-52, 8 figs. Derivation of general equations of rigid dynamics with center of gravity of aeroplane as origin; discussion of symmetric motion of aeroplane; problem of recovery from a steep dive a thigh speed treated by method of approximate calculations to various cases of sharp flattening-out of a military Curtiss JN2 tractor.

PLANES

CHRISTMAS. The Christmas Strutless Biplane. Aerial Age, vol. 8, no. 19, Jan. 20, 1919, pp. 948-949, 8 figs. Struts, cables and wires are entirely eliminated in machine reported to make 170 miles an hour with a 6-cylinder Liberty motor.

GERMAN PLANES. The Trend of German Aeroplane Design. Engineer vol. 127, no. 3289, Jan. 10, 1919, pp. 25-26. From a report issued by the Airplane Production (Technical) Department of the Ministry of Munitions.

HALBERSTADT. Report on the Halberstadt Two-Seater Type, C. L. IV. Aeronautics, vol. 15, no. 269, Dec. 11, 1918, pp. 550-552, 12 pfigs. Flight, vol. 10, no. 50, Dec. 12, 1918, pp. 1404-1407, 12 figs. Aeronautics: Biplane equipped with 180-hp. Mercedes engine;, carries one fixed and one movable gun. Flight: Similar to C. L. 11. type: Issued by Technical Department, Aircraft Productions, Ministry of Munitions.

LOENING. The Loening Two-Seater Fighting Monoplane. Aviation, vol. 5, no. 11, Jan. 1, 1919, p. 689. 1 fig. Brief description of simplified type of fighting airplane designed to facilitate production.

L. V. G. The L. V. G. Two-Seater Biplanes. Engineer, vol. 126, nos. 3284 and 3286, Dec. 6 and 20, 1918, pp. 483-486 and 525-527, 26 figs, and 17 figs,: Flight, vol. 10, nos. 51 and 52, Dec. 19 and 26, 1918, pp. 1426-1431 and 1457-1461, 20 figs; Aero- nautics, vol. 15, no. 267, Nov. 27, 1918, pp. 496-503, 48 figs, Engineer Dec. 6, Description and illustrations of details of construction; Flight, Dec. 19; C. V. and C.VI, types; Dec. 26; Wing construction, struts, ailerons, undercarriage controls, engine mounting, oil system, accessories. Issued by Technical Department Aircraft Production Ministry of Munition; Aeronautics, Nov. 27, C. V. and V. I. types. Report of Technical Department of Air Ministry.

MARTIN. The Martin Twin-Engine Bomber. Donald W. Douglas. Aviation, vol. 5, no 11, Jan. 1, 1919, pp. 677-689, 9 figs, Machine built to fulfill requirements of night bomber, day bomber, long-distance photography, and gun machine.

PFALZ. Report on the Pfalz (Dxii) Single-Seater Fighter. Aeronautics, vol. 15, no. 269, Dec. 11, 1918, pp. 544-549, 19 figs. Biplane equipped with 180-hp. Mercedes engine; carries two Spandan fixed guns. By Technical Department, Aircraft Production, Ministry of Munitioons.

STANDARD C-1. The Standard C-1 Single-Seater. Aerial Age, vol. 8, no. 20, Jan. 27, 1919, pp. 985-987, 6 figs. Characteristics of Standard Aero Corporation biplane designed as secondary training machine.

ENGINES

Altitudes. Performance of Aeronautic Engines at High Altitudes, H. C. Dickinson, Aeronautics, vol. 15, no. 269, Dec. 11, 1918, pp. 542-543. 3 figs. Describes a laboratory building where it is contemplated to study engine performance in general, including carburetion, under conditions corresponding to highest altitudes reached by aviators.

AUSTRO-DAIMLER. Austro-Daimler, 200-Hp. Aircraft Engine, Automotive Industries, vol. 40, no.1, 2, and 3, Jan. 2, 9 and 16, 1919, pp. 21-24, 64-67 and 132 and 134-135, 18 figs. Jan. 2;Detailed report on design, construction and general performance of latest type; Jan. 9.: Details of crankcase construction, ignition, fuel and cooling systems, results of power and endurance tests, analysis of weights and materials of construction; Jan. 16, : metallurgical and mechanical test data, general data, analysis of weights. Issued by Technical Departmet Aircraft Production, Ministry of Munitions.

CARBURETION. Carbureting Conditions characteristic of Aircraft Engines. Jl. Soc. Automotive Engineers, vol. 4, no. 1, Jan. 1919, pp. 9-12, 9 figs. Tests to determine changes in engine performance with changes in atmospheric temperature and pressure at various levels above earth's surface, with special reference to variables affecting functioning of carbureter and changes in performance resulting variables in carbureter itself. From Bur. of Standards report no. 10 on aeronautic power plants.

CURTIS. The Curtis Model K. 12 Cylinder Airplane Engine. Aviation, vol. 5, no. 11. Jan. 1, 1919, pp. 685-689, 7 figs.. Principal features. Engine is of fixed cylinder type and consists of 12 cylinders in two groups of six each with included angle of 60 degrees.

DUSENBURG. The Dusenburg Model H 850-Hp. Motor, G. Douglas Wardrop. Aerial Age, vol. 8, no. 20, Jan. 27, 199,, pp. 991-995, 12 figs. General dimensions and particulars. Motor is of 16-cylinder V type with cylinders at an angle of 45 deg.; weight of power plant with gear drive is 1575 lb.

HISPANO-SUIZA. The Model H, 300-Hp. Hispano-Suiza Engine, Aviation, vol.. 6, no. 1, Feb. 1, 1919, pp. 23-25, 4 figs. Points in which Model H. differs from other Hispano-Suiza engines, and particularly with regard to lubrication.

LIBERTY ENGINE. Ignition on Liberty Engine. Motor Age, vol. 35, no. 2, Jan. 9, 1919, pp. 20-21 and 39., 10 figs. Wiring diagram; arrangement of three arms of circuit breaker; diagram of firing order. Generator-battery type; special Delco system is used.

MILLER. The Miller 125-Hp. Aircraft Engine. Aviation, vol. 6, no. 1, Feb. 1, 1919, pp. 30-31, 2 figs. Features and dimensions of this four-cylinder engine.

Radio-Cylinder. Fixed Radial Cylinder Engines, John W. W. Smith. Jl. Soc. Automotive Engnrs., vol. 4, no. 1, Jan. 1919, pp. 24-26, 5 figs. Weight of power plant; reliability, durability, and balancing; fuel and oil consumption; streamline mounting; cooling. Radial engine is considered as having more advantages than V. type.

Specification of Engines. Complete Technical Specifications of Important American and Foreign Airplane Engines. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, Supplement, chart between pp. 134-135. Details of 37 different types as compiled by Technical Section. Division of Military Aeronautics.

MATERIALS OF CONSTRUCTION

Plywood. Plywood in Aeroplane Construction, Henry Harrison Suplee. Aerial Age, vol. 8, no. 19, Jan. 20, 1919, pp. 945-947, and 961, 7 figs. Design and construction of Plywood monocoque fuselages, plywood wing ribs and fuselage taps.

MECHANICS

Stress Determination. Stress Optical Experiments. A. R. Low. Flight, vol. 10, nos. 50 and 51, Dec. 12 and 19, 1918, pp. 1409-1410 and 1435-1439, 20 figs. Dec. 12: Examples of optical observations. Dec. 19: Deflection curves for top spar calculated and observed for total loads of 10, 20, 30, 35 and 40 lb.; principle of dynamical similarity applied to deformahle elastic structures. (Concluded.)

Struts. Design of Aeroplane Struts, W. H. Barling and H. A. Webb. Aeronautics, vol. 15, nos. 268 and 269, Dec. 4 and 11, 1918, pp. 521-525, and 538-541, 9 figs. Dec. 4:Analytical determination of shape which will cause strut, when endload rises and it deflects, to be subjected to the same maximum stress at every section; Dec. 11: Mathematical theory and formalæ, numerical examples, crinkling stress of steel tubes. Paper read before Roy. Aeronautical Soc.

An Approximate Graphical Treatmet of Some Strut Problems, John Case. Engineering, vol. 106, no. 2764, Dec. 20, 1918, pp. 669-670, 7 figs. Mathematical article discussing crippling load of a pin-jointed strut of varying section; deflection of a strut subjected to lateral load and terminal couples continuous beams with end load; proofs of formalæ.

Wing Structure Calculation. Incidence Wires in the Strength Calculations of Wing Structures, John Case. Aeronautics, vol. 15, nos. 268, 270 and 271, Dec. 4, 18 and 25, 1918, pp. 516-517, 566-570 and 602-607, 25 figs. Dec. 4, Ordinary processes of statics and principle of least work, as methods of computing thrust in members of frame. Physical aspect of difference between the two methods; Dec. 18: Formalæ for estimating loads in spars, struts, etc., and numerical examples of the methods of using these formalæ; Dec. 25: derivation of formulæ.

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British Planes. British Airplanes and Seaplanes. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, pp. 142-143. Principal types of engines and planes in use in the Royal Naval Air Service and in the Army.

U. S. Le Pere. The Le Père Fighter. Aerial Age, vol.. 8 , no. 18, Jan. 13, 1919, pp. 904-905. 5 figs. General dimensions, weights and performances of reconnaissance plane fitted with 400-hp. Liberty engine.

U. S. Planes. Record of Performance of American Planes. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, p. 103. Table illustrating types and principal features of airplanes built by U. S. Government since June 1917.

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Model Construction. Model Aeroplane Building as a Step to Aeronautical Engineering. Aerial Age, vol. 8, nos. 18, 19 and 20, Jan. 13, 20 and 27, 1919, pp. 913, 957 and 1001, 11 figs. Jan. 13: Details of wimgs; Jan. 20: Making tail surfaces, fin and rudder; Jan. 27: Details of stabilizer, elevators, fin and rudder for Ford motored airplane.

Model Aeroplanes.—XIX, F. J. Camm, Aeronautics, vol. 15, no. 268, Dec. 4, 1918, p. 529, 6 figs. Notes on driving mechanism.

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Charts. Nomographic Charts for the Aerial Propeller, S. E. Slocum. Aerial Age, vol. 8, no. 20, Jan. 27, 1919, pp. 988-990, 4 figs. Power, thrust, torque and efficiency charts representing formulæ derived from experimental data. Formulæ were discussed in Aerial Age Aug. 26 and Nov. 18, 1918.

Alcohol. A New Opening for the Electrometallurgical Industry. The manufacture of Alcohol from Calcium Carbide (Un nouveau débouché pour l'industrie électro-métallurgique. La fabrication de l'alcool (en partant du carbure). Revue Générale de l'Electricité vol. 4, no. 24, Dec. 14. 1819, p. 934. A current of acetelyne is passed over dilute solution of sulphuric acid having mercury salts as catalyser; resulting acetaldehyde is boiled and vapor passed over layer of finely powdered nickel. From Chemische Technische Wochenschrift, vol. 23, p. 55.

Ammonia. Commercial "Concentrated Ammonia-Liquor" and Its Impurities, H. G. Colman and E. W. Leoman, Jl. Soc. Chem. Indus., vol. 37, no. 24, Dec. 31, 1918, pp. 319T-323T and (discussion) 323T-324T. Analyses of samples from different plants.

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Benzols. Analysis of Commercial "Pure" Benzols, F. Butler Jones. Jl. Soc. Chem. Indus., vol. 37, no. 24, Dec. 31, 1918, pp. 324T-327T, 2 figs. Experimental determination of depression of freezing point of benzene occasioned by presence of carbon bisulphide, thiophen toluene and paraffin. A graph gives volumn percentages of four solutes in terms of observed temperatures and specific gravity.

By-Products. Relation of By-Produxts to Chemical Industries, W. H. Blauvelt. Gas Age, vol. 43, no. 1, Jan. 1919, pp. 19-21, 2 figs. Industries built up by Semet-Solvay Co. to utilize by-product chemicals.

Carbide. Practical Points on Carbide Sizes. Jl. Acetylene Welding, vol. 2, no. 7, Jan. 1919, pp. 330 and 354. Methods of classification according to sizes; relative value of different sizes of carbide. From Bulletin de Journal Suisse d'Acétylene.

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Coal-Tar Industry Products, British. Progress in the British Coal Tar Industry J. B. C. Kershaw. Gas Age, vol. 43, no. 2, Jan. 15, 1919, pp. 77-79, 2 figs. English practice in tar distillation and treatment of light oil fraction with dilute caustic soda; brief note on American methods of working up.

Coloring and Lacquering. Approved Practice in Coloring and Lacquering, James Sleetman. Brass World, vol. 14, no. 11, Nov. 1918, pp. 315-317, 6 figs. (Fourth and concluding article.)

Dust Recovery. Dust Recovery from Gas Scrubber Water. Blast Furnace, vol. 7, no. 1, Jan. 1919, p. 48, 1 fig. Dorr thickener installed in blast-furnace plant to provide automatically for settling of dust from gas scrubbers.

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France. Recent Progress and Future Possibilities of the Chemical Industry in France (Les progrès récentes et l'avenir des industries chimiques en France). Paul Razous. Génie Civil, vol. 73, no. 22, Nov. 30, 1918, pp. 429-433. Pharmaceutical products; petroleum distillation; conditions of growth for industry. (Concluded).

Gas Manufacture. New Signaling Pyrometer, a Means of Contending Against Effects of Inferior Labor. Am. Gas Eng. Jl. vol. 110, no. 2, Jan. 11, 1919, pp. 36-37, 2 figs. Lights inform attendant when damaging variation is approached.

The Utilization of Waste Heat in Gas Works (Die Gewinnung und Verwertung der Abwaerme im Gaswerksbetriebe). A technical and economic study by Director Wenger, Journal fuer Gasbeleuchtung, vol. 61, no. 43, Oct. 26, 1918, pp. 509-513, 3 figs. Continued from p, 501. Concluded Nov. 2. Description of experiments made to secure a higher yield of coke from coal. Waste heat used for heating water of municipal bathouse.

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Use of the Interferometer in Gas Analysis. Frank M. Seibert and Walter C. Harpster. Water & Gas Rev., vol. 29, no. 7, Jan. 1919, pp. 13-14, 1 fig. Sketch of Laboratory instrument; manner of conducting test. From tech. paper 185, Bur. of Mines.

Carbonization of Wood in Stockholm. Gas Age, vol. 43, no. 2, Jan. 15, 1919, pp. 74-76, 3 figs. Swedish experience in substitution of wood for coal. From Journal für Gasbeleuchung.

Inclined Chamber Ovens at Auburn Junction. Gas Age, vol. 43, no. 2, Jan. 15, 1919, pp. 80-83, 2 figs. Installation comprises two benches of three ovens, each 19 ft. 6 in. long; operation details and results.

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Glass Pots. Observations on Apparent Causes of Failure of Lead Glass Pots, A. F. Gorton. Jl. Am. Ceramic Soc., vol. 1, no. 9, Sept. 1918, pp. 648-659. Examination of remains of pots leads writer to conclude that cracking and corrosion are chief causes of failure. Cracks attributed principally to insufficient preheating and corrosion to slagging action of iron on clay.

Helium. The Production of Helium from Natural Gas, Frederick G. Cottrell. Mech. Eng. vol. 41, no. 2, Feb. 1919, pp. 155-158 and 188, 6 figs. Reviews recent work in liquefaction and separation of gases and production of helium for use of balloons.

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Industrial Electrochemical Manufacture of Nitrogenous Compounds: Nitric Acid and its Derivations, Cyanamide, Nitrides (La production électrochimique industrielle des composés nitrés: acide nitriques et derivés, cyanamide, azotures), Jean Escard. Revue Générale de l'Electricité, vol. 4, no. 25, Dec. 21, 1918, pp. 959-972, 20 figs. Scheme of installation for manufacturing nitric acid and nitrates from the air. Following furnaces and processes for producing synthetic nitric acid are described: Birkeland-Eyde, Schonherr, Pauling, Moscicki, Kilburn-Scott and Helbig.

Fixation of Nitrogen. Jl. Soc. Automotive Engrs., vol. 4, no. 1, Jan. 1919, pp. 16-17. Electric-arc process; building of concrete dam 100 ft. high and 1 mile long at Muscle Shoals to deliver 500,000 hp. for nitrogen fixation work; cyanamid and Haber processes.

Industrial Electrochemical Production of Nitrogenous Compounds: Nitric Acid and Derivatives, Cyanamide and Nitrides (La production électrochimique industrielle des composés nitrés; acide nitrique et derivés, cyanamide, azotures), Jean Escard. Revue Générale de l'Electricité, vol. 4, no. 26, Dec. 28..1918, pp. 1008-1012. Manufacture of cyanamide by reaction of nitrogen on calcium carbide; fixation of nitrogen in boron, magnesium and calcium nitrides; preparation and properties of these compounds.

Note on the Bucher Cyanide Process for the Fixation of Nitrogen, Eugen Posnjak and H. E. Merwin. Jl. Wash. Acad. Sci., vol. 9, no. 2, Jan. 19, 1919, pp. 28-30. Experiments with warying amounts of sodium carbonate, carbon and iron; object to determine hether sodium cyanide was formed by Bucher's reaction.

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RUBBER. Imitation Caoutchoucs or Vulcanized Oils. (Les caoutchousc factices on huiles vulcanisées), André Dubose Chimie & Industrie, vol., 1, no. 7, Dec. 1, 1918, pp. 727-732. Historical note of development.; processes of manufacture : classification.

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COAL PRODUCTION. Coal—Now and Next Year. C. E. Lesher. Coal Age, vol. 15, no. 3, Jan. 16, 1919, pp. 99-104, 4 figs. Statistics of production and consumption.

COKE-OVEN GAS. Washing Light Oil Fractions from Coke Oven Gas, F. D. Schreiber. Gas Age, vol. 43, no. 1, Jan.1, 1919, pp. 22-24, 1 fig. Suggestions from general foreman of benzol plant.

Coke Plant Producing Gas for Domestic Purposes. Gas Age, vol. 43, no. 1, Jan. 1, 1919, pp. 11-12, 3 figs. Example of by-product coking practice Plant consists of 65 Koppers cross-regenerative ovens (12½ tons) witth capacity of 1200 tons coal per day and is complete for recovery of gas, tar, ammonia, and benzols.

Coke-Oven Gas and the Demand for Cheap Fuel. Gas Age, vol. 43, no. 1, Jan. 1, 1919, pp. 16-17. Extent of coke production in ovens and in beehive ovens; importance of metering gas.

Chester Producer Fired by-Product Coke Ovens, J. D. Shattuck, Gas Age vol. 43, no. 1, Jan. 1, 1919, pp. 7-10, 6 figs. Operation of Philadelphia Gas & Elec. Co. plant for production of city gas and also for recovery of by-products.

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A New Coke Oven Installation. Engineer, vol. 126, no. 3282, Nov. 22, 1918, pp. 430-432, 5 figs. Description of battery of thirty-seven 12 ton Semet-Solvay coke ovens witrh washer and by-product recovery plant at one of plants of Newton, Chambers & Co., Ltd.

Economic Considerations in Coke Oveu Practice, W. Colquhoun. Gas World (Coking Section), vol. 69, no. 1794, Dec. 7, 1918, pp. 19-20. Deficiencies in present application of heat necessary to distil coal; advantages of hot direct-recovery process. Paper before Midland Inst. Min. Engrs.

Republic By-Product Coke Plant at Youngstown. Gas Age, vol. 43, no. 1, Jan. 1, 1919, pp. 13-15, 5 figs. Brief description of by-product coke-oven installation of 143 Koppers ovens, producing gas and coke for use iu steel manufacture.

Plant of the Seaboard By-Product Coke Company, D. MacArthur. Gas Age, vol. 43, no. 1, Jan. 1, 1919, pp. 1-6, 9 figs. Oven installation consists of 165 Koppers ovens subdivided into three units. Daily capacity is 3000 tons of coal, yielding 3,200 tons coke, 16½ million cubic feet surplus gas of 610 B. t.u. quality, 75,000 lbs. ammonium sulphate, 24,000 gal. tar and 10,000 gal. ligt oil. (To be continued.)

Insulation for By-Product Coke Ovens, P. A. Boeck. Gas Age, vol. 43, no. 1, Jan. 1, 1919, pp. 24-26, 5 figs. How insulating bricks are placed in wall; heat gradient and saving due to heat insulation; advantages of insulation.

RAIL TRANSPORTATION. Railroad Readjustmeut Problems Confront Coal Operators, John Callahan. Coal Trade Jl., year 51, no. 3, Jan. 15, 1919, pp. 51-52, How mining is affected by transportation control as well as by maintenance or modifications of existing regulations.

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IGNEOUS DIFFERRENTIATION. A Type of Igneous Differentiation, Frank F. Grout. Jl. Geol., vol. 26, no. 7, Oct-Nov. 1918, pp. 626-658, 12 figs. Rocks of Duluth gabbro lopolith are found to fall into two series, one related to gabbro family, other more closely to granites.

MANGANESE DIOXIDE BANDING. Rythmic Banding of Manganese Dioxide in Rhyolite Tuff, W. A. Tarr. Jl. Geol. vol. 26, no. 7, Oct-Nov. 1918, pp. 610-617, 5 figs. Explains origin of eccentric structures of manganese dioxide found near Tucson, Ariz., by manganese dioxide being derived from mineral located at nucleus of structure and being precipitated in successive rings by rhythmic precipitation following mingling of outwardly moving manganese solution with one of oxidizing character.

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Review of New Mineral Species (Revue des espèces minérales nouvelles), P. Gaubert. Bulletin de la Société Française de Minéralogie, vol. 41, nos. 4-5-6, Apr.-June 1918, pp. 93-96. Occurrences of crestmoreite, riverdsideite, katoptrite, ektropite aud flokite.

RADIOLARIAN CHARTS. The Radiolarian Charts of the Franciscan Group, E. F. Davis, Uuiv. Cal. Publications, Bul Dept. Geol., vol.11, no. 3, Dec. 23, 1918. pp. 235-432, 30 figs. Results of investigation to determine their origin.

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TEAR FIGURES AND MINERALS. Tear Figures on certain Minerals, Mikio Kuhara. Memoirs College of Eng. Kyoto Imperial Univ. vol. 2. uos. 2 and 3, July and Nov. 1918, pp. 53-62 and 71-82. 45 figs. July: Characteristics on tear-figures on aragonite, alum and borax; Nov. Characteristics on tear-figures on minerals belonging to retragonal and triclinie systems, wulfenite and cupper-sulphate crystals were selected as representatives of these systems.

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KENNECOTT DISTRICT. Mining Copper at Kennecott, Alaska, Min. & Sci. Press, vol. 118, no. 2, Jan. 11, 1919, pp. 53-56, 3 figs. Mining possibilities in Kennecott district.

MINERAL DETERMINATION. Sulphur Dioxide Method for Determining Copper Minerals in Partly Oxidized Ores, Charles E. Van Barneveld and Edmuud S. Leaver (Department of Interior. Bur. of Mines, tech. paper 198, 14 pp., 1 fig. Sources of error in sulphuric acid method and ammonia method for selective determination of copper minerals; procedure iu sodium tartrate method; sulphur dioxide method; results of leaching chalcolite and chalcopyrite with 5 per cent. solution of different reagents; results with four methods compared.

UTAH. The Utah Copper Enterprise.—IX, T. A. Rickard. Min. & Sci. Press,vol. 117, no. 26, Dec. 28. 1918, pp. 853-860, 9 figs. Smelting of conc entrate at Garfield smelter of Am. Smelting & Refining Co.

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HYDROMETALLURGY. Innovations in the Metallurgy of Lead, Dorsey A. Lyon and Oliver C. Ralston. Department of Interior, Bur. of Mines, bul. 157, 1918. 176 pp., 13 figs. Application of new hydrometallurgical and other methods to following types: oxidized lead ores, oxidized lead ores containing precious metals, oxidized lead zinc ores, simple sulphide ores of lead, leady zinc concentrates, lead-iron sulphide middlings, and complex sulphides of lead, zinc, iron and copper, with or without precious metals. Results of experiments conducted by Salt Lake City station of Bur. of Mines in co-operation with department of metallurgical research.

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MANGANESE. Electric Smelting on the Pacific Coast. W. L. Morrison. Jl. Elec. vol. 42, no. 2. Jan. 15, 1919, pp. 67-68. States that while absence of cheap power precludes general development of electric furnace, nevertheless there is real opportunity in electric smelting of silicon manganese.

Metallurgical Investigations During 1918, Van H. Manning. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 65-67. Production of ferro-manganese: smelting low-garde manganese ores in electric furnace; use of low-grade iron; problems studied by Bureau of Mines.

Manganese Deposits of East Tennessee—II, G. W. Stose and F. C. Schrader. Resources of Tennessee, vol. 8, no. 4, Oct. 1918, pp. 235-324, 14 figs. Report prepared under co-operative agreement between State Geol. Survey and U.S. Geol. Survey. Descriptions of mines based on examination of deposits by authors during three-month field trip. Each description includes location of deposit, extent of development of mine, brief account of plant, character and association of ore, and its geologic relations.

NICKEL. A Process for Electrolytically Refining Nickel, Geo. A. Guess. Gen. Meeting Am. Electrochem. Soc., Apr. 3-5, 1919, advance copy, paper 2, pp. 9-12. Impure nickel containing copper and iron is used as anode; both iron and copper go into solution, but copper is precipited by keeping powdered calcium carbonate suspended in electrolyte; cathode is enclosed in canvas bag; glue is used in solution.

ZINC. Metallurgy of Zinc, W. E. Ingalls. Eng. & Min. Jl., vol. 107, no. 2, Jan. 11, 1919, pp. 87-88. Roasting; distillation furnaces; distilling practice.

Foreign Zinc-Smelting Capacities and Prospects, W. R. Ingalls, Eng. & Min. Jl., vol. 107, no. 5, Feb. 1, 1919, pp. 227-228. Refers partieularly to England, Australia, Belgium and Silesia.

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CARS, MINE. Standardization of Mine Cars in Metal Mines, R. M. Raymond. Eng. & Min. Jl., vol. 107, no. 5, Feb. 1, 1919, pp. 220-224, 9 figs. Paper read at Seventh Annual Safety Congress Nat. Safety Council.

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DRILLING. The Technique of Diamond-Drilling, J. A. MacVicar. Min. Mag., vol. 20, no. 1, Jan. 1991, pp. 1825. Histoy and utility of the diamond-drill; patent specifications of Leschot diamond-drilling apparatus; operations followed in process of drilling; recent uses of diamond-drills in testing of foundations for dam sites. Paper read before Cornish Inst. Engrs.

Hammer Drills—Their History, Design, and Operation, Henry S. Potter. Jl. S. A. Instn. Engrs., vol. 17, no. 405, Nov.-Dec. 1918, pp. 68-80, 17 figs. Refers especially to popularly called Jack Hammer type. (To be concluded).

The Hand Hammer Drill, James P. Cotter. Monthly Bul. Can. Min. Inst. no. 82, Feb. 1919, pp. 207-211. Purpose in applying water and air to bottom of drill hole while drilling; uses of hammer drills in coal mines...

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GRAPHITE. Alabama Graphite in 118, W. E. Prouty. Eng. & Min. Jl. vol. 107, no. 4, Jan. 25, 1919, pp. 194-195. Processes in milling; classification of washers; costs.

MONAZITE. Monazite as a Source of Incandescent Lighting, Material. Sydney J. Johnstone. Gas World, vol. 69, no. 1794, Dec. 7, 1918, pp. 350-351. Sources and history of mineral monazite from which are obtained the rare earths composing luminous portion of incandescent gas mantle. From Jl. So. Chem. Indus.

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TUNGSTEN. The Tungsten Industry in 1918, Geo. J. Young. Eng. & Min. Jl. vol. 107, no. 2, Jan. 11, 1919, pp. 78-80. Difficulties of mining; inconvenience of not having standard specifications for buying tungsten ores; domestic and total world production figures.

Tungsten and the War, Julius L. F. Vogel. Min. Mag., vol. 20, no. 1, Jan. 1919, pp. 12-17, Qualities possessed by high speed tungsten steel; development of tungsten industry in Great Britain; manufacture of tungsten.

The Occurrence, Chemistry, Metallurgy and Uses of Tungsten, with Special Reference to the Black Hills of South Dakota, J. J. Runner and M.L. Hartman. South Dakota School of Mines, bul. 12. Departments of Geol. & Chem., Sept. 1918, pp. 1-159 and 257-252, 20 figs. Parts relating to deposits of Black Hills are the result of field work and laboratory research of authors.

A Bibliography of Tungsten Mines, Louis Hartman. South Dakota School of Mines, bul. 12, Departments of Geol. & Chem. Sept. 1918, pp. 160-255, and 262-264. Divided into following general sections: Early references; preparation of tungsten and its commercial compounds; properties; uses of metallic tungsten; compounds; analytical chemistry; mineralogy; geological occurrence in United States and foreign countries; mining and milling, miscellaneous references. Articles indexed have appeared in technieal periodicals

TUNGSTEN AND MOLYBDENUM. Manufacture of Tungsten and Molybdenum, Paul McJunkin. Am. Mach., vol. 50, no. 3, Jan. 16, 1919, pp. 99-100. How tungsten wire is made; coiling the spiral; properties; applications; use of tungsten disks in wireless apparatus; development of X-ray; tungsten wire data.

VANADIUM. Analysis of Vanadium in the Ferrovanadiums (Método de valoracion del vanadio en los ferrovanadios), Vincente Garcia Rodeja, Boletin des Minas, vol. 10, nos, 7-9, Sept. 30, 1918, pp. 122-128. Survey of methods in use; special reference to Slavig method by treatment with nitric and hydrochloric acids; fusion method of Pinerûa (agent in odium bioxide).

OIL AND GAS

CRUDE OIL PRODUCTION. Production of Crude at New High Level. Automotive Industries, vol 40, no. 3, Jan. 16, 1919, pp. 154-157, 2 figs. Exports of all mineral oil products except kerosene show steady increase for 21 years.

The Passing of Petroleum. Engineering, vol. 105, no. 2762, Dec. 6, 1918, pp. 633-635, 3 figs. Review of the present situation.

Petroleum. A Resource Interpretation, Chester C. Gilbert and Joseph E. Pogue. Jl. Soc. Automotive Engrs., vol. 4, no. 2, Feb. 1919, pp. 100-110, 4 figs. Traces waste in present exploitation of petroleum fields to lack of adjustment between economic circumstances affecting production, and the unique geological conditions under which petroleum occurs. It claims that the geological unit or reservoir, by nature indivisible, is arbitrarily subdivided into small parts for purposes of individualistic production.

GASOLINE. Making Gasoline from Gas. Motor Boating, vol. 23, no. 1, Jan. 1919, pp. 13-14, and 47, 2 figs. General arrangement of apparatus employed in process of recovering gasoline from casing-head gas.

Extraction of Gasoline from Natural Gas by Absorption Methods. George A. Burrell. P. M. Biddison and G. G. Oberfell. Water & Gas Rev., vol. 19, no. 7, Jan. 1919, pp. 25-26. Dry natural gas as source of gasoline; transportation of natural gas; effect of gasoline vapors on pipe-line coupling; development of absorption process; comparison of wet and dry natural gas. From bul. 120, Bur. of Mines.

Determining Gasoline in Natural Gas, W. P. Dykema and Roy C. Neal. Automotive Industries, vol. 40, no. 2, Jan. 9, 1919, pp. 57-59, 2 figs. Method evolved at Bartlesville Experiment Station Bureau of Mines.

Testing Gas for its Gasoline Content, W. P. Dykema and Roy C. Neal. Oil & Gas Jl. vol. 17, no. 32, Jan. 10, 1919, pp. 42 and 44, 2 figs. Absorption apparatus developed by Bureau of Mines experts.

MEXICO. Mexico as a Source of Petroleum and Its Products, R. de Golyer. Jl. Soc. Automotive Engrs., vol. 4, no. 2, Feb. 1919, pp. 74-76. Estimates of Reserves in Mexican oil fields; development since 1910; present conditions.

OIL RECOVERY. Production of Oil from Mineral Sources. F. Mollwo Perkin. Gas Jl. vol. 144, no. 2902, Dec. 24, 1918, pp. 658-660. When to use high or low temperature for carbonizing bituminous material. Paper read before Instn. Petroleum Technologists.

PETROLEUM INDUSTRY. Some General Observations on the Petroleum Industry, V. H. Manning. Jl. Soc. Automotive Engrs. vol. 4, no. 1, Jan. 1919, pp 35-38, 2 figs. Co-operation between Bur. of Mines and petroleum industry; possible technical research work; utilization of oil shales; foreign supply situation. From address by Director, Bur. of Mines, before Reconstruction Conference of Indus. War Service Committees.

SHALE. Commercial Possibilities of Oil Shale, Harry J. Wolf. Eng. & Min. Jl. vol. 107, no. 5, Feb. 1, 1919, pp. 217-219, 2 figs. Oil bearing shales in Colorado and Utah and their present development; methods of mining and milling, comparison with Scottish shale deposits.

WATER. SHUTTING OFF. Methods of Shutting Off Water in Oil and Gas Wells, F. B. Tough. Department of Interior, Bur. of Mines, bul. 163, 122,pp., 27 figs. Summarizes existing knowledge of methods and devices for protecting oil or gas sands from encroachment of water; California laws relating to protection of natural resources of petroleum and natural gas flow. Also in Water and Gas Rev., vol. 29, no. 7, Jan. 1919, pp. 28-29.

One of the Problems involved in excluding Water from Oil or Gas Works F. B. Tough. Water & Gas Rev., vol. 29, no. 7, Jan. 1919, pp. 28-29. Making watertight joint between string of casing and wall of hole at impervious stratum above productive sands and below water horizons; formulæ for collapsing pressures of modern lay-welded bessemer steel tubes.

PRECIOUS MINERALS

GOLD. The Value of Gold in the Economic System. Henry Strakosch. Min. & Sci. Press, vol. 117, no. 26, Dec. 28, 1918, pp. 861-863. Classifies gold mines and suggests means for stimulating production of gold.

Tee Gold Problem. Min. Mag. vol. 20. no. 1, Jan. 1919, pp. 28.31. Report of the British Government Committee, appointed to investigate problem of maintaining output of gold in face of increasing costs of mines

GOLD AND SILVER. Metallurgy of Gold and Silver, A. W. Allen. Eng. & Min. Jl., vol. 107, no. 2, Jan. 11, 1919, pp. 92-96. Amalgamation practice; reinstatement of charcoal as precipitant; South African metallurgical progress; gold extraction with colloidal carbon; refining gold bullion; sodium sulphide in cyaniding.

RARE MINERALS

Uncommon Ores and Metals, H. C. Meyer, Eng. & Min. Jl., vol. 107, no. 2, Jan. 11, 1919, pp. 124-125. Uses and demand of palladium, selenium, strontium ore, thorium ore, titanium, uranium and zirconium.

RADIUM. How Radium Bearing Ore Is Mined. Wallace T. Roberts. Min. & Sci. Press, vol. 118, no. 1, Jan. 4, 1919, p. 30, 3 figs.; Mine & Quarry, vol. 11, no. 1, Nov. 1918, pp. 1105-1110, 8 figs. Nov.: Prospecting carnotite areas in Colorado; Jan. 4; Methods of Prospecting followed by Colorado companies.

RADIUM. Its Properties and Occurrence in Nature—11, Richard B. Moore, Metal Rec. & Electroplater, vol. 4, no. 11, Dec. 1918, pp. 391-393. History of metal; location of principal ores and method of working each; present uses and future possibilities; mesothorium as substitute.

TIN

CONSERVATION. Symposium on the Conservation of Tin. Metal Rec. & Electroplater, vol. 4, no. 11, Dec. 1918, pp. 387-390 and 403. Methods by which tin cane be saved and its use reduced; tin alloys; bearing meals, soldiers, babbitts, bronzes and their substitutes.

VARIA

LAWS, MINING. Mining Law and Economics. Minerals, Mines and Quarries, David Bowen. Quarry, vol. 24, no. 263, Jan. 1919, pp. 5-7. Review of authoritative definitions of mineral, ore, mine and quarry with reference to English and continental European legal decisions establishing scope of signification.

MINERALS, INTERNATIONAL CONTROL. International Control of Minerals, C. K. Leith. Department of Interior, U. S. Geol. Survey, Mineral Resources of U. S., 1917—part 1, Dec. 31, 1918, pp. 7a-16a. Movement of minerals under pre-war conditions of international trade; possibility of post-war international control; specific plans of international control of minerals; position of U. S.; general conclusions from standpoint of U. S.

MINING EFFICIENCY. The Economic Limits to Domestic Independence in Minerals, George Otis Smith. Department of Interior, U. S. Geol. Survey, Min. Resources of U. S., 1917—part I, Dec. 28, 1918, pp. 1a-6a. Points out drawbacks in mining industries and that largest degree of national usefulness will be won from mineral resources only through highest efficiency secured by engineering advance and the linking up of mechanical power and man power.

PRODUCTION, U. S. FOR 40 YEARS. 40 Years of Domestic Metal Productioon. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, pp. 180-181, 2 figs. Steady increases shown throughout last 50 years; efforts being made to increase production.

CIVIL ENGINEERING

BRIDGES

AQUEDUCT. Aqueduct Crossing Under the Red River, for Winnepeg Water Supply, J. Armstrong, Contract Rec., vol. 33, no. 4, Jan. 22, 1919, pp. 63-67, 13 figs. Plans, cross section and details. Vertical shafts are 60 ft. deep, horizontal tunnel 1030 ft. long.

BASCULE BRIDGE. 138-Ft. Bascule Bridge at the Entrance of La Seyne Port, Toulon Roadstead (Pont basculant de 42 mètres de portée à l' entrée du port de la Seyne, rade de Toulon). Génic Civil, vol. 73, no. 23, Déc. 7, 1918, pp. 441-444, 25 figs. Detailed description of new French design in which span is raised to perfectly vertical position by atriculated system of levers.

COMBINATION GIRDER AND ARCH. An Unusual Bridge Design, Contract Rch., vol. 33, no. 4, Jan. 22, 1919, p. 74, 1 fig. Reinforced concrete structure which is combination of girder and arch design.

DESIGN. Finding the Most Advantageous Construction of a Bridge by Graphical Methods (Die wirtschaftlich guenstigste. Anordnung einer Brueckenanlage auf zeichnerzischem Wege), Prof. Robert Schoenhoefer, Braunschweig, Zeitschrift fuer Bauwesen, vol. 68, no. 10, to 12, 1918, pp. 502-515, 4 figs. Author refers to his book of same title, (1916, Berlin), as well as to 1916 volume of the Zeitschrift, in which he showed the lay-out for any bridge up to 10 arches. The present work extends this to bridges with any number of arches. The aim is to find the design involving the least cost of construction. The method succeeds where calculations would fail.

LONG SPAN. The Reconstruction of a Notable Railroad Bridge. Ry. Age, vol. 66, no. 4, Jan. 24, 1919, pp. 238-243, 9 figs. Reconstruction of the Ohio River Crossing at Louisville, containing the longest simple riveted span in the world.

MATERIALS. Data on Concrete and Steel Bridges, John W. Towle. Concrete Age, vol. 29, no. 3, Dec. 1918, pp. 16-18. Points out it is best to have shorter spans of concrete, longer ones of steel. Address delivered before North Carolina Good Roads Assn.

STEEL. Steel Bridge Replacements on the Sydney subdivision of Canadian Government Railways, A. H. Jones. Contract Rec., vol. 33, no. 2, Jan. 8, 1919, pp. 28-30, 6 figs. Account of alterations in masonry piers and replacements of light spans in 16 steel bridges and viaducts.

STRENGTHENING Stokesay Bridge, Shropshire, W. Noble Twelvetrees. Engineering, vol. 107, no. 2766, Jan. 3, 1919, pp. 3-6, 17 figs. Strengthening a Telford cast-iron bridge by ferro-concrete arch ribs.

Strengthening a Long Steel Viaduct. Ry. Maintenance Engr., vol. 15, no. 1, Jan. 1919, pp. 9-10, 3 figs. Measures taken by Chicago & Eastern Illinois Ry. to reinforce long steel viaduct so as to permit of its use by heavy locomotives.

STRESSES. Contraction Stresses in Bridge and Roof Trusses (Von der Schrumpfarbeit am Fachwerk), Leopold Ellerbeck, Berlin. Zeitschrift fuer Bauwesen, vol. 68, no. 10 to 12, 1918, pp. 472-502, 27 figs. Scientific analysis of the distortions found in all kinds of trusses. Considers the forces exerted upon a group of members.

WILSON BRIDGE, LYONS. The Sejourne System Wilson Bridge at Lyons, France. Eng. & Contracting, vol. 51, no. 4, Jan. 22, 1919, pp. 74-76, 1 fig. Description of certain features of design and construction.

BUILDING AND CONSTRUCTION

CAISSON METHOD. The Caisson Method for Foundations and Mine Shafts, George R. Johnson. Proc. Engrs.' Soc. Western Pa., vol. 34, no. 7, Oct. 1918, pp. 489-514 and (discussion) pp. 514-518, 20 figs. General survey of applications of caisson method in building foundations, bridge piers, and mine shafts, with numerous illustrative examples.

FLOORS. Test of a Flat Slab Floor of the Western Newspaper Union Building, Arthur N. Talbot and Harrison F. Gonnerman. Univ. Ill. Bul., vol. 15, no. 39, bul. 106, May 27, 1918, 52 pp., 22 figs. Building was nine years old at time of test. Stresses up to 30, 000 lb. sq. in., were developed in reinforcing bars. Information is given extensively on action of slab in its various parts.

Test of a Mixedstone Floor (Essai d'un plancher Mixedstone). Bulletin Technique de la Suisse Romande, year 44, no. 26, Dec. 28, 1918, pp. 233-235, 12 figs. Mixedstone floors are made of seprate reinforced concrete standard parts which are placed and cemented together to from a continuous structure. Tests were conducted at University of Paris to ascertain nodulus of elasticity, relative flexibility and ultimate strength of this construction.

HEATHCOTE PRECAST CONSTRUCTION. A New System of Reinforced Concreto Construction. Engineer, vol. 126, no. 3287, Dec. 27, 1918, pp. 551-552, 4 figs. Description of the Heathcote system of precast coucrete construction.

HOUSES. Fifty Double Wall Houses for Carnegie Employees. Concrete, vol. 14, no. 1, Jan. 1919, pp. 24-27, 8 figs. Five-and six-room houses with double 4-in. concrete walls.

281 Fireproof Dwellings Built of Large Precast Concrete Units, Harvey Whipple. Concrete, vol. 14, no. 1, Jan. 1919, pp. 3-8, 26 figs. Layout of housing development and details of houses built at St. Louis for Youngstown Sheet & Tube Co.

Pouring 75 All-Concrete Houses at Phillipsburg, N. J. Concrete, vol. 14, no. 1, Jan. 1919, pp. 9-14, 15 figs. Twenty-five houses are of four-room bath and basement Ingersoll mold and 50 are from new mold producing six-room and bath house. Plans of houses and construction are shown.

Seventy-five dwellings of Monolithic Concrete at Claymont, Del. Concrete, vol. 14, no. 1, Jan. 1919, pp. 15-19, 19 figs. Plans of four, five- and six-room houses.

Build 20 All-Concrete Houses Plan 20 Bungalows. Concrete, vol. 14, no. 1, Jan. 1919, pp. 20-23, 13 figs. Six-room and bath models but with exterior variation in roof and porch treatment to make attractive row.

MILL BUILDING. Erecting a Building of Pre-Cast Concrete Units. Contract Rec., vol. 33, no. 3, Jan. 15, 1919, pp. 46-47, 9 figs. Columns, beams and trusses' first cast as separate units on the ground and then crected after manner of steel building. Building in question is 160 ft. long, 200 ft. wide and 14 ft. high.

RESERVOIRS. 18,000,000 Gallon Reservoir at Winnipeg. Engineer, vol. 126, no. 3287, Dec. 27, 1918, pp. 545-548, 11 figs. Features of design and construction.

SCHOOLS. High School at Ville St. Pierre, P. Q. Contract Rec., vol. 33, no. 1, Jan. 1, 1919, pp. 4-5. 2 figs. Elevation and plan of modern fireproof educational building.

Academy St. Bernard, Shawinigan Falls, Que. Contract Rec., vol. 33, no. 2, Jan. 1, 1919, pp. 8-9, 4 figs. Three-story brick building 140 X 58 ft.

SEWER. Rosedale Creek Sewer Extension, Toronto. Can. Engr., vol. 36, no. 3, Jan. 23, 1919, pp. 163-164, 4 figs. Circular brick sewer 2598 ft. long, 6 ft. 6 in. diameter, one per cent. grade. Constructed partly in tunnel using compressed air.

WING WALL ABUTMENTS. Method and Formalas for Dimensioning Wing Wall Abutments, Benj. J. Parker. Eng. & Contracting, vol. 51, no. 4, Jan. 23, 1919, pp. 80-82, 5 figs.

CEMENT AND CONCRETE

CEMENT MANUFACTURE ECONOMIES. Make Cement Cheaper; Save Two Million Tons Coal, F. G. McKelvy. Concrete, Cement Mill Section, vol. 14, no. 1, Jan. 1919, pp. 1-4, 7 figs. Theory and practice of power production by use of exhaust gases from cement kilns. Paper presented before Portland Cement Assn.

CEMENT, PROPERTIES OF. Formation and Properties of Blast-Furnace Slag and Portland Cement (La Formation et les propriétés des latiers de haut fourneau et du ciment Portland), B. Neumann. Génie Civil, vol. 73, no. 26, Dec. 28, 1918, pp. 512-513. Chemical constitution and data of industrial value. From Stahl und Eisen, Oct. 17, 1918.

CONCRETE STRENGTH AND MIXING LIME. Effect of Time of Mixing on the Strength of Concrete, Duff A. Abrams. Am. Architect, vols. 114 and 115, nos. 2242 2243-2244 and 2246, Dec. 11, 18, 25, 1918 and Jan. 8, 1919, pp. 711-717, 745-750, 775-781 and 85-87, 30 figs. Report of tests conducted at Structural Materials Research Laboratory, Lewis Inst. Tests covered uniformly of machine-mixed concrete; study of time of mixing concrete on its consistency, effect of mix and size of aggregate on mixing time; study of rate of rotation of mixer drum; and effect of temperature of mixing water on strength of concrete. Paper for presentation to Am. Concrete Inst.

Concrete Tile. Making Concrete Tile for Government Housing. Concrete, vol. 14, no. 1, Jan. 1919, pp. 32-34, 4 figs. Concrete wall tile equivalent in volume to 10,000,000 common brick heing manufactured for United States Housing Corporation of Department of Lahor. Erection, equipment and operation of temporary factory on housing site.

Girder Poles. New Process for the Construction of Reinforced-Concrete Girder Poles (Nouveaux procédés pour la constrution de pylones en béton armé), L. Perrin. Génie Civil, vol. 73, no. 23, Dec. 7, 1918, pp. 452-453, 6 figs. Manufactured in pieces of about 10 in. in height and provided with suitable grooves for steel members; when assemhled grooves are covered with layer of cement mortar.

Iron Portland Cement. The Use of Iron Portland Cement in Reinforced Concrete, Edwin H. Lewis. Jl. West of Scotland Iron & Steel Inst., vol. 26, part 2 session 1918-1919, pp. 8-11 and (discussion) pp. 11-16, 5 figs. Records of furnace workings which show that in properly made iron portland cement (70 per cent. clinker and 30 per cent. water granulated slag) there is no difficuly in keeping sulphur content helow requirements of Brirish standard specification.

Pneumatic Method of Concreting. The Pneumatic Method of Concreting, H. B. Kirkland. Contract Rec., vol. 32 no. 2, Jan. 8. 1919, pp. 25-27, 2 figs. Arrangement of plant. Pneumatic method consists in blowing hatches of concrete through a pipe from a central point of supplies to their place in the concrete forms. Curve given shows amount of air required to convey concrete various distances.

Reinforced Concrete. The Factor of Safety in Plain and Reinforced-Concrete Bodies Subjected to Uniform and Eccentric Pressures. Based on the Experiments of C. Bach and O. Graf. (Ueber den Sicherheitsgrad von hewehrten und unbewehrten Betonkoerpern, die auf zentrischen und exzentrischen Druck heanspracht werden. Unter Zugrundelegung der Forsshungsarheiten Heft 166-169). Armierten Beton, vol. 11, no. 9, Sept. 1918, pp. 174-179, figs. 19 to 24. Continued from 158, mathematical discussion of stresses resulting from eccentric loads. Graphical solution of examples of loading causing deformations.

Reinforced Concrete Under Simple Bending Stress (Der auf einfache Eigung heanspruchte Eissenheton Querschnitt), Max Schendera, Armierter Beton, vol. 11, no. 10, Oct. 1918, pp. 195-199. Calculations, formula and tahles pertaining to deflection in slahs. (To be continued.)

Setting Action. Present Knowledge of the Setting Action of Cement and Plasters. Cement & Eng. News, vol. 31, no. 1, Jan. 1919, pp. 22-25. Brief summaries of addresses presented at international discussion of subject held hy Faraday Soc. of Lond. Following are titles: Setting process in plasters and cements; crystalloids against colloids in theory of cements; agglomeration of granular masses; constitution and hydration of portland cement; colloidal theory of setting; ancient and modern mortar; effect of addtion of slag on setting of cement; setting of portland cement in relation to engineering structures. From Concrete.

Wasteful Construction. Useless Waste in Concrete Construction Due to Legal Requirements. W. Stuart Tait. Am. Architect, vols. 114 and 115, nos. 2242, 2243 and 2248, Dec. 11, 18, 1918, and Jan. 2, 1919, pp. 717-718, 750-752 and 79-84, 6 figs. Draws attention to developments which have taken place in analytical side of reinforced concrete design and to improvements in materials used; shows that there is now in existence a large force of skilled mechanics and general contractors fitted to construct reinforced concrete, as compared with time when present methods of design and stresses were established. (To be continued.)

Wear of Concrete. The Wearing Resistance of Concrete, Duff A. Abrams. Contract Rec., vol. 33, no. 4, Jan. 22, 1919, p. 77. Methods for determining maximum resistance to wear.

Winter Concreting. Concreting in Cold Weather, Mun. Jl. vol. 46, no. 1, Jan. 4, 1919, pp. 718. Suggestions offered hy Portland Cement Assn.

Dams. See Earthwork, Rock Excavation, etc., below.

EARTHWORK, ROCK, EXCAVATION, ETC.

Blasting Pole Holes. Digging Pole Holes with Dynamite, C. R. Van Druff. Telephone Engr., vol. 21, no. 1, Jan. 1919, pp. 11-12, 4 figs. Hole is bored with 1.5-in. auger to within 1 ft. of desired depth; then charge is inserted and tamped down with earth and fired hy blasting cap and fuse.

Crushed Stone. Standard Sizes of Crushed Stone from the Standpoint of the Producer, R. W. Scherer. Contract Rec., vol. 33, no. 1, Jan. 1, 1919, pp. 11-13. Affirms that standard sizes of crushed stone throughout the states are possible and highly desirable and proposes that nomenclature he confined to stating maximum and minimum sizes. Suggests 3, 2, 1½, 1, ½, ¼ in. as screen sections.

Dams. Hollow Concrete Dam at the Outlet of Lake St. François. O. Lefebvre. Contract Rec., vol. 33, no. 3, Jan. 15, 1919, pp. 42-45, 6 figs. Plan, elevation, typical section and details of construction. Project calls for expenditure of $101,000.

Big Eddy Conservation Dam. Can. Engr., vol. 36, no. 2, Jan. 9, 1919, pp. 136 and 138. General dimensions of dam under erection at estimated cost of $1,750,000.

The Engineering and Construction of a Concrete Diverting Dam, George M. Bacon. Monthly Jl. Utah Soc. Engrs., vol. 4, no. 11, Nov. 1918, pp. 181-190, 8 figs. Sketch of dam on Boise River, which forms part of Payette-Boise Project of U. S. Reclamation Service. River at point of dam has extreme minimum flow of 650 and a maximum of 40,000 cu. ft. per sec.

Reservoir. Building a Reservoir in a Cavernous Country. Ry. Maintenance Engr., vol. 15, no. 1, Jan. 1919, pp. 15-17, 2 figs. How danger of leakage through subterranean channels was avoided.

Steam Shoveling. Steam Shovel Practice, Llewellyn N. Edwards. Can. Engr., vo. 36, no. 2, Jan. 9, 1919, pp. 123-126, 6 figs. Factors upon which economy of operation depends; essential characteristics of efficient operator.

Tunnels. Economics of the C. N. R. Tunnel at Montreal, H. K. Wicksteed. Can. Engr., vol. 36, no. 4, Jan. 23, 1919, pp. 157-162, 5 figs. Prohlems in location that arose when seeking entrance into that city; observations and incidents regarding construction difficulties. Paper read before the Toronto Branch Eng. Inst. Can.

HARBORS

Hamilton. Recent Harbor Improvement at Hamilton. John Taylor. Contract Rec., vol. 33, no. 3, Jan. 22, 1919, pp. 70-72, 4 figs. Completing construction of wharf wall and reclamation of enclosed area behind it.

Quebec. Champlain Dry Dock for Quebec Harbor, U. Valiquet. Engineering, vol. 106, no. 2762, Dec. 6, 1918, pp. 658-662, 16 figs. Illustrated description from paper before Canadian Soc. of Civil Engrs.

Singapore. Recent Harhor and Dock Works at Singapore, Straits Settlements. Engineering, vol. 106, no. 2761, Nov. 29, 1918, pp. 603-608, 17 figs. Account of recent developments and improvements.

ROADS AND PAVEMENTS

Bituminous Roads. Bituminous Surfaces in York County, Ont., E. A. James. Can. Engr., vol. 36, no. 3, Jan. 16. 1919, pp. 145-146. Classifies hituminous surfaces into surface mats and wearing surfaces; method followed for each is given. Paper hefore Ont. Good Roads Assn.

Canada. Width of Provincial Highways, W. A. McLean. Can. Engr., vol. 36, no. 2, Jan. 9, 1919, pp. 131-133, 5 figs.. Road sections proposed by Ontario Ontario Deputy Minister of Puhlic Highway.

Concrete Roads. The Construction of Concrete Roads, William W. Cox. Contract Rec., vol. 33, no. 3, Jan. 15, 1919, pp. 52-53. Notes on Drainage, preparation of suhgrade, selection of materials, workmanship and prospection. Paper before Mich. State Good Roads Assn.

Cracking of Concrete Roads and Its Prevention by Reinforcing with Steel, W. B. Sawyer, Jr. Cement and Eng. News, vol. 31, no. 1, Jan. 1919, pp. 28-29. Expansion of concrete by change of temperature; change in moisture content; non-uniform hearing on sub-base; expansion or contraction of hub-base due to change in moisture content; placing reinforcing steel. From Western Eng.

Drainage. Drainage, Methods and Foundations for County Roads, E. W. James, Vernon M. Peirce and Charles H. Moorefield. U. S. Department of Agriculture, hul. 724. Dec. 21, 1918, 86 pp., 33 figs. Discussion of important characteristics of different kinds of soils ordinarily encountered in highway construction; proper methods of draining roadbeds constructed of various kinds of soil and under different topographical conditions; explanation of how foundations may be designed to suit soil conditions, road surface and system of drainage.

Engineers, Highway. Engineers for Highway Work, John H. Mullen. Contract Rec., vol. 33, no. 3, Jan. 15, 1919, p. 48. Inadequate pay of highway engineers; qualifications of a highway engineer. From paper before Am. Assn State Highway Officials.

French Roads. American Methods and Machinery Applicable to Construction and Maintenance of French Highways, Arthur H. Blanchard, Mun. Jl., vol. 46, no. 2, Ja., 11, 1919, pp. 23-32, 16 figs. Restoring of French roads that have heen worn out by traffic or destroyed by enemy.

Heavy-Traffic Roads. Notes on Road Construction and Maintenance. Thomas Sawyer Bower. Quarry, vol. 24, no. 263, Jan. 1919, p. 18. Author's experience in regard to securing road which will stand abnormal traffic for long-periods. Abstract of paper before Instn. Civil Engrs.

Minnesota Highways. Proposed Highway System for Minnesota. Good Roads, vol. 16. no. 26, Dec. 28, 1918, pp. 249-250, 1 fig. Description of 6000-mile system of main roads proposed hy State Highway Department.

National Highways. A National Highway Policy and Plan, E. J. Mehren. Am. City, vol., 20, no. 1, Jan. 1919, pp. 1-5. Plea for selection, construction and maintenance by Federal Government of a national highway sytem that shall emhrace entire country. From address before Joint Highway Congress.

Road Surfaces. Investigations in the Structure of the Road Surfaces, Francis Wood. Surveyor, vol. 54, no. 1403, Dec. 6, 1918, p. 267, Quarry, vol. 24, no. 263, Jan. 1919, pp. 16-17. Surveyor: Tests over obstructions and hollows, and concerning two-coat work, remarks on voidless composition. Quarry: Suggests that, provided that a homogeneous mass of material is interposed between a stable suhstructure and wearing surface, foundations need not be more than 4 in. in depth, and such comhinations will satisfy regulations that apply to vehicles in England. Ahstract of paper hefore Instn. Civil Engrs. Also in Times Eng Supp., no. 530, Dec. 1918, p. 267.

Road Corrugation. Road Corrugation, Ernest Leonard Leeming. Surveyor, vol. 54, no. 1403, Dec. 6, 1918, p. 270. Probahle causes; suggestions for preventing or alleviating it. Ahstract of paper before Instn. Civil Engrs. Also in Times Eng. Supp., no. 530, Dec. 1918, p. 267.

San Francisco. Street Paving in San Francisco. Mun. Jl. vol 46, no. 1, Jan. 4, 1919, pp. 1-3, 3 figs. Basalt blocks for heavy traffic, hrick for steep grades, asphalt and hituminous concrete for easy gradees. Methods of constructing hase and wearing surface; grading streets; cost.

Subgrade. Methods for Subgrade Testing on Street Grading Work, E. Earl Glass. Am. City, vol. 20, no. 1, Jan. 1919, pp. 47-48, 2figs. Use of two 8-ft. rods graduated to feet and tenths from middle as zero, fitted with spikes, and having adjustahle targets

Wisconsin Highways. Marking and Mapping the Wisconsin Trunk Lime Highway System, A. R. Horst. Good Roads, vol 17, no. 2, Jan. 11, 1919, pp. 13-15, 3 figs. From a paper entitled The Underlying Principles, controlling the Laying Out., Marking and Maintaining of a State Trunk Highway System, presented at joint session of Am. Assn. State Highway Official and Highway Industries Assn.

SANITARY ENGINEERING

GARBAGE. Methods of Garbage and Rubbish Collection and Disposal in Larger Cities. Contract Rec., vol. 33, no. 2, Jan. 8, 1919, pp. 32-34. Methods followed in Baltimore, Chicago, Cincinnati, Cleveland, Kansas City, Mo., Milwaukee, Minneapolis, New York, St. Louis and St. Paul.

SEWAGE-PLANT OPERATION. Instruction for the Operation of State Sewage Plants. Contract Rec., vol. 33, no. 2, Jan. 8, 1919, pp. 35-37. Bulletin prepared by Bureau of Sanitary Engineers and issued by Texas State Board of Health.
Biological Purification of City Sewage (Die Klaeranlage der staedtischen Kanalisation, in St. Gallen). Schweiz Bauzeitung, vol. 72, no. 24, Dec. 14, 1918, pp. 231-233, 6 figs.Con- cluded in Dec. 21 number. Technical description of sewage purification plant for 60,000 inhabitants. The drip system used in conjunction with a small river.

SEWER CONSTRUCTION. Rideau River Intercepting Sewer, Ottawa, L. McLaren. Contract Rec., vol. 33, no. 2, Jan. 8, 1919, pp. 21-24, 9 figs. Design and construction of interceptor which will drain 1060 acres.
Some Sewer Construction Details. Mon. Jl., vol. 45, no. 26, Dec. 28, 1918, pp. 501-502, 2 figs. Laying a sewer above street grade; excavating. and laying sewer in deep trench in sand and water.

WATER SUPPLY

METERS. Sizes of Service Meters, W. R. Edwards. Mun. Jl., vol. 46, no. 1, Jan.4, 1919, pp. 4-5. Practices and experience of Passaic Water Co. in use of meters, especially in regard to desirable sizes. Paper before N. Y. Section, Am. Water Works Assn.

PIPE MAINTENANCE. Lead Pipe Couplings, J. A. Jensen. Jl. Am. Water Works Assn., vol. 5, no. 4. Dec. 1918, pp. 407-411. Examples of water loss to municipality on account of service leaks occurring between water main and meter; results of experimental examination of conditions developing leaks.
Cold Weather and Mains in Duluth. Mun. Jl., vol. 46, no. 1, Jan. 4, 1919, pp. 6-7. Experience with freezing and thawing by electricity.
Water Main Cleaning in St. Louis. Mun. Jl., vol. 46, no. 1, Jan. 4, 1919, pp. 5-6, 4 figs. Methods and results in cleaning 50 miles of mains.

RESERVOIRS. Waterworks Operation: Maintenance of Reservoirs. Mun. Jl., vol. 45, no. 26, Dec. 28, 1918, pp. 506-507; vol. 46, no. 1, Jan. 4, 1919, pp. 10-12. Dec. 28: Features of maintenance of small reservoirs and of large impounding reservoirs, sodding and other treatment of embankments: Jan. 4: Causes of leakage from reservoirs, their location, stopping them by use of cement, asphalt, clay, etc. (To be continued.)
Construction Methods Employed in Building the New Intake and Remodeled Reservoirs of the Oshkosh, Wis., Water Works, T. B. Jorgen, sen. Cement & Eng. News, vol. 31, no. 1, Jan. 1919, pp. 26-27, 3 figs. Intake consists of 300 ft. of piping connecting shore line with suction well in filtratian plant, and 1200 ft. of piping from shore line out in Lake Winnebago. It is constructed of 24-in. cast-iron piping.

WATER MAINS, PROTECTION OF. Protecting Water Mains, Fire Hydrants and Valves Against Freezing in Winnipeg, F. H. Hooper. Contract Rec., vol. 33, no. 1, Jan. 1, 1919, p. 3. Paper before Nat. Fire Protection Assn.

WATER PURIFICATION. St. Louis Water Purification Plant. Mun. Jl., vol. 45 no. 26, Dec. 28, 1918, pp. 503-505. Amounts and prices of chemicals used; methods and results of operation; cleaning filter sand; effects of chemicals on apparatus; itemized cost of operating plant.

WATER STORAGE. Advantages and Disadvantages of the Storage of Water, Melville C. Whipple. Contract Rec., vol. 33, no. 2, Jan. 1, 1919, pp. 6-7. Claims that storage of surface water affords effectual means of safeguarding its hygienic quality and indicates means to overcome increase of color and production of tastes and odors from growth of microscopic organisms.

WATERWAYS

GEORGIAN BAY CANAL. The Georgian Bay Canal, J. J. Bell. Engineer, vol. 126, no. 3286, Dec. 20, 1918, pp. 527-528, 8 figs. Description of proposed Canadian canal connecting Georgian Bay with the St. Lawrence at Montreal.

INTERIOR NAVIGATION. Notes in Interior Navagation of Various Countries (Apuntes soble la navegacion interior en algunos paises), Carlos Mendnza. Revista de Obras Publicas, year 66, nos. 2256 and 2257, Dec. 19 and 26, 1918, pp. 625-630 and 637-640. Dec. 19: Economical aspect of inland water transportation and railway construction in development of present network of canals and navigable rivers in France; Dec. 26: Data on navigabl courses in England, United States, Germany and Italy. (Concluded).

ITALY. The Port of Ostia Nuova. near Kome, and the Railway from Ostia to Rome (Le port d'Ostia Nuova, près de Rome et le chemin de fer Osti à Rome). Génie Civil, vol. 74, no. 1, Jan. 4, 1919, pp. 12-13, 2 figs. Project to build navigable canal connecting Rome and Ostia Nuova.

U. S. RULES WATER TTANSPORTATION. Rivers, General Rules and Regultions Prescribed by the Board of Supervising Inspectors as Amended at Board Meeting of January 1918, and Further Amended by Action of Executive Committee of the Board of Supervising Inspectors, Meetings of March 15, April 3, May 11, June 5, August 5, and September 24, 1918. Departmet of Commerce, Steamboat-Inspection Service, form 801-D, Nov. 19, 1918, 145 pp. 5 figs. Concerning boilers, attachments, boats, rafters, fire apparatus, ferrybots, barges, lifeboats, steam pumps, safety valves, etc.

MUNICIPAL ENGINEERING

TOWN PLANNING. Town Planning in New Zealand, A. G. Waller. Jl. Am. Inst. Architects. vol. 6, no. 12, Dec. 1918, pp. 567-577. Résumé of town-planning bill; conditions of trade, wealth and production in New Zealand; significance of town-planning in architectural developments.
Relation of the Curve to Town-Planning, H. L. Seymour. Can. Engr. vol. 36, no. 2, Jan. 9, 1919, pp. 119-121, 4 figs. Discussion of methods employed in laying out curves for streets or lot lines.

AUXILIARY EQUIPMENT

CONDENSERS. Auxiliary Machine on British Standard Ships. Shipbuilding and Shipping Rec., vol. 12, no. 25, Dec. 19, 1918, pp. 595-596, 5 figs. General arrangement of auxiliary machinery for A and B types; details of auxiliary condenser incorporated in main engine structure on marine engines

PROPELLERS. Chart for Diameters of 3-Bladed Propellers, Motor Boat, vol. 16, no. 1, Jan. 10, 1919, p. 12, 1 fig. To determine diameter of propeller from desired revolutions and horsepower delivered.
Screw Propellers, C. W. Dyson. Jl. Am. Soc. Naval Engrs., vol. 30, no. 4, Nov. 1918, pp. 753-805. 4 figs. Theoreitical discussion covering thrust deduction and wake gain; slip block coefficient : wiug screws; correction of slip block coefficient for variation of midship section coefficient from standard; mean relative clearance of propellers; resistance of hull appendages; basic conditions for analysis and design of screw propellers;general formulæ for power correction for "cavitation" and "dispersal of thrust column'"; standard forms of projected area ratio; standard forms of blade sections; problems in propeller design.

VALVES AND FITTINGS. Marine Practice in Valves and Fittings, A. G. Christie. Mech. Eng., vol. 41, no. 2, Feb. 1919, pp. 135-136. Suggests that certain features of central-station practice be extended to marine practice.

SALVAGE

SALVAGING DEVICE. Making the Sea Give Up Its Wealth. Am. Marine Engr., vol. 14, no. 1, Jan. 1919, pp. 12-14, 1 fig. Patented salvaging device consisting of dual system of non-capsizing pontoons to serve as lighters for salvage and quarters and workshops for wrecking crews as well as for raising vessels on an even keel.

S. S. ST. PAUL. The Salvage of the St. Paul. Engineer, vol. 126, no. 3284, Dec. 6, 1918, pp. 480-483, 7 figs. Account of raising of liner which sauk at her pier in New York Harbor.

SHIPS

CAMOUFLAGE. Principles Underlying Ship Camouflage, Alon Beent. Int. Mar. Eng., vol. 24, no. 2, Feb. 1919, pp. 90-93, 9 figs. Complementary colors to produce low visibility; dazzle system of ambiguous perspective to disguise ship's course; special color effects.

CASTINGS. Castings Used in Ship Construction. Ben. Shaw and James Edgar. Foundry Trade Jl. vol. 20, no. 203, Nov. 1918, pp. 579-584, 26 figs. Methods adopted in making pattern for and casting rudder; general considerations on large and small castings.

CONCRETE VESSELS. Reinforced Concrete Steamer "Armistice," Engineering, vol 107, no. 2767, Jan. 10, 1919, pp. 46-48, 8 figs. Illustrations with general description of a 205-ft. concrete steamer constructed by the Ferro-Concrete Ship Construction Co., Limited, Barrow-in-Furnass.
Concrete Ships, Times, Eng. Supp., no. 530, Dec. 1018, pp. 252-253, Program at Lancashire yards; equipment of yards.
New Type of Reinforced Concrete Boat. Concrete Age, vol. 29, no. 3, Dec. 1918, pp. 24-25. System followed at Aberthaw yard for building 500-ton lighters.
Structural Details of Concrete Ships, W. Noble Twelvetrees. Nautical Gaz., vol. 95, no. 2, Jan. 11, 1919, pp. 24-25. Systems of concrete shipbuilding followed in British shipyards and advantages claimed by advocates of each system. Frnm the Shipbuilder.
The Waller System of Reinforced Concrete Ship Construction, W. Noble Twelvetrees. Engineering, vnl. 106, no. 2760, Nov. 22, 1918, pp. 580-583, 16 figs. Description of system introducing precast concrete slabs into construction.

DETAIL DRAWING METHODS. Detail Drawing Method Used for 8800-Ton Steel Ships. Eng. News Rec., vol. 82, no. 4, Jan. 23, 1919, pp. 188-190, 3 figs. Adapted successfully to old-style ships of fully curved shape; permits checking pieces before they leave ship.

ELECTRICAL INSTALLATION WORK. Cutting Time on Installatinn Work. Jl. Elec., vol. 42, no. 1, Jan. 1, 1919, pp. 25-26. Systematic planning of electrical installation work as carried out in large shipyard.

ELECTRIC PROPULSION. The Ljungstroöm Turbo-Electric System of Ship Propulsion. Jl. Am. Soc. Naval Engrs., vol. 30, no. 4, Nov. 1918, pp. 813-834, 60 figs. Ljungstrôm turbine consists of two disks carrying intermeshing rings of reaction blading; each disk is direct-coupled to a generator. Turbine, equipment auxiliaries and mountings are treated at length. From Engineering.
Electric Propulsion on the New Mexico Wingrove Bathnn. Elec. World, vnl. 73, nn. 1, Jan. 4, 1919. pp. 7-10, 1 fig. Interview with Rear-Admiral Griffin nf U. S. N. New system nf driving ships adopted as national policy; Great Britain and France probably will follow American lead.

FABRICATED SHIP. The Fabricated Ship in America. Engineer, vol. 126, no. 3286, Dec. 20, 1918, pp. 523-524, 12 figs. Description and discussion of the "fabricated" ship.

FERRY STEAMERS. Train Ferries to France. Times Eng. Supp., no. 530, Dec. 1918, p. 251, 3 figs. Engineering features of ferry steamers and of bridges for loading and unloading them.

FORD CHASERS. Ford Methods in Ship Manufacture—11. Fred E. Rogers. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 119-124, 12 figs. Layout equipment and tools of shop where 200 tons of interchangeable steel parts for the Eagles are produced in a working day. (To be continued.)
The Building of American Submarine Chasers, Engineering, vol. 106, no. 2761, Nov. 29, 1918, pp. 608-609, 3 figs. Account of construction of "Ford "Eagles"

GROTON SHIPYARD. Groton Shipyard Built on Sloping Limestone Ledge. Eng. News-Rec., vol. 82, no. 3, Jan. 16, 1919, pp. 135-138, 6 figs. Fabricating and storage yards levels with rails on concrete craneways and 22 ft. above concrete shipways set into rock.

Hoo Island Ship. Plans for Hog Island Steel Cargo Ship. Int. Mar. Eng., vol. 24, no. 2, Feb. 1919, pp. 71-74, 3 figs. Design and construction of single-screw vessel of 7500 tons deadweight type; cargo space 380,000 cu. ft.

Launching. Notes on Launching, William Gatewood. Engineering, vol. 106, no. 2764, Dec. 20, 1918, pp. 710-711, 7 figs.; Int. Mar. Eng., vol. 24, no. 2, Feb. 1919, pp. 83-87, 7 figs. Paper before Society of Naval Architects and Marine Engineers, Philadelphia, Nov. 1918.

Refrigerator Ships. The Refrigerator Ship "Belle-Isle" (Le navire frigorifique "Belle-Isle"), Emile Gouault. Génie Civil, vol. 73, no. 26, Dec. 28, 1918, pp. 501-504, 7 figs. Conformation and plans. Ship is three-decked and of awning-deck type, with capacity of 12,000 beeves.

Turbine Propulsion. Italian Geared Turbine Cargo Steamer, Int. Mar. Eng. vol. 24, no.-2, Feb. 1919, pp. 94, 2 figs. Brief description wito plan of ship. Built by N. Odero & Company, at Sestri Ponenti, and fitted with Tosi geared turbie propelling and auxiliary machinery.

Progress in Turbine Ship Propulsion, Francis Hodgkinson. Engineering, vol. 107, no. 2767, Jan. 10, 1919, pp. 42-45, 9 figs. Report, sligthly abbreviated read before the Society of Naval Architects and Marine Engineers, Philadelphia, Nov. 1918.

Progress in Turbine Ship Propulsion, Francis Hodgkinson. Shipping, vol. 5, no. 13, Dec. 28, 1918, pp. 15-16, 1 fig. Auxiliaries used and practice followed. Abstract of paper before Soc. Naval Architects an Marine Engrs.

Ventilating and Heating. Ventilating and Heating from the Marine Point of of View, Chas. F. Gross. Jl. Am. Soc. Naval Engrs., vol. 30, no. 4, Nov 1918, pp. 728-736. Systems followed im merchant ships; design and installation of ventilators: allowance of square feet of radiator surface by leading shipbuilding companies.

Manufacturing a Ship's Ventilator, H. E. McCauley. Am. Mech. vol. 50, no. 2, Jan. 9, 1919, pp. 47-51, 15 figs. Describes manufacture of of American-type ventilator cowls.

Welded Ships. The First Electrically Welded Boat, John Liston. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 844-848, 10 figs. Particulars of boat built in 1915 at Ashtabula, Ohio, and still in service on Great Lakes.

The Adequacy of Welding in Constructing Hulls of Ships. H. M. Hobart. Gen. Electrical Rev., vol. 21, no. 12, Dec. 1918, pp. 840-843. Author expresses belief in adequacy of method.

Rules for Electrically-Welded Ships, Jl. Engrs., Club, St. Louis, vol. 3, no. 6, Nov.-Dec., 1918, pp. 331-334. Regulations adopted by general committee of Lloyd's Register of Shipping, London. From Nauticus, Sept. 7, 1918.

YARDS

Reduction Gears. Mechanical Reduction Gears, J. A. Davies. Jl. Am. Soc. Naval Engrs., vol. 30, no. 4, Nov. 1918, pp. 705-727, 11 figs. Formulæ for designing pinions; consideration on selection of material for bearings; types of couplings; undesirability of flexible couplings in high powered, high-speed machinery; contour used for teeth of marine reduction gears of double-helical type; accidents and changes due to wear or operation.

Shipbuilding, United States and Canada. Shipbuilding Development in the United States and Canada, W. R. Gray and Edward F. Clarke. Engineering, vol. 106, no. 2765, Dec. 27, 1918, pp. 740-742, 3 figs. Paper before North-East Coast Inst. of Engineers and Shipbuilders, December 1918.

Shipyards. Recent Developments in Shipyard Plants, S. M. Henry, Int. Mar. Eng., vol. 24, no. 2, Feb. 1919, pp. 74-76. From a paper before the Society of Naval Architects and Marine Engrs.

Welding. Application of Electric Welding to Shipping. Jl. Am. Soc. Naval Engrs., vol. 30, no. 4, Nov. 1918, pp. 912-919, Summary of experimental results obtained from tests conducted by Llyd's Register of Shipping. From Engineering.

Electric Welding in Ship Construction, H. Jasper Cox. Int. Mar. Eng., vol. 24, no. 2, Feb. 1919, pp. 95-99, 1 fig. Second and concluding article. Results of Lloyd's tests; tentative regulations for arc welding in ship construction; electrically welded vessels and proposed designs.

Oxy-Acetylene Restores Huge Marine Engine for British Navy, Norman MacLeod. Jl. Acetylene Welding, vol. 2, no. 7, Jan. 1919, pp. 336-338, 1 fig. Repairing a 30-ton triple-expansion marine engine all of whose cylinders were fractured.

Arc Welding in Shipyards, W. L. Roberts. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 860-864, 13 figs. Some applications of arc welding.

Electric Welding in Navy Yards, H. G. Knox. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 849-859, 20 figs. Arc-welding and resistance welding processes as related to their general application in navy yard; work conducted in each type of shop; recommendations as to kinds of welding equipment desirable; figures of speed and cost of welding ship structures.

Electric Welding in Ship Construction, H. Jasper Cox. Jl. Engrs.' Club' St. Louis, vol. 3, no. 6, Nov.-Dec. 1918, pp. 323-331. Summary of progress accomplished during recent months in application of electric (and specially arc) welding processes to structural work in shipbuilding. Paper before Soc. Naval Architects and Marine Engers. From Nauticus, Nov. 23, 1919.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

Storage Batteries. Hypothesis Concerning the Action of the Negative Plate in a Lead Storage Battery (Hypothèse sur le fonctionnement de la plaque négative de l'accumulateur au plomb). Ch. Féry. Industrie Electrique, year 27, no. 636, Dec. 25, 1918, pp. 467-467.

ELECTRODEPOSITION

Nickel Plating of Cast Iron. Depositing Nickel on Cast Iron from a Hot Electrolyte, Roay F. Clark, Metal Rec. & Electroplater, vol. 4, no. 11, Dec. 1918 pp. 401-402. Results achieved by plater on shears and scissors with date extending over long period; advantages of hot process.

Silver and Gold Refining. Electrolytic Silver and Gold Refining at Perth Amboy, N. J. Geo. G. Griswold. Gen. Meeting Am. Electrochem. Soc., Apr. 3-5, 1919, advance copy, paper 1, pp. 1-7, 8 figs. Refining silver bullion by Morobius process at works of Am. Smelting & Refining Co.; Wohlwill plant for electrolytically refining gold bullion and recovering from it platinum and palladium.

ELECTROPHYSICS

Alternating Currents. Mean Power and Power Factor in a Non-Sinusoidal Alternating-Current Circuit (De la puissance mayenne et du facteur de puissance dans un circuit à courants alternatifs non sinusoidaux), H. Pécheux. Revue Générale de l'Electricité, vol. 4, no. 22, Nov. 30, 1918, pp. 813-816, 2 figs. Calculation of costs from oscillographic records. Method followed for determining non-sinusoidal electromotive force is the one published in R. G. E., Feb. 8, 1918,

Cable, Armored, Resistance of. Effective Resistance and Reactance of a Three-Phase Armored Cable to Current Harmonics (Sur la résistance et la réactance effectives d'un cable armé triphasé pour les harmoniques du courant), R. Swyngedauw. Revue Générale de l'Electricité, vol. 5, no. 1, Jan. 4, 1919, pp. 16-17. Deduces from results of experiments that for third harmonic of fundamental frequency 50 per sec. resistance is comprised between 0.67 and 0.78 ohm per km., and reactance between 0.45 and 0.56 ohm. per km.

Coolidge Tube. On the Theory of the Coolidge Tube (Sur la théorie du tube Coolidge), G. Johannès and F. Wolfers. Revue Générale de l'Electricité, vol. 4, no. 26, Dec. 28, 1918, pp. 991-994. Criticism of A. Dauvillier's article (R. G. E., vol. 4, Sept. 1918, pp. 443-446) written in support of H. Pilon's theory (R. G. E., vol. 4, July 1918, pp. 99-102) concerning action of oxygen in tungsten anticathode of tube. Johannès and Wolfers establish that oxygen emitted by point of impact abates electronic emission.

Electrolytic Cell. Influence of a Magnetic Field and of a Mechanical agitation of Electrolyte on the Potential Difference at the Terminals of an Electrolytic Cell (Influence d'un champ magnétique et d'une agitation mecanique du bain sur la différence de potential aux bornes d'une cuve électrolytique), Toshikozu Mashimo. Revue Générale de l'électricité, vol. 5, no. 1, Jan. 4, 1919, pp. 17-18. Experiments with platinum electrodes in semi-normal solutions of iron chloride. From Memoirs of the College of Science, Kyoto Imperial Univ., vol. 2, no. 6, Oct. 1917, pp. 341-347.

Long Conductors. Some Experiments with Long Electrical Conductors, John H. Morecroft. Elecn., vol. 81, no. 2116, Dec. 6, 1918, pp. 658-660, 7 figs. From paper before Inst. of Radio Engrs.

Long-Line Phenomena. Long Line Phenomena and Vector Locus Diagrams, Edy Velander. Elec. World, vol. 73, no. 5, Feb. 1, 1919, pp. 212-216, 12 figs. Long-line transmission problems may be readily solved by the use of rigorous hyperbolic equations of very simple form; an anlysis of equations of this form with vector diagrams for graphical interpretation.

Parallel Conductors. Determination of the Resistance and Impedance of Any Number of Parallel Conductors (Détermination de la résistance et de l'impédance d'un nombre quelconque de conducteurs associés en parallèle), P. de Bancarel. Revue Générale de l'Electricité, vol. 4, no. 26, Dec. 28, 1918, pp. 989-990, 3 figs. Graphical process based on representation of resistances by trigonometive tangents. Simplification of method suggested by Haudié in Revue Générale de l'Electricité, vol. 3, Aug. 31, 1918, p. 297.

Paramagnetism. The Quantum Theory of Paramagnetism (Zum Quantentheorie des Paramagnetismus), Fritz Reiche. Annalen der Physik, Leipzig, vol. 54, no. 22, 1917, pp. 401-436, 7 figs. Discusses the kinetic theory of paramagnetism from the differential equations proposed by Jacobi, Hamilton, and Planck, and compares them with tests made by Kamerlingh Onnes and Oosterhuis.

Quenched Sparks. Processes Occurring in a Quenched Spark (Ueber die Vergaenge in sogenannten Loeschfunken), V. Pieck, Annalen der Physik, vol. 54, no. 19, pp. 197-244, 14 figs., 3 plates. Relates to electrical vibrations leading to shock. Experiments with various gases at different pressures and with magnesium electrodes. Dynamic theory of quenched sparks. Iron and electrons. Tests at University of Goettingen.

Short-Circuits. Substation Short-Circuits, R. F. Gooding, Elec. Jl., vol. 16, no. 2, Feb. 1919, pp. 61-65, 6 figs. Calculations to determine stresses to which oil circuit breakers, disconnecting switches, bus supports, etc., may be subjected in substations fed by parallel feeders at a time of short circuit. Several typical examples of special systems are selected.

Transverse Magnetization. The Influence of Transverse Magnetization on the Electrical Resistance of Tellurium (Ueber den Einfluss transvaler Magnetisierung auf den elektrischen Widerstand von Tellur), Bengt Beckman. Annalen der Physik, vol. 54, no. 19, 1917, pp. 182-196. Measurements given of the electrical resistance of rods of tellurium and other rare metals at various temperatures.

FURNACES

Electrically Heated Ovens. Electrically-Heated Ovens. Iron Age, vol. 1003, no. 3, Jan. 16, 1919, pp. 188-189, 2 figs. Construction and operation of enameling ovens; efficiency of different types compared.

Electrically-Heated Ovens. Metal Rec. & Electroplater, vol. 4, no. 11, Dec. 1918, pp. 395-396, 3 figs. Material for walls, insulation, floors; disadvantages of through metal; four general types; efficiency of the various form.

ITALY. Future of the Electric Furnace in Italy (Forni elettrici), G. Revessi. L'Elettrotecnica, vol. 5, no. 32, Nov. 15, 1918, pp. 454-456. Treats question from standpoint of economy, fuel shortage, industrial requirements, etc. According to writer, number of furnaces in Italy reaches 270, consuming about 150,000 kw. of energy, with addition of 250 baths for aluminum production.

METALLURGICAL FURNACES. Electric Furnace Developments, J. Bibby. Iron & Coal Trades Rev., vol. 97, no. 2652, Dec. 27, 1918, pp. 719-722, 7 figs. Abstract of paper before Cleveland Inst. of Engrs.

Application of the Electric Furnace to the Metallurgy of Iron and Its Alloys, H. Etchells. Elecn., vol. 81, no. 2119, Dec. 27, 1918, pp. 734-735. Abstract of paper read before the National Association of Industrial Chemists, November, 1918.

Electric Furnaces for Steel Foundry Work, W. E. Moore. Blast Furnace vol. 7, no. 1, Jan. 1919, pp. 76-77. Basic steel recommended on account of possibility of working to closer phosphorus and sulphur limits. Advocates furnace shell of large diameter with shallow bath.

RENNERFELT FURNACE. Developments in the Rennerfelt Furnace, H. A. De Fries and Jonas Hertenius. Iron Age, vol. 103, no. 3, Jan. 16, 1919, pp. 190-191, 1 fig. Important changes from original design; side electrodes now titlt; shape of shell is round.

SMALL FURNACES. Performance of Small Electric Furnace. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 477-479, 9 figs. Operation and equipment of two-ton electric furnace installed at inchrome plant.

GENERATING STATIONS

CANADA. Statistical Analysis of the Central Electrical Station Situation of Canada. Contract Rec., vol. 33, no. 5, Jan. 29, 1919, pp. 88-92, 7 figs. From data compiled by Dominion Water Power Branch of Department of the Interior, in cooperation with Bureau of Statistics of departmentof Trade and Commerce.

FLOATING STATION. Floating Electric Power Station. Engineering, vol. 106, no. 2762, Dec. 6, 1918, pp. 644-645, 6 figs. Description of floating power station built and operated during war for providing current for variable conditions overseas where mobility and convience were of importance.

LEGAL LIABILITY. Liability of Central Station Company for Failure of Electric Power, Chesla C. Sherlock. Elec. Rev., vol. 74, no. 6, Feb. 8, 1919, pp. 216-217. Several decisions covering the question of power failure, both through negligence of employees of utility company and breach of contract.

THREE-PHASE-TWO-PHASE TYPE. Features of Three-Phase-Two-Phase Generating Station. Elec. Rev., vol. 74, no. 3, Jan. 18, 1919, pp. 85-88, 9 figs. Installation and operation features of Eastern Wisconsin Electric Co's Sheboygan plant.

GENERATORS AND MOTORS

ASYCHRONOUS MOTORS. Asychronous Motor Diagram (Le diagramme des moteurs asynchrones), L. Lagron. Revue Générale de l'Electricité, vol. 4, no. 23, Dec. 7, 1918, pp. 861-863, 1 fig. Indicates method of constructing diagram knowing only value of currents in short-circuit, their augular displacements and resistance of stator and rotor.

CARBON BRUSHES. Characteristics of Carbon Brushes for Electrical Machinery, Warren C. Kalb. Power, vol. 49, no. 6, Feb. 11, 1919, pp. 202-204, 2 figs. Carrying capacities, contact drop co-efficient of friction, abrasiveness and hardness of carbon brushes defined and methods for determining these characteristics explained.

COLLIERY MOTORS. Figures Supplemental to Explosion Proof Equipments of Colliery Motors and Accessories (in Japanese), S. Hayashi, Denki Gakkwai Zasshi, no. 365, Dec. 10, 1918.

COOLING. Cooling Electric Motors, D. A. Mossay, Colliery Guardian, vol. 116, no. 3024, Dec. 13, 1918, pp. 1239-1240, 6 figs. From paper before Min. Inst. of Scotland.

Air-Cooled Electrical Search Light (Di uno speciale dispositivo ad arco raffreddato per proiettori di luce), Virgilio Bellini. Elettrotecnica, vol. 5, no. 21, July 25, 1918, pp. 286-287, 1 fig. Rotary positive carbon is cooled by air jet.

DESIGN. The Advantages of Uniform Motor Design, James Burke. Elec. Wld., vol. 73, no. 4, Jan. 25, 1919, pp. 172-175. From a paper the Electric Power Club, Cleveland, Ohio, January, 1919.

DYNAMICAL THEORY. The Dynamical Theory of Electric Engines, Llewelyn B. Atkinson. Jl. Instn. Elec. Engrs., vol. 57, no. 277, Dec. 1918, pp. 1-26, 26 figs. Kelvin's ideas concerning mechanical values of distributions of electricity, magnetism and galvanism; energy relations of electric and magnetic systems; constructive fundamental types of electric engines converting electric energy into mechanical work; possible primary types of electric engines; engines converting mechanical work into electrical energy; combined generator and motor cycles; similarity between expressions for efficiencies of ideal electric engines and general form or expression for efficiency of a perfect heat engine. Tenth Kelvin Lecture.

INDUCTION MOTORS. Repairing Induction Motors, L. Fokes, Colliery Guardian, vol. 116, no. 3017, Oct. 25, 1918, pp. 859-860, 8 figs. Electrical breakdowns; cleanliess; neatness; repairing a hand-wound coil; shaping and insulating; former-wound coils; rotor repairs.

The Interchangeability of Induction Motors, Gordon Fox. Ry. Elec. Engr., vol. 10, no. 1, Jan. 1919, pp. 5-8, 4 figs. Indicates necessary alterations in windings which will adapt motors for use on currents of different frequency and phase.

POLYPHASE INDUCTION MOTOR. Diagram of Polyphase Induction Motors Taking into Account Magnetic Saturation (Diagramme des moteurs polyphase asynchrones tenant compte de la saturation magnétique), J. Berthenod. Revue Générale de l'Electricité, vol. 4, no. 25, Dec. 21, 1918, pp. 941-946, 6 figs. The various fluxes are reduced to three, a common flux and two others having leakages proportional to primary and secondary currents, respectively; an approximate diagram is thus formed; another diagram is then developed which takes into account actual operating conditions.

POWER AND TORQUE. Power and Torque in Electric Motors, Justin Lebovici. Elec. Rev., vol. 74, nos. 4 and 6, Jan. 25 and Feb. 8, 1919, pp. 134-136, and 213-215, 18 figs. Articles discussing principles of different types of motors from a common standpoint; relations in single-phase induction aud repulsion motors.

REBUILDING GENERATORS. Rebuilding 25,000-kw, Generator, Thomas Wilson. Power, vol. 49, no. 3, Jan. 21, 1919, pp. 76-79, 11 figs. Account of rebuilding of generator of Commonwealth Edison Co., Chicago, which required upturning of 200-ton unit within space of its own foundation.

WINDING. A New Graphic Method for Winding Schemes, L. Fleischmann. Elecn., vol. 81, no. 2117, Dec. 13, 1918, pp. 689-690, 3 figs. Abstract of article in Elektrotechnische Zeitschrift, No. 7, 1918.

LIGHTING AND LAMP MANUFACTURE

COLORED LIGHT. Linking Science and Art in Lighting, M. Luckiesh. Elec. Rev., vol. 74, no. 1, Jan. 4, 1919, pp. 14-15. Possibilities of colored light. (Fourth article.)

HOME LIGHTING. Linking Science and Art in Lighting, M. Luckiesh. Elec. Rev., vol. 74, no. 5, Feb. 1, 1919, pp. 171-173, 2 figs. Fifth of a series of six articles. The lighting of a middle-class home.

LIGHT, MEASUREMENT OF. Photometric Apparatus for Measuring the Illuminating Value of Fluctuating Sources of High Candle Power. Gas Jl., vol. 144, no. 2902, Dec. 24, 1918, p. 658, 3 figs. Tube photometer and supplementary flare photometer which permit measurements of detail revealing power in its relation to rapidly-burning flares of great intensity. From presidential address to Illum. Eng. Soc.

MEASUREMENTS AND TESTS

BOUCHEROT WHEATSTONE BRIDGE. On Boucherot's Constant-Current Distributions (Sur les distributions à intensité constante de M. Boucherot), Tr. Lalesco. Revue Générale de l'Electricité, vol. 4, no. 26, Dec. 28, 1918, pp. 987-988, 3 figs. Shows that in Wheatstone-bridge arrangement for transforming constant-potential alternating current into one of constant intensity, it is not necessary that the four resistances be equal and operation may be secured by having two of the branches of equal resistance and opposite sign.

INDICATING INSTRUMENTS, HYSTERESIS OF. The Determinateness of the Hysteresis of Indicating Instruments, F. J. Schlink. Jl. Wash. Acad. Sci., vol. 9, no. 2, Jan. 19, 1919, pp. 38-45, 2 figs. Result of preliminary experiment to ascertain to what extent hysteresis or variance determinations with respect to non-integrating mechanical measuring instruments are sufficiently definite and reproducible to warrant wide application in instrument testing, calibration and utilization. Conclusion is reached that no extraordinary experimental care is required to arrive at hysteresis determination of very definite utility, and that, under stated conditions, such determinations are of a highly reproducible character.

MAGNET TESTING. Testing Permanent Magnets by Means of a Voltmeter. Elec. Wld., vol. 73, no. 6, Feb. 8, 1919, pp. 267-268, 1 fig. Magnetometer may be devised by modifying a d'Arsonval type voltmeter; descriptions of useful tests.

PORCELAIN INSULATORS. Photographic Study of Porcelain Insulators, Harold G. Tufty. Elec. Wld., vol. 73, no. 6, Feb. 8, 1919, pp. 268-271, 3 figs. Polarized light employed in examination of thin sections of insulators some of which have been properly fired while others were underfired and still others overfired; observations on used insulators.

RAILWAY MOTOR TESTING. Railway Motor Testing — II. Elec. Jl., vol. 16, no. 2, Feb. 1919, pp. 76-79, 3 figs. Survey of practical methods accepted by operating companies. Armature testing of standard four-pole lap or two-circuit wound 500-volt railway motors.

RESISTANCE MEASURING BY VOLTMETER. On the Voltmeter Method of Measuring Resistances (Note sur la mesure d'une résistance par la méthode du voltmètre), H. Panchon. Revue Générale de l'Electricité, vol. 4, no. 25, Dec. 25, 1918, p. 972, 1 fig. In formula $X = (E - U) R/U$. RE is called K and expression reduces to $(X + R) U = K$. The graph presented gives X in terms of U. Discussion of Puget's method in R. G. E., Aug. 31, 1918.

THERMOCOUPLES AND PYROMETERS. Checking Calibration of Thermocouples and Pyrometers. Elec. Rev., vol. 74, no. 2, Jan. 11, 1919, pp. 56-59, 6 figs. Sources of error in thermocouples, pyrometers and leads; methods of testing works units against secondary and works standards; maintenance of standards; apparatus recommended for carrying on work.

VOLTAGE MEASUREMENT. The Measure of High Voltages by Means of Kligelfuss Sclerometer (La mesure des hautes voltages au moyen du scléromètre Klingelfuss). Paul Joye. Archives des Sciences Physiques et Naturelles, vol. 46, Nov. 1918, pp. 243-251. An independent third circuit is introduced in induction coil in space which separates right and left portions of secondary winding; this circuit connected to a voltmeter is the sclerometer. Present article gives analytical discussion and experimental results of effects of voltages in primary aud secondary windings on readings of voltmeters.

WATT-HOURS METERS. Testing Single-Phase Watt-Hour Meters Using a Rotating Standard, P. B. Findley. Power, vol. 49, nos. 4 and 5, Jan. 28 and Feb. 4, 1919, pp. 118-121 and 168-171, 18 figs. Jan. 28: Considers meter used on distributing circuits and method of testing it, using an indicating watt-meter; Feb. 4: Construction of rotating standard watt-meter is described and application to testing single-phase watt-hour meters discussed.

POWER APPLICATIONS

AGRICULTURE, ITALY. Application of Electricity to Agriculture in Italy (Applicazioni agricole dell' elettricita con riferimento speciale alle condizioni dell' Arzo Romano), D'Escani Alessandro. Annali d'Ingegneria e d'Architettura, year 33, no. 21, Nov. 1, 1918, pp. 330-332. Discusses necessity for wider application of electricity to agriculture, especially for ploughing, threshing, pressing hay and traw, and for pumping water for irrigation purposes.

Coal Mines. The Electric Installations of the Coal Mines in Blackhall, England (Les installations électriques des charbonnages de Blackhall, Angleterre). Génie Civil, vol. 74, no. 1, Jan. 4, 1919, pp. 1-4, 6 figs.

Shop Motors. Light, Electricity and the Shop, C. E. Clewell. Am. Mach., vol. 50, no. 4, Jan. 23, 1919, pp. 163-167, 11 figs. Motors for drilling and boring machines.

Steel-Mill Drives. Electric Steel Mill Drive Developments, Brent Wiley. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 35-37, 5 figs. Consideration given to standardization; variation in mill schedule permitted by flexibility of electric drive; tendency toward central station and 60-cycle apparatus.

Electrically-Driven Plate Mills, G. E. Stoltz. Elec. Jl., vol. 16, no. 2, Feb. 1919, pp. 68-73, 10 figs. Typical steel mill drives; torque curves of induction motor at various r.p.m. rolling plate from slab; graphic chart of load on a 90-in plate mill; power consumption. Paper road before Phila. Section Assn. Iron & Steel Elec. Engrs.

Modern G. E. Electric Steel Mill Drives, Blast Furnace, vol. 7, no. 1, Jan. 1919, p. 37. Electric drive operating 1200-ton hydraulic bloom shear with rapid acceleration and retardation and distance control.

STANDARDS

Aluminum Conductors, Standards for. Proposed Specifications for Aluminum Electrical Conductors (Projet de conditions de réception des conducteurs d'électricité en aluminum). Revue Générale de l'Electricité. vol. 4, no. 24, Dec. 24, 1918, pp. 931-933. Preliminary report submitted to l'Union des Syndicats by one of their sub-committees. Report comprises chemical definition, mechanical resistance, modulus of elasticity, flexibility, coefficient of expansion and electrical conductivity of aluminum.

Current and Potential Standards. A New Standard of Current and Potential, Chester T. Allcutt. Elecn., vol. 81, no. 2117, Dec. 13, 1918, pp. 684-685, 6 figs. Abstract of paper before the American Institute of Electrical Engineers.

Standardization Division in Plants. Srandardization Division in a Plant Manufacturing Electrical Material (Organisation d'un service d'études des normalisations dans une usine de constructions électriques), J. Fièvez. Revue Générale de l'Electricité, vol. 4, no. 25, Dec. 21, 1918, pp. 975-978, 1 fig. Suggests division, under direction of technical department, to study selection of standards that will meet all conditions which may be required by public. Functions of proposed division and its relation to various other departments are outlined.

Wave-Shape Standards. Review of Work of Sub-Committee on Wave Shape Standard of the Standards Committee, Harold S. Osborne. Proc. Am. Inst Elec. Engrs., vol. 38, no. 1, Jan. 1919, pp. 1-28, 12 figs. After careful considerations and extensive experimental work sub-committee recommends that for the present the 10 per cent deviation rule should be retained and that trial use should be made of a supplementary wave-shape factor, based on the relation between voltage wave shape and interfering effect in telephone circuits when power and telephone lines parallel each other.

TELEGRAPHY AND TELEPHONY

Cables, Fault Location in. A Useful Arrangement of the Murray Loop Test, L. J. Sell. Post Office Elec. Engrs. Jl., vol. 2, pt. 4, Jan. 1919, pp. 225-228, 3 figs. Applicable in case of cable fault when some wires only are seriously affected and a good wire of same gage and length as faulty wires is available.

Fault Location Tests, J. B. Salmon. Post Office Elec. Engrs. Jl., vol.2, pt. 4, Jan. 1919, pp. 215-224, 5 figs. Examination of difficulties incidental with location of cable faults by Varley and Murray loop tests, Anderson and Kennelly overlap test and Blavier test. Conditions under which each of these tests is most suitable.

Central Battery System Telephones. Note on the C. B. S. Telephone System. Post Office Elec. Engrs. Jl., vol. 2, pt. 4, Jan. 1919, pp. 197-203, 6 figs. Essential features of central battery system and comparison with present signaling system; study of main characteristics desirable in an exchange designed for local battery talking and automatic calling and clearing.

Continuous Oscillation Generators. The Oscillating Valve, E. V. Appleton. Wireless World, vol. 6, no. 70, Jan. 1919, pp. 538-543, 6 figs. Elecn., vol. 81, no. 2119, Dec. 27, 1918, pp. 743-744, 3 figs. Wireless World: Formulæ to determine conditions required for production of continous electrical oscillations by any three-electrode valve from knowledge of its static characteristics; Elecn.: Three-electrode thermionic valves, functioning as generator of continuous electrical oscillations, regarded as a tube possessing negative resistance; action analigous to other continuous oscillation generators.

Multiplex Telegraphy. Modus Operandi of Multiplex Telegraphy. Elec. Rev., vol. 74, no. 2, Jan. 11, 1919, pp. 49-51, 6 figs. Further details concerning principles and application of recently developed system of multiplex telephony and telegraphy; equipment and operation of Washington-Pittsburg circuit.

Multiplex Telephony. New Multiplex System of Telephony. Elec. World, vol. 73, no. 1, Jan. 4, 1919, pp. 11-13, 5 figs. System developed to increase manifold the message-carrying capacity of long-distance telephone and telegraph wires; suggestive value of earlier undertakings in this filed.

Perturbations in Lines. Influence of Single-Phase Traction Lines on Lines Carrying Feeble Currents (Influencia de las lineas monofàsicas de traccion sobre las lineas de débil corriente), Francisco Wais San Martin. Revista de Obras Publicas, year 66, no. 2253, Nov. 28, 1918, pp. 590-592, 2 figs. Causes of perturbations in telephone and telegraph lines running parallel to electric roads; devices and arrangements to prevent perturbations.

Phanoplex. Phanoplex Telegraphy (in Japanese), Y. Fuseno. Denki Gakkwai Zasshi, no. 364, Nov. 18, 1918.

Quadruplex Telegraphy. Morse Quadruplex Working. Post Office Elec. Engrs., Jl., vol. 2, pt. 4, Jan. 1919, pp. 209-214, 2 figs. Discusses conditions under which stable quadruplex working on acrial wires may be contained at all times.

Radio Lighthouses. Accident Prevention at Sea by Radio-Lighthouse (La prévention des accidents de mer par radio-phares), A. Poidlouë. Génie Civil, vol. 73, no. 26, Dec. 28, 1918, pp. 510-512, 3 figs. Scheme and operation of Bellini-Tosi azimuth compass for determining direction of sending station; aerial installation consists of four vertical converging antennæ connected by horizontal conductors to compass; a coil is rotated around a divided circle; intensity of sound in telephone receiver is maximum when striking direction of origin of waves.

Radio Telegraphy. Progress of English Radiotelegraphy during the European War, and Notes on Its Application to Post-War Conditions (Exposé des progrès de la radiotélégraphie anglaise pendant la guerre européenne, accompagné de quelques notes sur l'application de cette découverte aux conditions qui existeront après la guerre). Goldfrey Isaac. Industrie Electrique, year 28, no. 637, Jan. 10, 1919, pp. 8-9.

The Vision of a Scientist. Wireless-World, vol. 6, no. 70, Jan. 1919, pp. 554-57. Remarkable forecasts of Sir William Crooks on wireless telegraphy. From Fortnightly Rev., Feb. 1892.

Radio Telephony. Some Aspects of Radio Telephony in Japan Eitaro Yokoyama. Wireless World, vol. 6, no. 70, Jan. 1919, pp. 569-574, 8 figs. Experiments on influence of electrode materials on discharge and of supply voltage on operation of discharger; static frequency transformer of T. Kujirai (Concluded) From Proc. Inst. Radio Engrs.

Sounder Silencers. Sounder Silences, R. T. King. Post Office Elec. Engrs. Jl., vol. 2, pt. 4, Jan. 1919, pp. 206-208, 2 figs. Modification of departmental relay no. 1000A so as to cause bell to ring when distant station holds down key for period of about ten seconds.

Telephone Circuits, Loaded. A Graphical Method of Calculating the Attenuation Constant of Loaded Telephone Circuits, E. S. Ritter. Post Office Elec. Engrs. Jl., vol. 2, pt. 4, Jan. 1919, pp. 187-196, 3 figs. Applicable only to loaded lines, including open wire aerial lines, underground and submarine cable.

Vacuum Tubes. The Development of the Vacuum Valve. Jl. Elec., vol. 42, no. 1, Jan. 1, 1919, pp. 20-22, 8 figs. Manufacturing details; uses in the war; importance in wireless telephony.

Developments in Radio Apparatus, George O. Squier. Elec. World, vol. 73, no. 3, Jan. 18, 1919, pp. 129-130. Application to radio communication of vacuum tube; improvements during war; airplane radio-telephone and radio-telegraph sets. From lecture before A. I. E. E. on Aeronautics in the United States from the Beginning of the War to the Present Time.

Theory of the Electric Oscillation in Vacuum Tubes (in Japanese) Y. Nozuki. Demki Gakkwai Zasshi, no. 365, Dec. 10, 1918.

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

Charts. Formulæ and Charts Relative to the Working under Load of Industrial Transformers (Formules et abaques relatifs au fonctionnement en charge des transformateurs industriels), L. Dubar. Revue Générale de l'Electricité, vol. 4, no. 22, Nov. 30, 1918, pp. 817-821, 7 figs. Output and voltage drop at various loads and with different angular displacements, obtained from construction data and test results.

Electric Furnace Transformers. High Intensity Transformers for Electric Fornaces (Etude sur le calcul de transformateurs à forte intensité pour fours électriques), R. Jacquot. Revue Générale de l'Electricité, vol. 4, no. 17, Oct. 26, 1918, pp. 602-617, 2 figs. Classification of transformers used in electrometallurgy; their respective losses and cost.

Oils. Some Characteristics of Transformer Oils, O. H. Eschholz. Elec. Jl., vol. 16, no. 2, Feb. 1919, pp. 74-76, 2 figs. Test figures comparing vapor pressures of transformer oil with those of liquids of well-known characteristics.

Operation. Essentials of Transformer Practice — XIX. Operating Conditions, E. G. Reed. Elec. Jl., vol. 16, no. 2, Feb. 1919, pp. 66-68. Short-circuits and grounds; drying out transformers; care of insulating oil; mechanical stresses on short circuit.

Starting Current. Calculation of Starting Current in A. C. Transformers for Electric Traction (Der Einschaltstrom von Wechselstrom-Transformatoren fuer die elektrishe Traktion), W. Kummer, Schweiz. Bauzeitung, vol. 72, no. 24, Dec. 14, 1918, pp. 233, abstracted from M. Vidmar's article in Elektrotechnik & Maschinenbau, 1918, p. 273. Gives formulas for calculating the resistance capacity of idle transformers.

TRANSMISSION, DISTRIBUTION, CONTROL

Cables, High Tension. Experimental Investigation of High-Tension Cables, Tsunezo Hada. Denki Gakkwai Zasshi, no. 364, Nov. 10, 1918, 27 pp., 15 figs. Establishes as result of experiments that in a strand cable the minimum potential gradient or the maximum breakdown voltage is practicaly at position where $D/2h = \epsilon$. as as in ease of a single-core conc entric cable.

Distribution Problems. North-Eastern. Centre: Chairman's Address, A. P. Pyne. Jl. Instn. Elec. Engrs., vol. 57, no. 277, Dec. 1918, pp. 53-40. Question of generating electricity in bulk and its distribution over wide areas.

Insulators, Line. An Operating View of High-Tension Insulators, P. Ackerman. Elec. World, vol. 73, no. 3, Jan. 18, 1919, pp. 116-119, 4 figs. Severe operating conditions that have caused failure of line insulators; later designs of pin and suspension types promise to solve insulator problem for some years to come.

Application of Theory and Practice to the Design of Transmission Line Insulators, G. I. Gilchrest and T. A. Klinefelter. Elec. Jl., vol. 16, no. 1, Jan. 1919, pp. 8-16, 28 figs. Laboratory tests of various new designs and comparison of these designs with those now in commercial use.

Line Poles. When a Line Pole Needs a Guy, Charles R. Harte. Elec. Ry. Jl., vol. 53, no. 3, Jan. 18, 1919, pp. 139-142, 7 figs. Summary of experience of telephone and power companies as guide to electric-railway transmission line construction.

METERS. Notes on Demand Meters, H. W. Richardson. Elec. World, vol. 73, no. 5, Feb. 1, 1919, pp. 219-222, 2 figs. Indicating demand meters for small and recording or curve-drawing meters for larger installations; principles upon which modern demand meters operate.

PHASE CONVERSION. The Supply of Single-Phase Power from Three-Phase Systems, Miles Walter. Elecn., vol. 81, no. 2117, Dec. 13, 1918, pp. 682-684, 5 figs. Abstract of paper before the Institution of Electrical Engineers.

POWER CONDUCTORS. Arrangement of Power Conductors. Jl. Elec., vol. 42, no. 2, Jan. 15, 1919, pp. 72-74, 9 figs. Recommendations for spacing of power lines as made by Cal. Committee on Inductive Interference. Figures and comparisons given apply to non-transposed circuits; comparisons of different configurations hold also for transposed circuits, provided circuits are transposed indentically.

POWER CONTROL. The Control of Large Amounts of Power, E. B. Wedmore. Power House, vol. 11, no. 12, Dec. 1918, pp. 363-367, 5 figs. Limitation by sectionalizing and employment of feeder or busbar reactances. Paper before Instn. Elec. Engrs. (To be continued).

POWER FACTOR. Improving Power Factor by Use of Synchronous Motors. (Emploi des moteurs synchrones pour améliorer le facteur de puissance), Paul Rieumier. Revue Gȷnérale de l'Electricité, vol. 5, no. 1, Jan. 4, 1919, pp. 3-16, 5 figs.

POWER TRANSMISSION. Latest Developments in the Electric Transmission of Power, P. M. Lincoln. Jl. Cleveland Eng. Soc., vol. 11, no. 3, Nov. 1918, pp. 153-159 and (discussion) pp. 159-161. Limitation of direct-current transmission; early experiments in transmission by alternating current; Tesla's patents in 1889; Mershon's first observations of corona phenomena; the 40,000-volt installation at Telluride Power Co.; recent discoveries concerning nature of coronas.

RELAYS. The Orling Jct Relay (Le relais Orling à jet), J. Pomey. Revue Générale de l'Electricité, vol. 4, no. 24, Dec. 14, 1918, pp. 899-900, 2 figs. Usage in extensive cable lines of relays constructed on electrocapillary principles.

SUBSTATIONS. Automatic Substations on the North Shore Line, Charles H. Jones. Elec. Ry. Jl., vol. 53, no. 2, Jan. 11, 1919, pp. 84-90, 8 figs. Three new substations in operation and another under construction save 177 miles of 500,000-cir mils cable worth $650,000.

SWITCHES, OIL. Oil Switches (Considérations sur les disjoncteurs à l'huile), W-A. Coales and W-H. Wadmore. Revue Générale de l'Electricité, vol. 4, no. 23, Dec. 7, 1918, pp. 882-887, 7 figs. Provisions which must be made in designing them : their use in connection with time lag relays; characteristic factors; installation.

WIRING, TRANSMISSION. Electric Transmission Wiring from the Viewpoint of Appearance (Zur Aesthetik des Linienbaues bei elektrischen Freileitungen). Dr. P. Neusch-Sigrist, Bern. Schweiz, Elektrotech,Verein Bulletin, vol. 9, No. 12, December 1918, pp. 277-289, 13 figs. Calls attention to the desirability of underground wiring, where feasible, and to the need of using judgment and good taste in the design and location of exposed wire supports.

VARIA

ALUMINUM. Aluminum in Electrical Apparatus (L'aluminum dans l'appareillage électrique), C. Zetter. Revue Générale de l'Electricité, vol. 4, no. 23, Dec. 7, 1918, pp. 887-891, 14 figs. How aluminum ingots, sheets and bars can be used in manufacture of some electrical fixtures which it has been customary to make of copper.

Use of Aluminum in the Electrical Industry (Sur l'emploi de l'aluminum dans l'industrie de l'électricité), E. Dusaugey. Revue Générale de l'Electricité, vol. 5, no. 2, Jan. 11, 1919, pp. 53-58, 14 figs. Aluminum conductors in electric transmission lines; aluminum in electrical machines. Conference before the Société Française des Electriciens. Also abstracted in Bulletin de la Société Française des Electriciens, vol. 8, no. 74, Nov. 1918, pp. 349-377, 14 figs.

LIGHTNING ARRESTERS. Impulse-Gap Lightning Arresters, Q. A. Bracket. Elec. Jl., vol 16, no. 2, Feb. 1919, pp. 52-54, 4 figs. Scheme is essentially a Wheatstone bridge that is balanced at low frequency and unbalanced at high frequency. Diagram and typical com mercial construction are illustrated.

TRANSMISSION LINES, PROTECTION OF. Degradation Perpetrated on Electric Transmission Lines and Their Repression (Des déprédations commises contre les réseaux électriques et de leur répression), Jean de la Ruelle. Revue Générale de l'Electricité, vol. 4, no. 25, Dec. 21, 1918, pp. 981-983. Proposes asking tribunals to establish severe penalties for delinquencies and also to effect such modifications as greater separation of poles, construction of lines through private property, and eventually securing a right of way the same as railroads

MECHANICAL ENGINEERING

AIR PUMPS. Air Ejectors (Les éjecteurs extracteurs d'air), L. Couge. Revue Générale de l'Electricité, vol. 4, no. 17, Oct. 26, 1918, pp. 629-632, 6 figs. Details of Westinghouse-Leblanc air pump, of Breguet ejector and of British Westinghouse apparatus.

CORROSION

WIRE ROPES. Interior Corrosion of Wire Ropes, Wm. Fleet Robertson. Can. Min. Jl., vol. 40, no. 1, Jan. 8, 1919, pp. 6-7. Report of tests undertaken on rope which broke, it is said, by oxidizing of wires, chiefly internally, caused by action of corrosive water and a humid atmosphere.

FORGING

DROP HAMMERS. 4-ton Drop Hammer at Crewe Works. Engineering, vol. 106, no. 2765, Dec. 27, 1918, pp. 736-737, 7 figs. Description with illustrations of the hammer and some of its work. Its development and the necessary equipment.

EUROPEAN SITUATION. Some Drop Forge Possibilities Abroad, L. W. Alwyn-Schmidt. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 471-473. Review of present conditions; situation in foreign countries; methods of procuring business in Europe.

FORGE-SHOP CAPACITY. Selecting a Source of Supply for Forgings, W. F. Rockwell. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 1-3. Convenience of enlarging forge-shop capacity; preference of buyers to order forgings by sets.

FORGE SHOP. Pan Motor Forge Shop About Completed. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 490-492. Details of layout and equipment; methods for handling raw and finished material. Shop to be largest in U. S.

A Progressive Forge Shop in Rockford. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 480-481, 6 figs. Equipment and general layout of departments.

Modern Forge Shop at the Essington Plant. Am. Drop. Forger, vol. 4, no. 12, Dec. 1918, pp. 474-475, 3 figs. General description of works turning out marine equipment. Layout of Shops allows for future expansiou.

FORGING INDUSTRY. A Review of the Drop Forging Industry, A. W. Peterson. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 36-38, 2 figs. Data showing production development of forging industry over period of 35 years; importance of forging industry during years of war.

FURNACES. Heating and Preheating Forging Furnaces. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 57-59, 4 figs. Recent installation designed to withstand distorting action of heat as well as wear. Combustion chambers on preheating furnaces are stagfered on each side.

HISTORICAL DATA. Historical Data on Hammers and Forgings, Howard Terhune. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 39-41. Review of improvements since issue of first patent in 1842; introduction of principle of moderu board drop hammer in 1861; present tendencies.

FOUNDRIES

BRASS FOUNDRIES. Materials and Chemicals Used in Brass Fouudry Practice, Charles Vickers. Brass World, vol. 14, no. 12, Dec. 1918, pp. 343-345. Deals with history, properties, appearance, physiological action and commercial use of substances commonly used in brass founding. First of series of articles.

CASTING METHODS. Molding and Pouring a Gasoline Engiue Bed, F. H. Bell. Can. Machy., vol. 21, no. 5, Jan. 30, 1919, pp. 106-108, 4 figs. Shows method of casting a sheet steel bottom into a grey iron casting making entire bed into a tank.

CORE OVENS. The Application of Pyrometers to Core Ovens, G. W. Keller. Foundry, vol. 47, no. 318, Feb. 1919, pp. 72-74, 3 figs. From a paper before Am. Foundrymen's Assn.

FURNACE, ELECTRIC. The Electric Furnace in the Grey Iron Foundry, F. H. Bell. Can. Machy., vol. 21, no. 1, Jan. 2, 1919, pp. 7-8, 4 figs. Practicability of melting gray iron for foundry purposes by electricity; process followed at Bowmanville Foundry Co.

IRONS. Conversion of White Iron into Foundry, C. T. Huang. Iron Age, vol. 103, no. 4, Jan. 23, 1919, pp. 231-232. How Chinese native irons may be made available as a means of relieving the scarcity of other grades in that country.

MOLDING. Molding Shoes for Caterpillar Tractors. Iron Age, vol. 103, no. 2, Jan. 9, 1919, pp. 119-120, 3 figs. Daveuport molding machine with hurriedly devised handling rigging gives satisfactory results; 1000 shoes made per day.

PATTERNS. The Laying Out of Patterns, Joseph A. Shelly, Machy., vol. 25, no. 6, Feb. 1919, pp. 493-497, 12 figs. Methods of making the drawings or layouts that are required by the patternmaker in planning his work, together with allowances necessary for draft and shrinkage and for machining castings in the shop.

STEEL CASTINGS ON PACIFIC COAST. Steel Castings on the Pacific Coast. Iron Age, vol. 103, no 4, Jan. 23, 1919, pp. 233-235, 2 figs. Growth of industry due to the war; good steel made without pig iron; overcoming manufacturing difficulties.

TUMBLING BARRELS. Tumbling Barrels in Foundries (Scheurfaesser und Putztrommeln in Giessereibetrieben), Rauch und Staub, vol. 8, no. 12, Sept. 1918, pp. 113-114. General discussion on construction, use and advantages of tumbling barrels for changing castings. States that castings up to 45 in. long and weighing 2000 lbs. can be cleaned in suitable revolving drums. Describes inclined drums 36 ft. long, 28 in. in diameter.

FUELS AND FIRING

ARGENTINE. Fuels in Argentine (Die Brennstoffe Argentinens), Rauch und Staub, vol. 8, no. 12, Sept. 1918, pp. 114-115. General discussion on the fuel situation in Argentina, abstracted from Berichte ueber Handel und Industrie, vol. 23, no. 4, Feb. 1918.

ASH. Fusibility of West Virginia Coal Ash, Walter Selvig. Coal Age, vol. 15, uo. 1, Jan. 2, 1919, pp. 12-16, 2 figs. Method of preparing ash for fusion test and determining initial softening temperature and interval of fusion. Includes a tabulation of tests on West Virginian coals.

BAGASSE. Bagasse Feeders, Furnace Design and Furnace Control, A. Gartley. La. Planter, vol. 62, no. 21, Jan. 11, 1919, pp. 25-28, 5 figs. Suggestions on design; curves giving pounds of water which can be evaporated per pound of bagasse having differeut percentages of moisture. Paper before Hawaiian Sugar Planters' Assn.

BRIQUET. Some Notes on the Manufacture of Fuel Briquettes, E. H. Robertson. Trans. Min. & Geol. Inst. India, vol. 13, pt. 1, Sept. 1918, pp. 49-61, 6 figs. Analysis of manufacturing methods; results obtained by some experimenters; examples of survivance of briquettes.

The Economy of Briquetting Small Coal, J. A. Yeadon. Trau. Min. Inst. Scotland, vol. 40, pt. 7, 1918-1919, pp. 145-148 and (discussion) pp. 148-150. Gain in calorific power by briquetting with pitch as agglomerant rectangular and " ovoid " forms of briquettes.

COAL SELECTION. Selecting Coal for Power Plant Use, Robert June. Elec. Rev., vol. 74, no. 3, Jan. 18, 1919, pp. 94-97, 4 figs. Characteristics of various coals; influence of coal upon furnace-chamber design; purchase of coal. (First of series on power-plant management.)

CLAY PRODUCTS BURNING. Fuel Economy in Clay Products Burning III, A. V. Bleninger and A. F. Greaves Walker. Can. Mfr., vol. 39, no. 1, Jan. 1919, pp. 87-88. Means of controlling burning.

CONSERVATION. Fuel Conservation, Robert Collett. New England R.R. Club, Dec. 10, 1918, pp. 190-208. Waste of fuel by reason of engines delayed on road and by engines kept under steam unnecessarily at terminals; improper handling of engines; excessive firing; engines not in good condition; fuel not up to contract specification.

The Threatened Coal Shortage and the Possible Methods of Economising Fuel—II, John B. C. Kershaw. Cassier's Eng. Monthly, vol. 54, no. 6, Dec. 1918, pp. 308-315, 2 figs. Applicability of remedies proposed in October issue to English conditions; recommendations of U. S. Fuel Administration; coal-dust firing as an aid to fuel conservation.

Fuel Economy Will Continue a Serious Problem, W. A. Shoudy. Elec. World, vol. 73, no. 1, Jan. 4, 1919, pp. 14-16, 3 figs. Can be improved by proper application of correctly designed apparatus maintaining high vacuum, eliminating small wastes and not operating too many boilers; other suggestions.

DRAFT. Saving the Waste in the Chimney—III, Robert Sibley and Chas. H. Delany. Jl. Elec., vol. 42, no. 2, Jan. 15, 1919, pp. 79-80, 1 fig. Determination of actual draft required for different fuels. Chart showing lbs. of coal burned per sq. ft. grate surface pr hr. against draft between furnace and ash pit in in. of water.

Steam Plant Efficiency. Coal Trade Jl., year 51, no. 2, Jan. 8, 1919, pp. 37-38, 4 figs. Relation between kinds of coal and completeness of combustion for six sets of conditions; gaging air supply for given furnace and fuel. (Concluded.)

FUEL REQUIREMENTS FOR FACTORIES. Fuel Requirements for Factories, Charles L. Hubbard. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 125-126. How to make tests of fuel requirements for extremes of weather, calculate needs for other conditions and outside temperatures, and estimate amount of fuel needed month by month throughout heating season.

GAS. Uses Gas in Twenty-One Manufacturing Processes, F. M Lester. Gas Age, vol. 43, no. 2, Jan. 15, 1919, pp. 102-104, 6 figs. How gas is used in plant manufacturing gasoline motors and railway supplies and consuming 10,000,000 cu. ft. gas per month.

HEAT VALUE, DETERMINATION OF. Use of the Hydrogen-Volatile-Matter Ratio in Obtaining the Net Heating Value of American Coals, A. C. Fieldner and W. A. Selvig. Department of Interior, Bur. of Mines, tech. paper 1917, 13 pp. 4 figs. Curves, constructed from 2000 analyses, showing relation between percentages of hydrogen and volatile matter of different coals.

Calorific Valuation of Coal Without a Calorimeter, Proctor Smith. Cassier's Eng. Monthly, vol. 54, no. 6, Dec. 1918, pp. 333-334. Approximate analysis by Goutal's formula.

INDIANA COALS. Getting Better Combustion of Indiana Coals, T. A. Marsh. Elec. World, vol. 73, no. 2, Jan. 11, 1919, pp. 72-74, 7 figs. Practical methods by means of which furnace equipment installed years ago can be made to produce results comparable with good modern practice.

LIGNITES. Combustion of Lignite and High-Moisture Fuels, T. A. Marsh. Elec. World, vol. 73, no. 6, Feb. 8, 1919, pp. 265-267, 5 figs. Typical nalyses of high-moisture fuels in the United States and Canada and summary of experience derived from burning fuels of the kinds described in power plants.

Notes on Lignite, S. M. Darling. Power Plant Eng., vol. 23, no. 3, Feb. 1, 1919, pp. 148-150. Characteristics and utilization. Abstract of Technical Paper 178, Bureau of Mines.

LIQUID FUELS. Liquid Fuels (Les combustibles liquides), A. Guiselin. Mémoires et Compte rendu des travaux de la Société des Ingénieurs civils de France, year 71, no. 10, Oct. 1918, pp. 453-548, 2 figs. Study of the means to insure equilibrium between production and consumption of liquid fuels in France. Following topics are considered: Liquid fuels in U. S. and in England; possible progress in distillation of bituminous schists; production of tars and benzol in France; utilization of lignite and peat deposits; other sources of manufacturing liquid fuels with reference to the work done by the Société des Etablissements Simon-Carvès.

MOTOR FUEL. The Motor Fuel Problem, W. R. Ormandy. Colliery Guardian, vol. 116, no. 3021, Nov. 22, 1918, pp. 1076-1077. From paper before Instn. of Petroleum Technologists.

PEAT. Peat and Electrical Industry (La tourbe et l'industrie électrique), Pierre Gieu. Revue Générale de l'Electricité, vol. 4. no. 22, Nov. 30, 1918, pp. 843-851, 3 figs. Artificial drying and gasification of peat; effects of humidity on its calorific value; permissible percentage of humidity. Results of an extended investigation undertaken under the direction of Minister of Mines, Canada.

Peat in 1917, C. C. Osborn. Department of Interior, U. S. Geol. Survey, Mineral Resources of the United States—Part II, Dec. 19, 1918, pp. 257-283, 1 fig. General conditions of peat industry; occurrence, propeities and uses of peat; peat industry in principal foreign countries; selected bibliography; map of U. S. showing principal peat deposits.

POWDER FUEL. Progress Realized During the War in the Utilization of Fuels (Progrès réalisés pendant la guerre dans l'utilisation des combustibles), E. Damour. Industrie Electrique, year 28, no. 637, Jan. 10, 1919, pp. 5-7. Gasification and pulverization of fuels. From extensive account in Chimie et Industrie.

Powdered Coal Advance and Development. H. A. Kimiber. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 67-68. Use of powdered fuel for steam generation; improvements in distribution; control of fuel; summary of furnaces for which pulverized coal was installed during 1918.

A review on the Use of Powdered Coal, W. O. Renkin. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 22-25, 3 figs. Early uses and present methods; comparative data on fuels.

Suggestions for Burning Pulverized Coal, W. G. Wilcox. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 492-494. Control of combustible and air in burning pulverized coal; method of projecting coal in suspended form into furnace; importance of mixing coal dust properly.

STOKERS. Fuel Burning Equipment of Modern Power Stations, Joseph G. Worker. Elec. Jl., vol. 16, no. 2, Feb. 1919, pp. 55-60, 15 figs. Examples of various installations using underfeed stokers, auxiliary equipment to control their operation.

Mechanical Stokers—II, Robert June. Brick & Clay Rec., vol. 53, no. 14, Dec. 31, 1918, pp. 1147-1149, 3 figs. Concludes from examination of various types that chain-grate stoker is suitable for boilers of good size up to 250 per cent rating and overfeed stoker for medium sized installations up to 200 per cent rating.

WASTE HEAT, UTILIZATION OF. Utilization of Waste Heat at Municipal Gas Works of Tuebingen (Die Abhitzegewinning und verwertung im staedt, Gaswerk Tuebingen), Henig. Journal fuer Gasbeleuchtung, vol. 61, no. 45, Nov. 9, 1918, pp. 529-534, 1 fig. History and performance of rational waste-heat system utilized for heating water for distant muncipal bath. Tests. Costs.

Steam Raising with Waste Heat from Coal and Oil-Fired Furnaces, Iron & Coal Trades Rev., vol. 97, no. 2648, Nov. 22, 1918, pp. 580, 4 figs. Description of standard heat-raising unit (Brett system); embodying coal-fired furnace with boiler.

GAGES

PROFILE GAGES. Grinding Accurate Profile Gages by Means of Master Plates, Herbert M. Darling. Am. Mach., vol. 50, no. 3, Jan. 16, 1919, pp. 105-106, 3 figs. Description of operation.

THREAD AND WING GAGES. Thread Gages; Wing Gages, Erik Oberg. Machy., vol. 25, no. 6, February, 1919, pp. 502-506, 13 figs. Last of a series of articles describing principles involved and procedure followed by the Pratt & Whitney Company in developing gaging systems for interchangeable manufacture.

The Precision Measurement of Thread Gages, Can. Machy., vol. 21, no. 5, Jan. 30, 1919, pp. 113-115, 4 figs. Commercial equipment manufactured by Arthur Knapp Eng. Corporation after models developed by Bur. of Standards.

HANDLING OF MATERIALS

ASH HANDLING. Bennis Ash Handling Plant. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 84-85, 3 figs. Pneumatic ash plant; steam suction conveyors, ash elevators and ash hoists.

COAL HANDLING. Coal Handling at Ports, H. Hubert. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 42-45, 6 figs. An account of a number of modern plants for dealing with coal at ports.

Coal-Handling Appliances at the Coventry Electricity Works, George Frederick Zimmer. Engineering, vol. 107, no. 2767, Jan. 10, 1919, pp. 37-42, 27 figs. Drawings, general data and description of the plant.

Coal Tipple and Washery at Lehigh, Mont., E. P. Stewart, Coal Age, vol. 15, no. 1, Jan. 2, 1919, pp. 9-11, 4 figs. Apparatus designed to clean coal thoroughly and prepare locomotive fuel.

Coal Handling Plant at Sewall's Point, Virginia. Power, vol. 40, no. 2, Jan. 14, 1919, pp. 54-56, 5 figs. Description of new facilities of Virginia Railway at coal pier near Norfolk, Va. From Coal Age.

COKE. The Mechanical Handling of Coke, Alwyne Meade. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 57-61, 8 figs. The problems involved; description of conveyors dsigned to overcome difficulties; aspects of cost.

EXPLOSIVES. Munition Handling Devices. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 73-75, 5 figs. A few examples in which well-known types of conveying apparatus are modified to serve specific purposes in the manufacture of explosives.

GRAVITY ROLLER RUNWAY. The Gravity Roller Runway, George Frederick Zimmer. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 33-41, 28 figs. The component parts of gravity roller runways; accessory plant such as shoots, "humpers," stackers and "gadets."

MECHANICAL HANDLING. The Mechanical Handling of Materials, Percy G. Donald. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 29-32, 8 figs. After discussing objections to mechanical handling, the author deals with such plant as an investment, the speed that is desirable, the importance of a suitable layout, and finally indicates the various types of plant that are available.

PAPER MILL. Material Handling in a Paper Mill, Henry J. Edsall. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 97-103, 18 figs. Labor-saving equipment of Dill & Collins Co. (To be continued).

PNEUMATIC HANDLING OF CEREALS. Pneumatic Handling of Cereals, C. Bentham, Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 61-67, 15 figs. Importance of peneumatic systems in unloading ships; types of plant in operation; the exhauster; problems involved in the design of a suitable nozzle. Portable Pneumatic Grain Unloading Plant. Conveying. Cassier's Eng. Monthly Supp., vol. 1, no. 7, Dec. 1918, pp. lxxxiii-lxxxvi, 4 figs. Equipment includes 6-cylinder Aster petrol engine of 85 hp. with rotary blower, mounted on 4-wheeled, 25-ton railway truck.

HEAT TREATING

DEVELOPMENTS IN 1918. 1918 Developments in Heat Treating, James H. Herron Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 53-54. Changes in methods used for heat-treating materials; scope of heat-treating activities.

FURNACES. Heating Furnaces and Annealing Furnaces—II, W. Trinks. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 69-72 and 80, 7 figs. Design, operation and construction. Furnace capacity; rate of heat transfer; temperature to which metal is to be heated.

MALLEABLE IRON. Reducing the Malleable Iron Annealing Period, A. E. White and R. S. Archur. Foundry, vol. 47, no. 318, Feb. 1919, pp. 61-65, 12 figs. Report of an investigation made at the University of Michigan. From a paper before the American Foundrymen's Association.

Steel for Motors. Treatments of Steels Used in the Construction of Light-Weight Engines. (Emplois et traitments des aciers utilisés dans la construction des moteurs légers), M. L. Barbillon. Bulletin Technique de la Suisse Romande, year 44, nos. 15 and 17, July 27 and Aug. 24, 1918, pp. 140-142 and 158-160, 4 figs. July 27; Steel employed for shafts, nuts, bolts and cams. Aug. 24: Soft carbon steels; chrome-nickel steels; nickel steels; tungsten steels; special steel having 0.20C + 0.13 Si + 0.36 mm. + 12 Ni.

Lincoln Motor Co.'s Heat Treating Plant, F. L. Prentiss. Iron Age, vol. 103, no. 2, Jan. 9, 1919, pp. 107-111. 7 figs. Department equipped for quantity production in plant designed for changing from airplane to commercial motor work.

HEATING AND VENTILATION

Air Cooling. Special Applications of Small Air-Cooling Systems. Heat & Vent. Mag., vol. 16, no. 1, Jan. 1919, pp. 43-46, 4 figs. Arrangements with forced and gravity circulation of air.

Boiler Rating. Heating Versus Power Boiler Rating, P. J. Dougherty. Power, vol. 49, no. 3, Jan. 21, 1919, pp. 84-85. Showing why rules in general used for determining and comparing rating or capacity or high-pressure boilers are not applicable to low-pressure or so-called heating boilers.

Central Station Heating. Central Station Heating; Its Economic Features with Reference to Community Service, John C. White. Department of Interior, Bur. of Mines, tech. paper 191, 23 pp., 6 figs. Data on costs and results obtained with central heating stations.

Factory Heating. Modern Factory Heating, Alfred G. King. Domestic Eng., vol. 86, nos. 1 and 2, Jan. 4, 11, 1919, pp. 27-30 and 76-79, 11 figs. Requirements for factory heating; construction details.

Tunnel Ventilation. The Ventilation of Tunnels and Buildings, Francis Fox. Universal Engr., vol. 28, no. 6, Dec. 1918, pp. 40-46. Ventilation systems in operation at several European tunnels; prescribed hygienic practice concerning renovation of air in dwellings.

Ventilation Plant for Simplon Tunnel (Die Ventilationsanlage des Simplon Tunnels), F. Rothpletz. Schweizerische Bauzeitung, vol. 73, no. 1, Jan. 4, 1919, pp. 3-4, 3 figs. Remodeling and enlarging of the ventilation system, located at the north entrance only of the twin-tunnel, operated electrically. South ward air current chosen to avoid rusting of structural steel due to condensation if southern air were sent northward. Total air volume 180 cu. m. per sec. at velocity in tunnel of 3 to 4 m. per sec. Part 1.

Two-Pipe System. Care of Heating and Ventilating Equipment, Harold L. Alt. Power, vol. 49, no. 5, Feb. 4, 1919, pp. 156-159, 14 figs. A discussion of the two-pipe system. Seventh article.

Vapor Heating. Modern Practice in Vapor Heating. Heat & Vent. Mag., vol. 16, no. 1, Jan. 1919, pp. 48-52, 6 figs. The Broomell system.

HOISTING AND CONVEYING

Conveyor Types. Conveyors for Engineering Works. Engineer, vol. 126, no. 3283, Nov. 29, 1918, pp. 462, 3 figs. Deals with types in use in engineering works, wuch as conveyors for rapid assembly of motors, case elevators, and shell conveyors. (Form paper beofre Manchester Assn. of Engrs., by W. H Atherton).

Design. Some Details of Conveyors and Elevators, W. H. Atherton. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 46-49, 20 figs. Design of a number of essential details in conveyors and elevators, dealing with chains, sprocket wheels, buckets, skidders, frames and bearings.

Design of Electrically-Driven Lifting Blocks. Elecn., vol. 81, no. 2115, Nev. 29, 1918, pp. 639-640, 7 figs. Abstract of article in Elektro-technische Zeitschrift, No. 1, 1918.

Electric Haulage. Notes on Three-Phase Electric Haulage Equipment, L. Fokes. Colliery Guardian, vol. 116, no. 3025, Dec. 20, 1918, pp. 1295-1296, 5 figs. Haulage room; motor; slip rings and brush gear; control equipment; isolating switch; reversing switch; controller; resistances; liquid resistance.

History. History of Conveying — II, George Frederick Zimmer. Conveying, Cassier's Eng. Monthly Supp., vol. 1, no. 7, Dec. 1918, pp. lxxv-lvvvii, 9 figs. Bucket elevators; elevator and conveyor chains. (Continued).

Trucks. Shop Trucks. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 18-22, 16 figs. Discussion and description of different types of industrial trucks.

Wire Rope. The Wire Rope and Its Uses for Conveying Purposes, Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 77-79. General principles; single and double ropeway systems; single fixed rope system.

HYDRAULIC MACHINERY

Hydraulic Plants. Extension to the Ontario Power Co.'s Plant, Thos. H. Hogg. Can. Engr., vol. 36, no. 3, Jan. 16, 1919, pp. 139-144, and 149-151 23 figs. Construction of 13 miles of 13.5-ft. diameter wood-stave pipe for 50,000-hp. capacity; steel differential surge tank, 60 ft. in diameter, 94 ft. high; installation of two 20,000-hp. turbines with direct-connected generators.

Turbines. Banki's New Hydraulic Turbine (Neue Wasserturbine von Donat Banki, Professor in Budapest), Schweiz, Bauzeitung, vol. 72, no. 24, Dec. 14, 1918, pp. 235-236, 4 figs. The new turbine fills the gap between the Pelton wheel and the Francis turbine. Vevy compact.

New 2500-Hp. Turbine in the Kubel Hydro-electric Power House, near Saint-Gall, Switzerland (La nouvelle turbine de 2500 ch. de l'usine hydro-électrique de Kubel près Saint-Gall Suisse). Revue Générale de l'Electricité, vol. 5, no. 1, Jan. 4, 1919, pp. 19-25, 9 figs. Results of trials of compact design of turbine with overhanging rotor to determine output, regulation and efficiency. Regulator was specially constructed and is comprehensively described.

Turbine Operation. Economical Operation of Hydraulic Turbines, E. A. Gibbs, Can. Engr., vol. 36, no. 2, Jan. 9, 1919, pp. 127-128. Cleanliness, care and upkeep important factors in obtaining maximum efficiency. Also abstrated in Elec. World, vol. 73, no. 1, Jan. 4, 1919, pp. 25-26.

Turbine Tests Standard Testing Code for Hydraulic Turbines, F. H. Rogers. Elec. Wld., vol. 73, no. 4, Jan. 25, 1919, pp. 164-166. Engineering societies are urged to adopt code of Machinery Builders' Society.

Water Hammer. Charts for Calculating Water Hammer. Jl. Elec., vol. 42, no. 2, Jan. 15, 1919, pp. 74-75, 2 figs. Constructed to give maximum possible rise or fail in pressure due to water hammer as determined form $h = a\ V/g$, a being velocity of wave (in an additional diagram) and velocity of flow in pipe.

INTERNAL-COMBUSTION ENGINES

design. Port Design for Two-Cycle Oil Engines, D. O. Barrett. Gas Engine, vol. 21, no. 2, Feb. 1919, pp. 37-42. Description of some types of two-cycle engines; formulæ for inlet, transfer and exhaust ports.

Diesel Engine. The Diesel Engine, Herbert Haas. Jl. Soc. Automotive Engrs., vol. 4, no. 1, Jan. 1919, pp. 28-34, 2 figs. Motor Boating, vol. 23, no. 1, Jan. 1919, pp. 280-29. 2 figs. Jl. Soc. Automotive Engrs.; Pumps designed to force fuel against high pressure, air compressors and receivers mechanical efficiency characteristics of high-speed engines, desirable properties of petroleum fuel, lubricating oils, ship propulsion (From Bur. Mines Bull, 156, pt. 11); Motor Boating; Pressure-volume diagram, Sabathé four-stroke cycle motor; indicator diagrams of four-cycle Diesel engine, construction of cylinders and cylinder forms. (To be continued).

Oil Engines. The High-Compression Oil Engine, W. G. Gernandt. Jl. Soc. Automotive Engrs., vol. 4, no. 2, Feb. 1919, pp. 112-117 and discussion), pp. 117-118.

Internal Combustion Engine Development, Eng. Rev., vol. 32, no. 6, Dec. 16, 1918, pp. 164-166, 8 figs. Piston designs; leading particulars of engines developing 80 hp. per cylinder. (Continued).

LUBRICATION

Motor-Cylinder Lubrication Motor-Cylinder Lubrication, G. S. Bryan. Universal Engr., vol. 28, no. 4, Oct. 1918, pp. 37-45, 1 fig. Study of conditions under which lubrication takes place and of characteristics of motor-cylinder oils that determine their suitability for these conditions.

MACHINE ELEMENTS AND DESIGN

Ball Bearings. Why Do Ball Bearings Sometimes Fail? F. J. Jarosch. Am. Mach., vol. 50, no. 5, Jan. 30, 1919, pp. 209-213, 23 figs. An analysis of failures arising from poor selection and mis-treatment.

Floating Frame Reduction Gear. The Design and Progress of the Floating-Frame Reduction Gear, John H. Macalpine. Proc Engrs.' Soc. Western Pa., vol. 31, no. 7, Oct 1918, pp. 519-535. Discussion. (Continued from Proc. Feb. 1918, p. 71). Discussor contends regid-frame gears are running continuously, with equally high tooth pressures, at the same speeds as floating-frame gears.

Machine Design. Developing Designs for Machinery and Tools, F. E. Johnson. Machy., vol. 25, no. 6, Feb. 1919, pp. 517-518, 5 figs. Cost of designing a new machine; evolution of design of a specific machine; overcoming defect in original design.

Screws. Optical Projection for Screw-Thread Inspection, James Hartness. Mach. Engr., vol 41, no. 2, Feb. 1919, pp. 127-135, 10 figs. Analysis of screw-thread elements essential to strength and dependability; description of method for their accurate inspection.

Determination of Screw Dimensions (Détermination des dimensions à donner aux vis). La Métallurgie, year 51, no. 1, Jan. 1, 1919, pp. 21-23. Formulæ in three cases; (1) when screw is subject to tension and compression, (2) when screw is subjected to tension of compression by motion of nut, (3) when subjected to shear.

Springs. A Theory of Plate Springs, David Landau and Percy H. Parr. Jl. Soc. Automotive Engrs., vol. 4, no. 2, Feb. 1919, pp. 67-72, 9 figs. Based on assumption that any leaf of a spring can be considered as a beam, encastre at one end, loaded at the other, and having a flexible support somewhere between the point of encastrement and that of application of the load. (To be continued). Form Jl. Franklin Inst.

MACHINE SHOP

Die Making. The question of our Die Room Equipment. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 26-32, 23 figs. Improvements in die-room practices during years of war; suggestions to executives in regard to selecting equipment.

Grinding. Abrasives for Grinding Malleable Castings, W. T. Montague. Foundry vol. 47, no. 318, Feb. 1919, pp. 74-75. Adapted from a recent publication of the Norton Co.

Machine Shops. Westinghouse Marine Engineering Works, Edward K. Hammond. Machy., vol. 25, no. 6, February, 1919, pp. 538-544, 12 figs. Description of a new plant at South Philadelphia for manufacturing the Westinghouse Marine System.

Milling Cutters. How Milling Cutters Are Made, F. B. Jacobs. Iron Trade Rev., vol 61, no. 2, Jan. 9, 1919, pp. 150-151. 14 figs. How quantity production is secured by modern standard machinery and careful routing of work.

Some Milling Applications and Adaptations. Engineer, vol. 127, no. 3288, Jan. 3, 1919, pp. 6-9, 22 figs. Description of the development and use of the milling cutter in munitions work.

Repair Shop. Camp Holabird Motor Truck Repair Shops. Jl. Soc. Automotive Engrs., vol. 4, no. 2, Feb. 1919, pp. 86-87. Repair shop procedure. Shop does 80 per cent of repair work required by Army trucks.

Tool Casting. Casting Tools from and Air-Hardeinng Steel Foundry, vol. 47, no. 318, Feb. 1919, pp. 66-67, 3 figs. New alloy used successfully in the manufacture of dies and forming tools without forging; tungsten not present in the metal.

Tool Making. The Alfred Herbert Machine Tool Shop. Cassier's Eng. Monthly, vol. 54, no. 6, Dec. 1918, pp. 325-332, 8 figs. Facts about British key industries. (Second article).

Machine Shop Economies. Universal Engr., vol. 28, no. 6, Dec. 1918, pp. 35-39. Manufacture of jigs and special tools; possible economy in selecting speeds and feeds.

MACHINERY, METAL-WORKING

Boring Machine. Cylinder Boring and Reaming Tools, Franklin D. Jones. Machy., vol. 25, no. 6, Feb. 1919, pp. 507-515, 26 figs. Types and designs of cutter heads used for rough-boring and reaming small engine cylinders.

Boring Mill for Precision Work, Iron Trade Rev., vol. 64, no. 2, Jan. 9, 1919, pp. 156-157, 3 figs. Base and column of horizontal boring machine are heavily ribbed and metal distributed to reduce vibration. Operating mechanism is provided with ball thrust bearings.

Drilling Machine. The Hill Multiple-Spindle Drilling Machine. Am. Mach., vol. 50, no. 5, Jan. 30, 1919, pp. 189-190, 2 figs. Spindle drive design permits of close spacing of the drilling heads with a simple mechanism.

Lathes. The Bullard 8-inch Mult-Au-Matic. Am. Mach., vol. 50, no. 5, Feb. 6, 1919, pp. 236-241, 6 figs. A detailed description of the machine.

Marking Machine. Making Milling and Gear Cutting Attachment — II. Robert Mawson. Can. Machy., vol. 21, no. 4, Jan. 23, 1919, pp. 78-81, 17 figs. Tools and methods used by Presto Machine Co., with special reference to marking machine for graduating dividing head base.

Milling Machines. Making Milling and Gear Cutting Attachment — III, Robert Mawson. Can. Machy., vol. 21, no. 5, Jan. 30, 1919, pp. 97-100, 15 figs. Tools and methods followed when machining vertical slide column base, dividing head, index bearing and plates of attachment.

Building the Kempsmith Milling Machine, M. E. Hoag. Am. Mach., vol. 50, nos. 3 and 5, Jan. 16 and 30, 1919, pp. 101-104 and 195-198, 23 figs. Description of some of operations followed in construction of milling machines.

MACHINERY, WOOD WORKING

Felling Trees, Machine. Machine for Felling Trees (Machine abatteuse-billonneuse électrique pour le sciage et l'abatage des bois). Revue Générale de l'Electricité, vol. 4, no. 21, Nov. 23, 1918, pp. 156D-166D, 2 figs. An abstract is given of French patent no. 469,995, describing electrically-driven circular saw for felling trees.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

Cast Iron. Wearing and Anti-Frictional Qualities of Cast Iron, J. E. Hurst. Iron & Coal Trades Rev., vol. 97, no. 2647, Nov. 15, 1918, pp. 546. Abstract of "Preliminary Note" to a Carnegie Scholarship Memoir.

Porcelain. Some Types of Porcelain, F. H. Riddle and W. W. McDanel. Jl. Am. Ceramic Soc., vol. 1, no. 9, Sept. 1918, pp. 606-627, 13 figs. Determination of burning range of porcelain bodies having covering fired at cone 10 and above. Composition of bodies used varied from 45 to 85 per cent clay content and from 10 to 30 per cent flux.

MEASUREMENTS AND MEASURING APPARATUS

Boiler Feedwater. Measuring Boiler Feedwater, D. L. Fagnan. Nat Engr., vol. 23, no. 1, Jan. 1919, pp. 18-22, 5 figs. Discussion of various methods; principles of operation and construction of representative types. Paper before Nat. Assn. Stationary Engrs.

Calorimeters. The Calorimetry of Coal. Engineering, vol. 107, no. 2767, Jan. 10, 1919, pp. 33-36, 10 figs. A description of the calorimeter and its use.

Hardness. Report on Hardness Testing Relation Between Ball Hardness and Scleroscope Hardness, A. F. Shore. Iron & Steel Can., vol. 1, no. 11, Dec. 1918, pp. 434-445, 9 figs. Charts showing relation (1) between scleroscope and ball tests from hardest to soft metals, using 3000 kg. throughout under 10-mm. steel ball, (2) of ball test and scleroscope, using 62 kg., 250 kg., 500 kg. and 750 kg., and (3) scleroscope against number of pounds required to cause a 10-mm. ball impression of 1 mm. in diameter from softest to hardest metals. Paper presented before Iron & Steel Inst., Supt. 1918.

Hardness of Soft Iron and Copper Compared F. C. Kelley. Iron & Steel Can., vol. 1, no. 11, Dec. 1918, pp. 433-434. Tests by Brinell methods on samples of American ingot iron and ordinary commercial cold-rolled copper which were given similar treatments in an electrically heated vacuum furnace.

Instruments for Hardness Tests, C. E. Clewell. Am. Mach., vol. 50, no. 3, Jan. 16, 1919, pp. 93-96, 5 figs. Importance of hardness tests; early forms of Brinell hardness determination and recent modifications; use of scleroscope as check on pyrometer; methods suggested for holding materials under test.

Testing Materials for Hardness. Howard Ensaw. Am. Mach., vol. 50, no. 6, Feb. 6, 1919, pp. 257-258. Describing some methods of testing materials for hardness.

Pyrometers. How to Test Pyrometer Efficiency. Iron Trade Rev., vol. 64, no. 2, Jan. 9, 1919, pp. 158-159, 5 figs. Method provides for maintenance of calibrated platinum-platinum-rhodium thermocouple and comparison of this standared with instruments to be tested.

Standards of Temperature and Means for Checking Pyrometers. Proc. Steel Treating Research Soc., vol. 2, no. 1, 1919, pp. 30-37, 7 figs. Method for carrying out necessary tests and suggestions of various equipments suitable for determining inaccuracies in pyrometer readings, which, it is said, are always traceable to thermocouple, measuring instruments of lead wires.

Shearing Strength. New Machine for Measuring the Shearing Strength of Cast Iron (Nouvelle machine pour mesurer la résistance de la fonte par la méthode du cisaillement). Ch. Fremont. Génie Civil, vol. 73, no. 26, Dec. 28, 1918, p. l'Academie des Sciences, vol. 167, no. 24, Dec. 516, 9 figs.; Comptes rendus des séances de 9, 1918, pp. 949-952, 9 figs.

Stack Heat Losses. Measurement of Stack Heat Losses, J. H. Blakey. Power Plant Eng., vol. 23, no. 3, Feb. 1, 1919, pp. 151-152, 2 figs. Electrical device embodying simplicity and accuracy for determining stack heat losses.

MECHANICAL PROCESSES

Barrels, Steel. Manufacture of Steel Barrels, Edward K. Hammond. Machy., vol. 25, no. 6, February, 1919, pp. 526-533, 19 figs. Blanking the barrel heads, bending the sheets for the bodies, welding flanging, brazing, bilging, pickling and testing.

Boiler Manufacture. How to Design and Lay Out a Boiler — III, William C. Strott. Boiler Maker, vol. 19, no. 1, Jan. 1919, pp. 10-12, 4 figs. Thickness of butt straps; rivet failures due to tearing of plate, stretching of holes or tendency to shear. (To be continued).

Boiler Smoke Tubes. The Repair of Steel Boiler Smoke-Tubes. Ry. Gaz.. vol. 29, no. 26, Dec. 27, 1918, pp. 729-731, 4 figs. Specifications to which tubes are purchased; operations in repairing of tubes removed from boiler.

Brass Extrusion. The Extension of Brass, Alfred Hutt. The Central (Jl. City & Guilds Eng. Col.), vol. 15, no. 44, Dec. 1918, pp. 68-77, 5 figs. Description of a brass extrusion press. By extrusion is meant process whereby a plastic substance is given a definite shape by being forced through an orifice or die under pressure. Alloy used is Muntz metal consisting of 60 per cent copper and 40 per cent zinc.

Cement Mills. Operating Details of an Electrically Operated Cement Mill. Elec. Rev., vol. 74, no. 6, Feb. 8, 1919, pp. 210-212, 4 figs. Progress of material through mill; process of cement manufacture; apparatus and size of motor utilized.

Chains, Cast Steel. The Manufacture and Testing of Cast Steel Chain Cables. Jl. Am. Soc. Naval Engrs., vol. 30, no. 4, Nov. 1918, pp. 858-862. Memorandum issued by Llyod's Register of Shipping. From Engineer.

Coke Manufacture. Plant of the Seaboard By-Product Coke Company, D. MacArthur. Gas Age, vol. 43, no. 2, Jan. 15, 1919, pp. 68-73, 9 figs. Coke-loading equipment; electrical control switchboard; light-oil extraction and refining. (Concluded.)

Cotton Compression. Economics of High Density Cotton Compression. Richard Hoadley Tingley. Textile World Jl., vol. 55, no. 2, Jan. 11, 1919, pp. 133, 191 and 381, 4 figs. Description of present compression methods; brief history of high-density movement.

Dies. Making Dies for Cutting Robber. Leather, Paper, Cloth, etc., S. A. Hand. Am. Mach., vol. 50, no. 2, Jan. 9, 1919, pp. 52-54, 11 figs.

Kilns. The Use of Car Tunnel Kilns for Brick and Other Products of Crude Clays, Ellis Lovejoy. Jl. Am. Ceramic Soc., vol. 1, no. 9, Sept. 1918, pp. 628-634, and (discussion) pp. 634-636. Features and respective values of (1) direct heating in car-tunnel kilns, (2) indirect heating in tunnel, and (3) compartment-operation types of car-tunnel kilns.

Lubricator, Mechanical. Manufacturing a Mechanical Lubricator, M. E. Hoag. Am. Mech., vol. 50, no. 2, Jan. 9, 1919, pp. 71-74, 13 figs. (Third article).

Machine Knives. Making Machines Knives, W. F. Stutherland. Can. Machy., vol. 21, no. 4, Jan. 23, 1919, pp. 73-77, 8 figs. Operations connected with welding and grinding of knives ofr wood-working tools and paper cutters.

Magnetos. The Magneto Industry. Engineer, vol. 127, no. 3289, Jan. 10, 1919, pp. 26-29, 12 figs. Description of the Thomson-Bennett Works, Birmingham.

Oil House. Modern Steel Mill Oil House Installation Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 49 and 59, 1 fig. Central distribution point for oil Building is of concrete monolithic construction with brick curtain walls and steel sask 62 by 133 ft.

Plate Mills. New Plate Mills with Modern Lay-Out, Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 43-47, 8 figs. Designed to give sufficient capacity of heating, finishing and shipping.

Lukens New Mill Largest in the World. Boiler Maker, vol. 19, no. 1, Jan. 1919, pp. 6-10, 6 figs. Mill is of 4-inch type with rolls 204 in. wide, and will roll 5000 tons of plate per week.

Pliers. The Liberty Plier; Drop-Forged Victory. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 32-35. Distribution of work and sanitary dispositions at Krauter plant where 23,000,000 forgings have been completed during last 18 months.

Sugar Manufacture. Sugar Factory Engineering, C. B. Thompson and J. O. Frazier. Nat. Engr., vol. 23, no. 1, Jan. 1919, pp. 23-26, 2 figs. Problems peculiar to industry and equipment details of factory; preparation and burning of bagasse; arrangement of multiple effect.

Tin Plate. Tin Plate Manufacturing and Detinning. Engineering, vol. 106, no. 2764, Dec. 20, 1918, pp. 701-702. An historial article.

MECHANICS

JOINTS, RIVETED. Rigidity of Riveted Joints of Steel Structures. Engineering, vol. 106, no. 2762, Dec. 6, 1918, pp. 638-640, 9 figs. From bulletin No. 104, Engineering Experiment Station, Univ. of Ill.

SHAFTS, WHIRLING SPEED OF. The Whirling Speed of Shafts Supported in Three Bearings, Arthur Morley. Engineering, vol. 103, no. 2760, Nov. 22, 1918, pp. 573-574, 3 figs. Introduction notation; calculation from equation of energy; method of successive approximation; application o f various forms of support; Dunkerley's empirical rule; Bauman's method. (To be continued).
New Critical Shaft Speeds as Effects of the Gyroscopic Disc-Action, A. Stodola. Engineering, vol. 106, no. 2763, Dec. 13, 1918, pp. 665-666, 4 figs. Mathematical development.

SPRINGS. A New Theory of Plate Springs, David Landau and Percy H. Parr. Jl. Franklin Inst., vol. 187, no. 1, Jan. 1919, pp. 65-97, 14 figs. Study of trapezoidal, circular, parabolic and square leaf points. It is concluded that tapering points of leaves of leaf springs in plane of width only has no parctical effort on strengths, reactions, stresses, or flexibilities of springs. Calculations of stresses, bending moments and deflections. Separation of loads in the top compound plate.

WIRES, TENSION IN. Rapid Determination of the Tension in Stretched Electric Wires (Recherche rapide de la tension à laquelle travaile le metal dans les canalisations électriques sous l'action de l'effort de traction), Jean Hely. Revue Générale de l'Electricité, vol. 5, no. 1, Jan. 4, 1919, pp. 26-27, 1 fig. Chart constructed on physical law of vibration of chords. Tension determined from number of transversal vibration of a known length.

MOTOR-CAR ENGINEERING

AIR CLEANERS. Carbureter Air Cleaners, W. G. Clark. Jl. Soc. Automotive Engrs., vol. 4, no. 1, Jan. 1919, pp. 18-22 and (discussion) pp. 22-23, 14 figs. Classification and description of four types; cleaners having cloths or screens or both, inertia cleaners, those in which water or some other liquid is used to wash air, and centrifugal or gravity cleaners.

DESIGN. 1919 Engineering Trends, H. Ludlow Clayden. Automotive Industries vol. 10, no. 3, Jan. 16, 1919, pp. 88-89, 94-97 and 157, 11 figs. Graphs showing increase of crankshaft revolutions per mile, increase in stroke-bore ratio, tendencies in drive of accessories, comparative percentages of disk and cone clutches, use of vacuum gasoline feed, use of spiral bevel drive and changes in lubricating systems.
Trucks Show Few Mechanical Changes. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, pp. 110-111, 4 figs. Claims that war activities have retarded mechanical development in commercial vehicle design and that curtailment of supplies of raw material has reduced production originally planned.
Automotive Industry Achievements in 1918. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 44-48, 2 figs. Development in tractor, truck, trailer and aeroplane manufacture; relation of drop-forging industry to automotive-engine evolution.

FUELS. Benzol as a Motor Fuel, S. E. Whitehead. Gas Jl., vol. 144, no. 2901, Dec. 17, 1918, pp. 615-616. Remarks that a Motor Union Committee in 1907, reported they had successfully used benzol, either alone or in combination with petrol, as motor fuel. It then takes up more in detail properties of benzol and its intrinsic adaptability as motor fuel.
The Motor Fuel Problem, W. R. Ormandy. Petroleum Rev., vol. 39, nos. 853, 854 and 855, Nov. 22 and 30, Dec. 7, 1918, pp. 335-336, 355-356 and 363. Demand and supply of motor fuels in British Empire. Solid gaseous and and liquid fuels are considered separately.

HEADLIGHTS. The Requirements of Automobile Headlights. Illum. Engr., vol. 11, no. 9, Sept. 1918, pp. 209-211. Report of a committee on the Illum. Eng. Soc.

HORN. Electrical and Mechanical Warning Signals for Automobiles, Fred I. Hofman. Automotive Industries, vol. 40, no. 2, Jan. 9, 1919, pp. 47-50, 21 figs. Principles involved in operation of diaphragm signals; relative advantages of electric motor horn, electric vibrator horn and hand-operated horn; variety in mechanism of hand horns.

KEROSENE ENGINES. Bellem-Brégéras Method of Using Refined Petroleum and Heavy Oils in Low-Compression Oil Engines (Emploi du pétrole lampant et des huiles lourdes dans les moteurs à explosion à basse compression. Procédés Bellem et Brégéras. Génie Civil, vol. 73, no. 22, Nov. 30, 1918, pp. 433-435, 3 figs. Description of machine which obtained 50,000 franc prize offered by the Chambre Syndicate des Industrie du Pétrole for best automobile petroleum engine. Account of tests also given.

LOCKING DEVICES. Automobile Locking Devices. Jl. Soc. Automobile Engrs., vol. 4 no. 2, Feb. 1919, pp. 97-98, 1 fig. Result of study of automobile locking devices by committee of Soc. Automobile Engrs.

LUBRICATION. Lubrication and Fuel Tests on Buda Tractor Type Engine, P. J. Dasey. Jl. Soc. Automotive Engrs., vol. 4, no. 1, Jan. 1919. pp. 50-53, 5 figs. Horsepower developed at different speeds by four fuels; power developed per lb. of fuel, fuel consumption in lb. per b-hp. hr.

PRODUCTION. Future Production Plans Will Require Special Machinery, J. Edward Schipper. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, pp. 145-149, 13 figs. Description of certain machines which permit production on large scale and forecast of develgpments on jigs, tools, gases, etc., necessary to fit into efficient production scheme.

SPARK PLUGS. Effect of Temperature on Spark Plug Insulations. Automotive Industries, vol. 40, no. 1, Jan. 2, 1919, p. 25, 1 fig. Experiments carried out in England show that minimum permissible insulation resistance varies with frequency of sparks and comprehension pressure.

STATISTICS. Truck Production for 1918 Is 250,000. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, pp. 128-129, 1 fig. Gain of 32 per cent over 1917. Proportion of trucks of each regular capacity shown diagramatically.

TANKS. U. S. A. Two-Man Tank Fitted with Motor Car Engines. Motor Age, vol. 35, no. 2, Jan. 9, 1919, pp. 16-18, 6 figs. Automotive Industries, vol. 40, no. 2, Jan. 9, 1919, pp. 43-46, 6 figs. Motor Age: Adaptation of standard units in construction of Ford tank; Automotive Industries: Two-Man fighting machine having a duplicate Ford automobile power plant, radiator mounted at rear, warm drive.
U. S. Tank and Tractor Details. Motor Age, vol. 34, no. 26. Dec. 26, 1918, pp. 20-21, 4 figs. Cargo carrier Mark VII: Ford tank.

TRACTORS, SPECIFICATIONS FOR. Detailed Technical Specifications of Gasoline Farm Tractors for 1919. Automotive Industries, vol. 40, no. 3, Jan. 10, 1919, pp. 176-179. Tabulated data on 98 different makes of American types produced by 69 manufacturers with makes of principal parts, including engine, governor, lubricator, ignition system, air cleaner, gear set, clutch and axle.

TRUCKS, SPECIFICATIONS FOR. Detailed Technical Specifications of Gasoline Motor Trucks for 1919. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, pp. 112-127. Full particulars on types and makes of principal truck parts, including engines, clutches, gear sets, rear axles, steering gears, governors and electric and fuel systems; 489 gasoline, 19 electric and one steam motor-truck chassis described.

WATER INJECTION. Mixing Water with Gasoline. Motor Boating, vol. 23, no. 1, Jan. 1919, 25-26, 9 figs. Advantages gained by introducing limited quantities of water into intake manifold. Its use as a decarbonizing medium.

PIPE

ELECTROLYSIS. Fuel Administration Interests Itself in Electrolysis in Natural Gas Mains, Frank H. West. Am. Gas Eng. Jl., vol. 110, no. 2, Jan. 11, 1919, pp. 22-23. Electrolytic action made patent by pipes taken from streets of Kansas City. Claimed that damage by electrolysis amounts to millions annually in U. S.

REINFORCED CONCRETE PIPE. On the Reinforced-Concrete Pressure Pipe (in Japanese), N. Sugimura. Denki Gakwai Zasshi, no. 365, Dec. 10, 1918.
Reinforced Concrete Pressure Pipe, Colman Merriwether. Jl. Am. Water Works Assn., vol. 5, no. 4, Dec. 1918, pp. 419-429, 2 figs.; Water and Gas Rev., vol. 29, no. 7, Jan. 1919, pp. 11-12, 2 figs.; Can. Engr., vol. 36, no. 3, Jan. 16, pp. 146-148, 2 figs. Jl. Am. Water Works Assn.: Details of joint with crimped copper band; Water and Gas Rev.: Action of joint constructed with crimped copper band, details of manufacturing 66-in. reinforced-concrete pressure pipe for 10 miles of Greater Winnipeg water conduit; Can. Engr.: Installation of plant for manufacturing 66-in. reinforced-concrete pressure pipe, details of manufacture, lead gasket cast-iron joint. Paper before Ill. Section Am. Water Works Assn.

TEMPLATES AND PATTERNS. Templates and Patterns for Pipes, James Edgar. Brass World, vol. 14, no. 10, Oct. 1918, pp. 291-294, 34 figs. On construction of templates and patterns for special connections, especially in shipbuilding industry.

POWER GENERATION

APPALACHIANS. New Plant of the Appalachian Power Company, H. S. Slocum. Elec. World, vol. 73, no. 3, Jan. 18, 1919, pp. 123-127, 9 figs. Steam station rated at 20,000 kw. just completed to supplement hydroelectric plants in meeting heavy industrial demands; development of rich mining district due largely to central-station power supply.

CANADA. Electric Power Generation in Ontario on Systems of Hydroelectric Power Commission, Arhur H. Hull. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 1, Jan. 1919, pp. 29-52, 16 figs. Systems of Hydroelectric Power Commission of Ontario.
Canada Builds 300,000 Hp. Niagara Hydro Plant, Louis B. Black. Mine & Quarry, vol. 11, no. 1, Nov. 1918, pp. 1097-1104, 8 figs. Hydro Electric Power Commission of Ontario is engaged upon construction of a canal 8½ miles long, which will divert a flow of 10,000 sec.-ft. of water from Niagara Falls and enable 300,000 hp. to be developed.

CENTRALIZATION. Central Station Power for Mines, A. Taneig. Bul. Affiliated Eng. Societies minn., vol. 3, no. 12, Dec. 1918, pp. 205-207. Advantages to each mine of centralized power generation.
Transportation and Power, C. G. Gilbert and J. E. Pogue. Can. Engr., vol. 36, no. 2, Jan. 9, 1919, pp. 128-130. Advantages and disadvantages of centralization of power stations and generation of electrical energy in bulk. Excerpt. from report to Smithsonian Instn. on Power: Its Significance and Needs.
Centralizing Power Production. Power Plant Eng., vol. 23, no. 2. Jan. 15, 1919, pp. 99-104, 9 figs. Operation of dual driven auxiliaries, induced draft and modern coal and ash handling equipment features of Cromby Station of Philadelphia Suburban Gas & Electric Co.

EASTERN STATES. Development of Hydroelectric Resources in Eastern United States, D. H. Colcord. Elec. Rev., vol. 74, no. 6, Feb. 8, 1919, pp. 207-209, 4 figs. Deterring influences and development outlined; brief review of what has been accomplished; urgent needs and benefits of hydroelectric development.

GLACIERS. Power from Glaciers. Electric Traction, vol. 15, no. 1, Jan. 15, 1919, pp. 1-4, 9 figs. Addition to White River Power Plants of Puget Sound Traction, Light & Power Co. for electrification of Milwaukee Ry.

HETCH HETCHY. The Power Project at Hetch Hetchy, Rudolph W. Van Norden. Jl. Elec., vol. 42, no. 2, Jan. 15, 1919, pp. 65-66, 2 figs. Gives details of 66,000 hp. development at Moccasin Creek, a part of project planned by city of San Francisco.

MAINE. Investigation of Maine Water Powers. Elec. World, vol. 73, no. 3, Jan. 18, 1919, pp. 120-121, 1 map. Publio Utilities Commission sends to governor and council results of an exhaustive study of water-power resources; hydroelectric systems, power sites, plant locations and storage conditions dwelt on.

MASSACHUSETTS. Development of Massachusetts' Water Power. Elec. World, vol. 73, no. 6, Feb. 8, 1919, pp. 272-273, 1 map. From the report of a special commission to investigate the facilities and possibilities in this direction; Action urged; public ownership declared to be of doubtful value as a water-power policy.

MICHIGAN. Simplicity Marks Michigan's Largest Hydroelectric Development. Elec. Rev., vol. 74, no. 5, Feb. 1, 1919, pp. 167-170, 6 figs. Simplicity of layout, coordination of turbines installed to water flow and 140,000 volt transmission line are features of the Junction Development.

PACIFIC COAST. Water-Power Development on the Pacific Coast; George F. Sever. Elec. World, vol. 73, no. 4, Jan. 25, 1919, pp. 177-178; Jl. Elec., vol. 42, no. 1, Jan. 1, 1919, pp. 6-10. Elec. World: Study of economic and financial conditions leads to outline of developments approximating $50,000,000 cost, all power furnished can be absorbed easily within two years after development; Jl. Elec.: Survey of projects in progress of construction in California, rules of Forest Service in their relation to hydroelectric development. From paper before San Francisco Association of Members of Am. Soc. C.E.

TENNESSEE. The Larger Undeveloped Water-Powers of Tennessee, J. A. Switzer. Gen. Meeting Am. Electrochem. Soc., Apr. 30, 1918, paper 24, pp. 169-202, 15 figs. Power sites and essential data pertaining to their development and exploitation.

TIDES. Utilization of Power from Tides (Etude sur l'utilisation des marées pour la production de la force motrice), E. Maynard. Revue Générale de l'Electricité, vol. 4, nos. 22, 23, 24, 25 and 26, Nov. 30, Dec. 7, 14, 21 and 28, 1918, pp. 823-843, 865-877, 903-944, 947-959 and 997-1007, 34 figs. Nov. 30: Derivation of continuous power from tide basins and sea reaches: application of system to St. Malo and La Rochelle regions. Dec. 7: Continuous power of operation at set intervals after high and low tides; application to St. Malo and La Rochelle. Dec. 14: System comprising two basins to utilize ebb and flow currents respectively so as to produce continuous work; application of plan to St. Malo and La Rochelle. Dec. 21: Application of processes described in previous articles to Rotheneuf Bay, near St. Malo. (Ille et-Vilaine), and Bay of La Rochelle. Dec. 28: Possibilities at mouth of La Rance river in 21-km., region where action of tides is felt.

POWER PLANTS

BOILER CORROSION. Action of Water on Metals, S. W. Parr, Can. Engr., vol. 36, no. 3, Jan. 16, 1919, p. 148. Reactions involved when alkaline waters are used in steam generators. Paper before Ill. Section, Am. Water Works Assn.

BOILER OPERATION. Safety and Economy in the Boiler Room, W. E. Snyder. Iron Age, vol. 103, no. 5, Jan. 30, 1919, pp. 303-307. Practical suggestions for reducing hazards and increasing efficiency; thorough inspection and careful training of men required. From a paper before the Engineers' Society of Western Pennsylvania.

BOILER SETTINGS. Combustion and Boiler Settings, A. D. Williams. Power, vol. 49, nos. 2 and 6, Jan. 14 and Feb. 11, 1919, pp. 57-59 and 205-208, 2 figs. Jan. 14: Notes on location of heating surfaces, placing of baffles, and formation of soot in relation to combustion. Feb. 11: Effect produced on combustion reactions and circulation of gases by the chilling due to contact with water-cooled surfaces.

DRIP WATER. Saving and Returning Drip Water, William E. Dixon. Power Plant Eng., vol. 23, no. 2, Jan. 15, 1919, pp. 105-109, 9 figs. Where drip taps should be made; methods employed for returning condensate; utilizing oily drips.

ECONOMIZERS. Care of Economizers, J. F. Daggett. Power, vol. 49, no. 6, Feb. 11, 1916, pp. 192-193. 4 figs. Some suggestions as to the operation and care of economizers.

EQUIPMENT. Power Station at Mark Plant, Gordon Fox. Power Plant Eng., vol. 23, no. 3, Feb. 1, 1919, pp. 141-144, 4 figs. Describes power plant of the Sheet Tube Company of America, dealing with turbine generators and blower, condensing system and electric features. Second article.

EXHAUST STEAM. Utilizing Exhaust Steam in Knitting Mill, L. H. Stark. Nat. Engr., vol. 23, no. 1, Jan. 1919, pp. 2-6, 5 figs. How savings were effected by several changes in equipment and use of indicating and recording devices.

FIREBOX. Boiler Efficiency Increased by New Type of Firebox. Ry. Age, vol. 66, no. 2, Jan. 10, 1919, pp. 151-153, 2 figs. Eighteen per cent greater evaporation per pound of coal secured in tests on C., M. & St. P.

HAND-FIRED PLANTS. Fuel Economy in Hand-Fired Power Plants. Power Plant Eng., vol. 23, no. 2, Jan. 15, 1919, pp. 110-113, 4 figs. Fifth Installment of abstract of Circular No. 7, Univ. of Ill., Eng. Experiment Station.

LOW-GRADE FUELS. Peace Problems in the Power Plant, George H. Perkins and Perry Barker. Textile World Jl., vol. 5, no. 2, Jan. 11, 1919, pp. 391-392. Importance of continuing war economies; difficulties in use of low-grade fuels.

OPERATION. Turbine House Plant Operation, T. G. Otley and V. Pickles. Elecn., vol. 82, no. 2120, Jan. 3, 1919, pp. 4-6. Abstract of a paper read before the South African Institute of Electrical Engineers.

STOKERS. Power Plant Management—VII. Mechanical Stokers, Robert June. Refrig. World, vol. 54, no. 1, Jan. 1919, pp. 25-26, 2 figs. Adaptability of various types of stokers according to ratings of boilers; points to remember regarding stoker operation.

Automatic Cleaning Under-Feed Stoker. Nat. Engr., vol. 23, no. 1, Jan. 1919, pp. 100-102, 4 figs. Type developed by Under-Feed Stoker Co. is similar to standard Jones stoker but is self-cleaning.

PRODUCER GAS

GERMAN PRODUCERS. New Coke-Fired German Gas Producer. Iron Age, vol. 103, no. 3, Jan. 16, 1919, pp. 180-181, 1 fig. Making gas low in moisture and sulphur; pig iron high in manganese and phosphorus a by-product.

PRODUCER-GAS USERS. Modern Applications of Producer Gas, Earl E. Adams. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 41-44, 2 figs. Its use in heat-treating and carbonizing furnaces; economy and general advantages.

WUERTH PRODUCER. The Wuerth Gas Producer. Foundry Trade Jl., vol. 20, no. 203, Nov. 1918, pp. 600-601, 1 fig. Features of apparatus which is worked on blast furnace principle and consists of a hearth without grating, a bosh and a shaft. From Stahl and Eisen.

PUMPS

CENTRIFUGAL PUMPS. High-Lift Centrifugal Pumps for Irrigation, B. P. Fleming. Power, vol. 49, no. 4, Jan. 28, 1919, pp. 133-136, 3 figs. Water forced through steel manifold to reinforced-concrete conduit leading up to canal; design features; pump test show over 81 per cent efficiency under 90-ft. head.

PUMP STATION. A Non-Drowning Pump-Station, C. Erb Wuench. Min. & Sci. Press, vol. 118, no. 1, Jan. 4, 1919, p. 18, 1 fig. Design utilizing principle of hydraulic diving bell.

VACUUM PUMPS. Automatic Variation of Gas Pressure and Its Application to a Vacuum Pump. Circulation of Gases, Magnetic Stirrer, O. Maas. Jl. Am. Chem. Soc., vol. 41, no. 1, Jan. 1919, pp. 53-59, 3 figs. Control apparatus by means of which pressure established by a Geissler, or any other suction pump, can be automatically varied between definite limits and the period of each variation can be adjusted to any desired length of time.

REFRACTORIES

CORROSION. Report on the "Corrosion Action of Flue Dust on Fire-Bricks," J. W. Mellor. Gas Jl., vol. 144, no. 2897, Nov. 19, 1918, pp. 421-423. Experimental research by refractory materials committee of Instn. Gas Engrs.

CRUSHING RESISTANCE. Crushing Resistances of Refractory Materials (Mesure des résistances à l'écrasement des matériaux réfractaires), A. Bigot. Chimie & Industrie, vol. 1, no. 7, Dec. 1, 1918, pp. 724-726, 7 figs. Gives results of experiments on 1-in. cubes of silicat brick, refrasory argil, white bauxite, carborundum, etc., in charts.

PRODUCTION. Our Present Knowledge Concerning the Industry of Refractory Products (Nos connaissances actuelles sur l'industrie des produits refractaires), J. Bied. Chimie & Industrie, vol. 1, no. 6, Nov. 1918, pp. 579-600, 28 figs. Invention of processes for utilizing dolomitic clinkers; calcination of magnesia from Eubée and Italy; manufacture of bricks; high-temperature resistance of silica-aluminum products.

SILICA PRODUCTS. Silica Products (Les produits de silica). Chemie & Industrie, vol. 1, no. 7, Dec. 1, 1918, pp. 712-723, 7 figs. Chemical and physical analyses of sillceous rocks; photomicrographs of bricks manufactured in Martin furnaces.

SOUTH WALES. The Refractory Materials of South Wales, J. Allen Howe. Quarry, vol. 24, no. 263, Jan. 1919, pp. 11-15. Geological characters of carboniferous strata from which are obtained silica rocks, fireclays and dolomitic limestones, Paper before Refractories Section of Ceramic Soc.

TESTS. Standard Tests for Refractory Materials. Quarry, vol. 24, no. 263, Jan. 1919, pp. 19-20. Chemical analysis of fireclays, dolomite and magnesite; identification of various forms of silica in silica bricks; physical tests. Report of Committee on Standardization of Tests for Refractory Materials. Refractories Section, Ceramic Soc.

ZIRCONIA. Zirconia—Its Possibilities in Metallurgy, Leopold Bradford. Foundry Trade Jl., vol. 20, no. 203, Nov. 1918, pp. 596-597. History, occurrence, composition and uses; its application in refractory brick industry.

REFRIGERATION

AMMONIA COMPRESSORS. The Ammonia Compression Refrigerating System—XXVI, W. S. Doan. Refrig. World, vol. 54, no. 1, Jan. 1919, pp. 33-34, 2 figs. Remarks on oil-cup scheme for external lubrication of open-type ammonia compressors.

Capacity and Power Consumption of Ammonia Compressors, Charles H. Herter. Refrig. World, vol. 34, no. 1, Jan. 1919, pp. 11-13, 1 fig. Graphs for the varying capacity and power consumption of compressors, at different pressures, compared to 20 lb. and 185 lb. as standard pressures.

AMMONIA CONDENSERS. Ammonia Condenser Data, Henry Torrance. Power, vol. 49, no. 3, Jan. 21, 1919, pp. 106-109, 6 figs. Author shows that both flooded atmospheric and flooded injector types of condensers, are wrong in theory and practice. From July Jl. of Am. Soc. Refrig. Engrs.

AMMONIA RECOVERY. Effects of Ammonia Recovery, T. B. Smith. Gas Jl., vol. 144, no. 2902, Dec. 24, 1918, pp. 661-662. Comparison of the effects of the direct and indirect processes upon the working of other parts of the plant.

EXPORT BUSINESS. The Trend of the Foreign Situation, L. W. Alwyn-Schmidt. Refrig. World, vol. 54, no. 1, Jan. 1919, pp. 21-22, and 32. Hints to refrigerating-machine manufacturers as to future of export business and necessity for immediate action.

FREEZING TANKS. Care and Maintenance of Freezing Tanks, F. L. Brewer. Ice and Refrigeration, vol. 56, no. 1, Jan. 1919, pp. 41-42. How to lower cost of freezing tank; erecting and insulating tank; causes of leakage in sides and corners. Paper before Nat. Assn. Practical Refrig. Engrs.

HISTORY. The Growth and History of Refrigeration, James F. Patton. Power House, vol. 11, no. 12, Dec. 1918, pp. 351-353, 5 figs. Dependence of cities, battleships and armies in field on refrigerating plant.

ICE PLANTS. Building Ice Plant Efficiency, G. B. Bright. Ice & Refrig., vol. 56, no. 1, Jan. 1919, pp. 55-56. Tonnage and cost of manufacturing Ice, 1904, 1908, 1918; changes necessary in steam plants to meet new conditions.

Large Converted Steam-Driven Ice Plant. Ice & Refrig., vol. 56, no. 1, Jan. 1919, pp. 63-65. Steam plant replaced by electric power air-ignitating system; cost.

PACKING INDUSTRY. Refrigeration in the Packing House Industry. Refrig. World, vol. 51, no. 1, Jan. 1919, pp. 14-16, 5 figs. Recent improvements and additions to equipment made at plant of Armour Co., Hamilton, Can.
Meat Packing in South America. Refrig. World, vol. 54, no. 1, Jan. 1919, pp. 23-24 and 32. Data and comparisons of requirements and capacity of meat-packing and freezing plants of various companies in Argentina, Brazil, Paraguay, Uruguay and Columbia.

RESEARCH

CHEMICAL RESEARCH. Address by Charles Frederick Juritz. South African Jl. Sci., vol. 15, no. 1, Aug. 1918, pp. 1-30. Exhortation to establish chemical research stations. Position of science in the present age; its use and abuse; its part in the war; industrial potentialities in advancement of chemistry. Presidential address before South African Assn. for Advancement of Sci.

INDUSTRIAL RESEARCH. Science and Industry, J. C. Fields. Can. Engr., vol. 30, no. 2, Jan. 9, 1919, pp. 133-135. What Britain, United States, France and Japan are doing in industrial research. Results being obtained by manufacturers.

SWITZERLAND. Organization for Public Welfare in Switzerland Based on Scientific Research at the Federal University. (Stiftung zur Foerderung Schweizerischer Volkswirtschaft durch Wissenschaftliche Forschung an der Eidgenoessischen Hochschule), Schweizerische Bauzeitung, Zurich, vol. 73, no. 1, Jan. 4, 1919, pp. 1-2. Swiss engineers are raising a fund of at least 500,000 francs with which to conduct researches of the Federal University with the object of assisting Switzerland to practice greater economy and efficiency in national life than in the past, and to help the country in overcoming the losses suffered during the war. The present article describes the organizationa end its onstitution.

STANDARDS AND STANDARDIZATION

S. A. E. STANDARDS. S. A. E. Standardization Work in 1918. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, pp. 158-171, 31 figs. Tables of new standards put on record, mainly relating to aeronautical, motorcycle and marine work.

TIRES FOR MOTOR CARS. New Standard List of Pneumatic Tire Sizes. Automotive Industries, vol. 40, no. 3, Jan. 16, 1919, pp. 172-174, 21 figs. Collection of recently adopted S. A. E. standards and recommended practices relating to tires and rims.

STEAM ENGINEERING

BOILERS. Espujols Inexplosible and Demountable Boiler (Générateur de vapeur inexplosible démontable, système d'Espujols. Génie Civil vol. 73, no. 23, Dec. 7, 1918, p. 455, 2 figs. Inclination of tubes and other arrangements contribute to facilitate active circulation of water and steam, thus protecting boiler and increasing its efficiency.
Feeding and Circulating the Water in Steam Boilers, John Watson. Jl. Am. Soc. Naval Engrs., vol. 30, no. 4, Nov. 1918, pp. 834-838, 3 figs. Review of adaptation of various appliances. Abstract of paper before Inst. Marine Engineers. From Shipbuilding Shipping Rec.
The Waste Heat Boiler as Practical Steps in FuelConservation, H. D. Baylor, Concrete, Cement Mill Section, vol. 14, no. 1, Jan. 1919, pp. 5-6, 1 fig. Comparative data taken on two cement kilns 10 x 150 ft., dry process, using coal as fuel before and after installation of waste-heat boilers. Paper presented before Portland Cement Assn.

CONDENSERS. The Steam Condenser, Victor J. Azbe. Power Plant, Eng., vol. 23, no. 3, Feb. 1, 1919, pp. 145-158, 4 figs. Gain by condensing, influencing conditions, cleaning tubes, cooling water systems.

SUPERHEAT. Determination of Superheating Surface, C. H. Baker. Power, vol. 49, no. 3, Jan. 21, 1919, pp. 86-89, 4 figs. Author gives charts showing relationship between superheat and factors that influence it.

TURBINE GOVERNORS. Steam Turbine Governors, J. Humphreys. Iron & Coal Trades Rev., vol. 97, no. 2650. Dec. 13, 1918, pp. 661-662, 5 figs. Discussion of several types.

TURBINES. 2500-Hp. Rateau Marine Geared Turbines. Jl. Am. Soc. Naval Engrs., vol. 30, no. 1, Nov. 1918, pp. 842-849, 8 figs. Arrangement of 2500-shaft-hp. turbine set and double reduction gearing at works of British Westinghouse Co. From Engineer.
A New Theory of the Steam Turbine, Harold Medway Martin. Mechanical Engineering, vol. 41, no. 2, Feb. 1919, pp. 150-151, 3 figs. Theory is based on assumption that steam is never in thermal equilibrium until condenser is attained. Abstract of serial in Engineering.
Steam Leakages in Dummies of the Lungstrom Type. Engineering, vol. 107, no. 2766, Jan. 3, 1919, pp. 1-3, 2 figs. Comparison of the results obtained by the use of a formulæ with step by step calculations of the discharge through a labyrinth using the precise formulæ given by Professor Callendar.
Steam Turbine Progress and Possibilities. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 495-497, 5 figs. Higher boiler pressures. Intermediate steam reheating in large multiple-cylinder machines. Feedwater heating. Economy to be expected from extended use of economizer.
Historical Development of the Steam Turbine—II. Power House, vol. 11, no. 12, Dec. 1918, pp. 346-349, 12 figs. Growth in size of turbo-generator units in recent years.
Operation of Steam Turbines, J. Humphreys. Iron & Coal Trades Rev., vol. 97, no. 2642. Oct. 18, 1918, pp. 430-432. 4 figs. Deals with Parsons turbine.
Land aud Marine Steam Turbines. Engineering, vol. 106, no. 27ye, Dec. 13, 1918, pp. 674-679, 13 figs. Illustrations of details and brief description of steam turbines constructed by the Atlas Engineering Co., Copenhagen.
45,000 kw. Cross-Compound Steam Turbine. Elec. News, vol. 27, no. 24, Dec. 15, 1918, pp. 24-27, 4 figs. Unit consists of separate high and low-pressure elements, each coupled directly to its own generator. High pressure element is a single-now, reaction-type turbine running at 1800 r.p.m. and expanding to atmosphere; low-pressure element is a double-flow turbine of same type, running at 1200 r.p.m. and expanding to vacuum.

TEXTILES

FABRIC LOOMS. An Apparent Revolution in Fabric Looms. Flight, Dec. 26, 1918, pp. 1463-1464, 4 figs. New Trautvetter loom claimed to weave (auto and aero fabric) diagonal threads in two directions as well as ordinary warp and weft.

THERMODYNAMICS

HEAT TRANSMISSION. The Transmission of Heat Through Heavy Building Materials. Engineering, vol. 106, no. 2765, Dec. 27, 1918, pp. 735. From bulletin issued from University of London, University College, Department of Heating and Ventilating Engineering, entitled Report of Research on Transmission of Heat Through Heavy Building Materials, by Arthur H. Barker and W. Kinoshita.

WELDING

ARC WELDING. Electric Arc Welding in Tank Construction, R. E. Wagner. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 899-911. 35 figs. Practice followed at Pittsfield works of General Electric Co.
A Review of Electric Arc Welding, John A. Seede. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 881-886, 11 figs. Evolution of present practice of arc welding.
Equipment Accessories Desirable in Electric Arc Welding. Elec. Ry. Jl., vol. 53, no. 2, Jan. 11, 1919, pp. 93-95, 6 figs. Proper protection of operator is essential and conveniences added insure better workmanship. From 1918 report of committee of Assn. of Ry. Elec. Engrs.
Notes on Regulations for Arc Welding, H. M. Sayers. Elecn., vol. 81, no. 2118, Dec. 20, 1918, pp. 715-717. Abstract of paper with discussion before the Insitution of Electrical Engineers, Dec. 1918.
Arc-Welding Systems, Otis Allen Kenyon. Elec. Wld., vol. 73, no. 4, Jan. 25, 1919, pp. 167-171, 10 figs. Welding system discussed in a broad way, showing advantages and special usefulness of each method.

CUTTING OF METALS. The Cutting of Iron and Steel by Oxygen—XX, M. R. Amedeo. Acetylene & Welding Jl., vol. 15, no. 182, Nov. 1918, pp. 199-200. Cost of Cutting. Translated by a member of the Union de la Soudure Autogene.

INSPECTION. Inspection of Metallic Electrode Arc Welds, O. S. Escholz. Am. Mach., vol. 50, no. 5, Jan. 30, 1919, pp. 215-217, 6 figs. Outlines the methods for satisfactory inspection tests.
Determining the Characteristics of Metallic-Electrode Arc Welds, O. S. Escholz. Elec. Ry. Jl., vol. 53, no. 6, Feb. 8, 1919, pp. 280-282, 3 figs. By testing and inspection of the welds a reliable indication of their soundness may be obtained.

LEAD. The Autogenous Welding of Lead, V. P. Rosenberg. Acetylene & Welding Jl., vol. 15, no. 182, Nov. 1918, pp. 205-206, 2 figs. Power of blowpipe. (To be continued.)

LLOYD'S TESTS. Lloyd's Experiments on Electrically Welded Joints, H. Jasper Cox, Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 864-870, 15 figs. Nature and description of experiments; summary of experimental results.

OXY-ACETYLENE. The Oxy-Acetylene Flame and Blowpipe Efficiency, Arthur Stephenson. Acetylene & Welding Jl., vol. 15, no. 182, Nov. 1918, pp. 194-196, and (discussion) pp. 196-198, 5 figs. Diagram giving length of luminous cone in mm. for respective consumption of acetylene in litres per hour; graph showing diversity in acetylene consumption as specified by various makers for welding iron and steel; blowpipe movements. Paper before British Acetylene & Welding Assn. Also abstracted in Jl. Acetylene Welding, vol. 2, no. 7, Jan. 1919, pp. 338-344.
Oxy-Acetylene Welding, Stuart Plumley. Jl. Am. Soc. Naval Engrs., vol. 30, no. 4, Nov. 1918, pp. 737-752, 4 figs. Detailed exposition of methods and usages followed in United States.
Use of Oxy-Acetylene Welding in the French Army. Universal Engr., vol. 28, no. 6, Dec. 1918, pp. 22-28, 8 figs. Uses in manufacturing (practically the same as in U. S.); uses in repair work; outfit.
Oxy-Acetylene in Peace Time Manufacture, David Baxter. Jl. Acetylene Welding, vol. 2, no. 7, Jan. 1919, pp. 345-348, 8 figs. Instruction and information to welders engaged in general repair business. First of series.
Difficult Repairs Successfully Accomplished by Welding. Can. Machy., vol. 21, no. 1, Jan. 2, 1919, p. 15, 2 figs. Repairs effected by oxy-acetylene welding on a crankshaft and piston.
Oxy-Acetylene Pipe Welding and Cutting. Gas Age, vol. 43, nos. 1 and 2, Jan. 1 and 15, 1919, pp. 27-28 and 85-88, 13 figs. Jan. 1: Resumé of best practice; welding gas mains; strength of welds. Jan. 15: Safe radius of bend for wrought Iron or steel pipe; examples of welding operations; welding meter connections.
Oxy-Acetylene Welding and Cutting. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 48-53, 7 figs. Review of its early history, development and modern application in industry and war with special reference to its use in forge plants.

RAIL JOINTS. New Type of Electrically Welded Joint Successful. Elec. Ry. Jl., vol. 53, no. 4, Jan. 25, 1919, pp. 182-183, 8 figs. Process used at St. Louis believed to eliminate cracking of rail around joing; applicable to new and old track.

RAILROAD SHOPS. Oxy-Acetylene and Electric Welding, A. F. Dyer. Welding Engr., vol. 4, no. 1, Jan. 1919, pp. 45-46. Application of these processes at Grand Trunk Railway shops.

SPOT WELDING. Research in Spot Welding of Heavy Plates, W. L. Merrill. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 919-922, 7 figs. Experiments pointing to new and enlarged field for spot welding.
Spot Welding and Some of its Applications to Ship Construction, H. A. Winnie. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 923-927, 6 figs. Advantages of spot welding over riveting with respect to strength, time and labor; limitations of spot welding.

THERMIT. Modern Welding and Cutting, Ethan Viall. Am. Mach., vol. 50, no. 6, Feb. 6, 1919, pp. 243-248, 6 figs. Firt article. Thermit welding; its history, nature and uses.

VARIA

Inspection and Theory of Probability. Application of the Theory of Probability to the Matter of Inspection (Sull applicazione del calcolo delle probabilita ad una importante categoria di collandi), U. Bordino, L'Elettrotecnica, vol. 5, no. 30, Oct. 25, 1918, pp. 422-430, 8 figs. Mathematical analysis of the problem: what can be asserted of the properties of a number of objects after having examined and tested a determined percentage of the total number.

Silo Granaries. The Equipment of Silo Granaries, R. A. Sidley. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 68-73, 13 figs. General operations carried out in a silo granary.

Tanks, Storage. Round Storage Tanks for Liquids, H. Eisert. Monthly Jl. Engrs. Club of Baltimore, vol. 7, no. 8, Feb. 1919, pp. 155-168, 6 figs. Design formulæ and calculations.

ORGANIZATION AND MANAGEMENT

ACCOUNTING

Ice-Plant Auditing. Auditing and Supervision of Ice Plants, George E. Wells Ice & Refrigeration, vol. 56, no. 1, Jan. 1919, pp. 48-49. Proposes auditing engineering conditions in a plant and gives particulars and audit forms for ice plants.

Appraisals Industrial. Three Industrial Appraisals in One, Charles W. McKay. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 141-143. For excess-profits tax computation, for plant accounting and for insurance adjustment.

EDUCATION

Agricultural Instruction. Reference Material for Vocational Agricultural Instruction. Federal Board for Vocational Education, bul. 13 and 14, March and June 1918, 42 pp. and 25 pp. March: Outlines provisions to be made by states for meeting requirements of Smith-Hughes Act relating to agricultural instruction. June: Suggestions for cataloging and filing, bulletin, report, etc., for agricultural education.

Airplane Mechanics. Emergency War Training for Airplane Mechanics. Federal Board for Vocational Education, bul. no. 12, April 1918, 62 pp. Outline of course in airplane construction and repair.

Crippled Soldiers. The Evolution of National Systems of Vocational Re-education for Disabled Soldiers and Sailors. Douglas C. McMurtrie. Federal Board of Vocational Education, bul. 15, May 1918, 318 pp., 33 figs. Fundamental principles of rehabilitation; categorical description of methods for vocational rehabilitation in force in the various warring countries, including Germany and Austria-Hungary; extensive bibliography of American and foreign literature, inclu ive of news items in periodicals, relating to vocational rehabilitation.

Cripples. Reducing the Cost of Disability, Douglas C. McMurtrie. Iron Age, vol. 103, no. 6, Feb. 6, 1919, pp. 362-363. Rehabilitation restores and may enhance earning capacity; insurance costs lessened; the economy of liberal medical attention.

The Conservation of Industrial Man Power, Arthur J. Westermayr. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 501-504, 3 figs. Question of rehabilitating crippled soldiers; how vocational rehabilitation act will be operated.

Engineering Colleges. The Effect of the War on Engineering Education, C. R. Mann. Bul. Soc. Promotion Eng. Education, vol. 9, no. 4, Dec. 1918, pp. 108-118. War experiences analyzed under (1) production of soldiers, and (2) production of supplies. Present college curricula described as aiming to impart knowledge of physical laws and properties of materials exclusively, and as insufficient to develop men who will accomplish reorganization of industrial production, for which task an understanding of the methods by which human wills are co-ordinated for team play is essential.

Export and Shipping. Vocational Education for Foreign Trade and Shipping. Federal Board for Vocational Education, bul 24, Nov. 1918, 85 pp. Present importance of education for foreign trade; advanced courses in shipping; comparative plans for teaching foreign trade; study outlines of fundamental courses; suggested study plans.

Industrial Education. Industrial Education in Wilmington, Delaware. Department of Interior, Bur. of Education, bul. 25, 1918, 97 pp. Report of survey made under direction of Commissioner of Education; suggestions for program of industrial educational.

Industrial Schools. Buildings and Equipment for Schools and Classes in Trade and Industrial Subjects, Federal Board for Vocational Education, bul. 20, Nov. 1918, 75 pp., 25 figs. Type schools and classes; detailed description of building and equipment for a trade or industrial school; equipment, courses of study, and methods of instruction in carpentry.

Evening Industrial Schools. Federal Board for Vocational Educational, bul. 18, Sept. 1918, 55 pp. Possibilities in evening schools under provisions of Smith-Hughes Act; suggestive courses which have been prepared and carried out of evening schools; approved methods of establishing and conducting evening industrial schools for trade workers.

Italy. Need for Increased Technical Education in Italy (Per l'avvenire della industria meccanica in Italia), G. Belluzzo. Industria, vol. 32, no. 21, Nov. 15, 1918, pp. 635-637. Points out defects of Italian system of training as at present conducted and outlines a system which follows closely that given in best shops in England and United States. (Concluded.)

Naval Architecture. The Requirements of a Course of Training in Naval Architecture, Lawrence B. Chapman. Bul. Soc. Promotion Eng. Education, vol. 9, no. 4, Dec. 1918, pp. 119-130. Outlines plan in which professional work starts early in course and parallels outside training.

Part-Time Schools. Part-Time Trade and Industrial Education. Federal Board for Vocational Education, bul. 19, Oct. 1918, 51 pp. Need for part-time schools in United States; school, man and employer as factors in promoting part-time education; part-time studies already established in U. S.; continuation schools in England, France and Germany; types of part-time schools; federal aid; principles which should underlie compulsory legislation.

Physical Education. Recent State Legislation for Physical Education, Thomas A. Storey and Willard S. Small. Department of Interior, Bureau of Education, bul. 40, 1918, 35 pp. Chronological analysist of laws enacted in eight states since the beginning of the war; analysis of purpose and scope of state laws; principles of state legislation for physical education; state laws for physical education.

Radio Operators. Emergency War Training for Radio Mechanics and Radio Operators. Federal Board for Vocational Education, bul, no. 16, Sept. 1918, 74 pp., 8 figs. Outline of course for preliminary training.

Secondary Education. Cardinal Principles of Secondary Education. Department of Interior. Bur. of Education, bul. 35, 1918, 32 pp. Report of Commission on the Reorganization of Secondary Education, appointed by Nat. Education Assn.

Shop Training. Training Operators at Winchester Plant, W. E. Freeland. Iron Age, vol. 103, no. 3, Jan. 16, 1919, pp. 178-179, 2 figs. Short intensive course in training shop for men; three years' apprenticeship in school for boys; details of system. (Eleventh article of series on Winchester plant.)

The Training Department—Past and Future, John C. Spence. Iron Age, vol. 103, no. 4, Jan. 23, 1919, pp. 237-239. The crippling of one plant for another: real and pretended interest in workmen; some training plans for the common good.

Technical Education, Primary. Toronto Builders' Exchange Urges Forward Movement in Technical Education. Contract Rec., vol. 33, no. 3, Jan. 15, 1919, p. 49, Deputation recommends Ministry of Education that technical schools be owned by Government,that education be made compulsory between 14 and 20 years and that parents decide boy's vocation.

Trade and Industrial Education, Organization and Administration. Federal Board for Vocational Education, bul. no. 17, Oct. 1918, 124 pp. Contains information and suggestion concerning organization and administration of trade and industrial schools and class under Federal law.

U. S. Training Service. The U. S. Training Service and Its Work, Charles T. Clayton. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 103-104. Value of service in saving to manufacturers expense of hiring men; industrial training as a means of lessening turnover and increasing output.

Universities. The Universities and the New World, Geo. F. Swain. Jl Elec., vol. 42, no. 1, Jan. 1, 1919, pp. 12-14. Readjustment of schools and universities to fulfil new demands in education created by general reconstruction of past conditions.

Welders. The Training of Electric Welders, H. A. Horner. Gen. Elec. Rev., vol. 21, no. 12, Dec. 1918, pp. 876-881, 9 figs.

Emergency War Training for Oxy-Acetylene Welders. Federal Board for Vocational Education, bul. no. 11, June 1918, pp. 86. 30 figs. History of development and application of oxy-acetylene in industry and war; U. S. Army course of instruction in oyy-acetylene welding and oxygen cutting.

Operators and Instructors Necessary for Electric Arc Welding. Elec. Ry. Jl., vol. 53, no. 4, Jan. 25, 1919, pp. 191-192, 4 figs. From 1918 report of Committee of Association of Railway Electrical Engineers.

The Future of Army Welding Schools, Cyrus K. Rickel. Jl. Acetylene Welding, vol. 2, no. 7 Jan. 1919, pp. 331-335, 7 figs. Discusses qualifications of successful welding school.

Women Workers. Little Causes and Great Effects (Petites causes et grands effects). François Villain. Société Industrielle de l'Est. bul. 142 Nov. 1918, pp. 7028, 8 figs. Plea for enforcing law which requires teaching of household arts to young girls in elementary schools; influence of this policy on welfare of women. Conference before the Société Scientifique d'Hygiène Alimentaire.

Training Women for Record Output, Robert I Clegg. Iron Age, vol. 103, no. 3, Jan. 16, 1919, pp. 169-174, 11 figs. General results abroad and at home; diligence and industry of women; practical system of schooling on shop production lines.

FACTORY MANAGEMENT

Employment Management. The "Conscience" of Modern Industry. C. T. Clayton. Jl. Engrs. Club St. Louis, vol. 3, no. 6, Nov.-Dec. 1918, pp. 352-354. Employment management as a factor to reduce industrial misunderstanding and friction.

Extreme Methods in Employing, Charles M. Horton. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 145-148. Criticises some practices of employment managers.

Industrial Fatigue. A Suggestion for the Prevention of Waste of Human Energy in Factories, H. G. P. Castellain. Carrier's Eng. Monthly, vol. 54, no. 6, Dec. 1918, pp. 303-307. Discusses industrial fatigue from a medical point of view and suggests improvement in medical education and establishment of courses for factory inspectors and medical men.

Investigations. Engineer and Plant Management, J. G. Worker. Aera, vol. 7, no. 6, 1919, pp. 596-599. Suggestions as to investigations, reports and installations of waste preventing boiler room methods.

Labor Management. Use of Non-Financial Incentives, Robert B. Wolf. Can. Mfr., vol. 39, no. 1, Jan. 1919, pp. 79-80, 2 figs. Stimulating production in industry by internal motives rather than by external discipline, that is, by making comparisons, cost sheets, etc.

Observation. The Value of Observation in Works Practice, H. H. Ashdown. Engineering, vol. 107, no. 2766, Jan. 3, 1919, pp. 11-14, 14 figs. A paper before the Society of Engineers and Metallurgists, Sheffield, Nov. 1918.

PLANT OPERATION. Lifting Power Plant Capacity by Its Boot Straps, Charles L. Hubbard. Factory, vol. 22, no. 1, Jan. 1919, pp. 35-37, 1 fig. Improvements which contribute to increasing efficiency; how superheating steam increases capacity; how increasing speed affects engine; use of compound engines of low-pressure turbines.

PRODUCTION CONTROL. Graphic Production Control — VI, C. E. Knoeppel. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 113-118, 10 figs. Two ways to tie together and coordinate various features of control mechanism; by use of charts, and by control boards. Last article of series.

OVERTIME. Graphic Analysis of an Overtime Problem, R. von Huhn. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 86-88, 5 figs. Casting delivery on a large contract and amount of overtime needed to machine pieces

REPORTS. Facilitating Sewer Pipe Factory Management, W. B. Harris. Brick & Clay Rec., vol. 54, no. 1, Jan. 14, 1919, pp. 39-44, 10 figs. Forms and records of making reports; placing workmen.

STOKERS. Power Plant Management; Mechanical Stockers, Robert June. Power House, vol. 11, no. 12, Dec. 1918, pp. 553-355, 2 figs. Efficiency; characteristics of chain grate; instructions for operation.

STORAGE OF MATERIALS. Principles of Purchasing and Storing Applied to Rough, Bulky Materials in Yard Storage, Dwight T. Farnham. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 108-112, 7 figs. Six principles are considered in planning yard storage; Effort required to transport; weight and material to be stored on each square foot of space; rate of stores turnover; storage unit; allotted space; efficient package.

TIMEKEEPING. Providing a Double Check on Timekeeping. Factory, vol. 22, no. 1, Jan. 1919, pp. 48-50, 4 figs. Layout of Eastman Kodak Co. time-clock room.

WATER WORKS. Office Records of the St. Louis Water Division, Distribution Section, Thomas E. Flaherty. Jl. Am. Water Works Assn., vol. 5, no. 4, Dec. 1918, pp. 412-418. Brief description of organization for planning, direction and execution of work.

WELFARE WORK. Promoting Employees' Welfare Brings Large Returns. Ry. Maintenance Engr., vol. 15, no. 1, Jan. 1919, pp. 5-8, 8 figs. Policies of Richmond, Fredericksburg & Potomac R. R. Co.

FINANCE AND COST

COST ACCOUNTING. Cost Accounting to Aid Production — V. G. Carter Harrison. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 131-139, 4 figs. Diagrams illustrating coordinated cost, planning and production systems. (To be continued.)

Costing at Nation Factories, W. Webster Jenkinson. Iron & Coal Trades Rev., vol. 97, no. 26-43, Oct. 25, 1918, pp. 455-458, 10 figs. Beginning series of articles abstracts from address before London School of Ecocomics and Political Science.

POWER COSTS. Simple Method of Determining Power Costs, T. H. Fenner. Power House, vol. 11, no. 12, Dec. 1918, pp. 361-363, 1 fig. How to arrive at costs when no instruments are available.

WORKS COSTS. The Economics of Works Costs, J. R. Dick. Elecn., vol. 81, no. 2115, Nov. 29, 1918, pp. 643-645, 2 figs. (First installment of a continued article).

FOREIGN TRADE

BOILERS. New Foreign Markets for American Made Boiler aud Boiler Equipment, L. W. Alwyn-Schmidt. Boiler Maker, vol. 19, no. 1, Jan. 1919, pp. 3-4. Exports increased over one-sixth. New fields developed is South America and the Far East. European markets remain on war footing.

CANADIAN EXPORTS. Canadian Industries and the Export Trade, J. F. Heffron. Can. Machy., vol. 21, no. 1, Jan. 2, 1919, pp. 9-12. Canadian possibilities in developing foreign trade; German credit methods of fostering export trade; articles for export.

DROP-FORCE EQUIPMENT. Campaigning for Foreign Business, L. W. Alwyn-Schmidt. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 3-6. Suggestions to obtain foreign drop-forge business.

GERMAN METHODS. Effectiveness and Service in Foreign Trade. Textile World Jl., vol. 55, no. 2, Jan. 11, 1919, pp. 127 and 159. Necessity of considering customer's viewpoint; German commercial vices.

German Foreign Trade Extension Measures, Norman L. Anderson. Blast Furnace, vol. 7, no. 1, Jan. 1919, pp. 78-79. Private associations for promoting foreign trade; German exhibitions; government trade activities; purposes of suggested "Auslandamt."

ITALIAN MARKET. Our Opportunities for Foreign Trade, V. Macchi di Cellere. Am. Drop. Forger, vol. 5, no. 1, Jan. 1919, p. 17. Market possibllities of Italy, from address before Am. Mfrs. Export Assn.

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ORDNANCE DEPARTMENT METHODS. How Ordnance is Inspected, Fred H. Colvin. Am. Mach., vol. 50, no. 6, Feb. 6, 1919, pp. 263-267, 8 figs. Description of organization and methods of Ordnance Department for inspection.

LABOR

BATHHOUSES. Mine Bathhouses in Utah. A. C. Watts. Coal Age, vol. 15, no. 1, Jan. 2, 1919, pp. 4-8, 4 figs. Description of typical bathhouses with comparison of American and European costs.

BLIND. An Experiment in Employing the Blind, Dale Wolf. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 105-107. How blind men have been put to work ou jig drilling of shackles for locks.

BONUS SYSTEM. Bonus System in Power Generation, W. L. Whitlock. Nat. Engr., vol. 23, no. 1, Jan. 1919, pp. 9-11, 2 figs. Standing order to employees and scale for computing bonus. System of Denver Tramway Co., which is said to effect saving of $150,000 per year.

Bonus System Reduces Coal Consumption at Denver, W. E. Casey and E. Weber. Elec. Ry. Jl., vol. 53, no. 6, Feb. 8, 1919, pp. 266-271, 7 figs. By installation of new turbine and introduction of bonus system, coal consumption on Denver Tramway System in reduced to less than 2.5 per kw-hr., with saving in operating expense of $150,000 per year.

Coal-Economy bonuses in a Ceutral Electric-Power House (Prime au personnel sur les économies de charbon dans une centrale électrique thermique), M. Grospaud. Revue Générale de l'Electricité, vol. 5, no. 2, Jan. 11, 1919, pp. 58-63. From data showing variations in thermal efficiency of coal, writer concludes it is illusory to base bonus system ou coal consumption; he proposes instead a system based on scientific and methodic thermal control and outlines its practical working details.

The Engineer — Worker and Organizer, G. W. Tripp. The Central (Jl. City & Guilds Eng. Col.), vol. 15, no. 44, Dec. 1918, pp. 46-54, 1 fig. Comparison between Rowan bonus scheme and system based on 50 per cent payment. Abstract of lecture to Woolwich Arsenal apprentices.

BRITISH. Paper on "The Industrial Future," Cecil Walton. Jl. West of Scotland Iron & Steel Inst., vol. 26, pt. 2, session 1918-1919, 19-24 and (discussion) pp. 25-31. Labor conditions and the future development of Glasgow. Reference is made to question of wages.

Labor Administration, Edward T. Elbourne, Engineer, vol. 126, nos. 3282, 3283, 3284, 3285, and 3287, Nov. 22, aud 29, Dec. 6, 13 and 27, 1918, pp. 432-435, 7 figs.; pp. 435-454, 3 figs.; pp. 478-480, 5 figs.; pp. 504-507, 5 figs.; pp. 548-550, 4 figs. Nov. 22; Control of production; Nov. 29, The Wages office; Dec. 6; Wages office continued; Dec. 13; Accidents; Dec. 27: General discipline and general facilities. (Articles 9-13 inclusive).

CANADA. Education and Cooperation the Wisest Course in Dealing with Labor, Gideon Robertson and T. Moore. Contract Rec., vol. 33, no. 2, Jan. 8, 1919, pp. 19-20. Opinions and suggestions of Canada Minister of Labor and of the President Trades and Labor Congress.

CRIPPLED WORKERS. Human Reconstruction Reclaims War's Disabled for Industry, W. H. Llyd. Iron Trade Rev., vol. 64, no. 1, Jan. 2, 1919, pp. 80-86, 11 figs. Courses being offered to disabled soldiers and employments being secured for them.

How to Deal with Our Crippled Workers, T. Norman Dean, Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 498-500. Indicates that rehabilitation should be carried on scientifically.

The Conservation of Industrial Man Power, Arthur J. Westermayr. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 504-506, 3 figs. Question of rehabilitating crippled soldiers so that they can stand on their own merits; discussion of rehabilitation vocational act.

EMPLOYMENT DEPARTMENT. The Principles of Employing Labor, E. H. Fish. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 81-85. Fundamental principles underlying establishment and mainteuance of employment department, promotion of personal relations. First of five articles.

FEDERAL CONTROL. What Federal Control Has Done for Labor, W. S. Carter. Ry. Maintenance Engr., vol. 15, no. 1, Jan. 1919, pp. 11-12. Résumé of measures taken to improve relations between managements and employees. Abstract from address delivered before convention of Acad Political Sci.

HOUSING. Housing the Workers — An Unfinished Job, George Gove, Am. City, vol. 20, no. 1, Jan. 1919, pp. 23-25. Present status of Government housing projects. Challenge to local chambers of commerce to meet emergency.

The Present and Future Government of War-Created Communities, Ernest Cawcroft. Jl. Am. Inst. Architects, vol. 6, no. 12, Dec. 1918, pp. 553-558. Suggestions in regard to housing projects undertaken by War Department, Navy Department, U. S. Housing Corporation and U. S. Shipping Board.

LABOR PROBLEM. The Labor Problem Analyzed, Magnus W. Alexander. Open Shop Rev., vol. 16, no. 1, Jan. 1919, pp. 3-16. Social, political and economic aspects of labor vroblem. Address delivered at convention of Nat, Founders' Assn. (To be continued).

LUNCH ROOMS. Mill Lunch Rooms for Employees, A. W. Anderson. Textile World Jl., vol. 55, no. 2, Jan. 11, 1919, pp. 397 and 401, 4 figs. Description of employees rooms used by several companies.

OLDER MEN. Superannuation of Technical Men. Times Eng. Supp., no. 530, Dec. 1918, p. 257. Proposes that industrial firms take over policies of technical men in their employment and keep them on same basis as adopted in federation of universities.

PROFIT SHARING. Enlisting Labor in Production, L. W. Schmidt. Am. Mach., vol. 50, no. 6, Feb. 6, 1919, pp. 253-256, 3 figs. Some methods of making labor interested in the part it is playing in production.

Wage Questions Must Be Handled form Inside the Industrial Unit, Harry Tipper, Automotive Industries, vol. 40, no. 2, Jan. 9, 1919, pp. 62-63. Importance of profit-sharing collective agreement.

REPRESENTATION OF EMPLOYEES. Where the Men Settle Their Own Troubles. Factory, vol. 22, no. 1, Jan. 1919, pp. 29-31, 1 fig. A board of appeals, consisting of two representatives from each department, one elected by the workers, the other appointed by management, has jurisdiction over all controversies concerning wages, hours of work, discharges, promotions, etc.

TURNOVER OF LABOR. Labor Maintenance and Its Indices, Winthrop Talbot. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 127-130, 2 figs. Criticism of accepted theories of labor turnover and methods for computing it as percentage; presentation of theory of labor maintenance and a way of calculating indices to show stability, maintenance and replacement of working force.

WAGES. Notes on the Formulæ of Modern Wages, (Quelques réflexions sur les formules de salaire moderne). Génie Civil, vol. 73, no. 22, Nov. 30, 1918, pp. 425-428, 5 figs.

Labor Share. Min. & Sci. Press. vol. 117, no. 26, Dec. 28, 1918, pp. 864-866. Conditions brought about by abnormal requirements of war; objections raised by workmen to changing war scale.

The Human Factor in Shop Production, Margaret K. Strong. Am. Drop Foeger, vol. 4, no. 12, Dec. 1918, pp. 489-490. Points out that high wages given high productiveness because workman who is well fed and nourished can do greater amount of work.

Wages in War and Peace. Open Shop Rev., vol. 16, no. 1, Jan. 1919, pp. 19-23. Impossibility of maintaining present high wages.

The Modern Wage Rates and the Public Works and Construction (Les tarifs de salaire moderne et l'entreprise de travaux publics et du bâtiment), G. Bouf. Génie Civil, vol. 74, no. 1, Jan. 4, 1919, pp. 9-11, 1 fig. Study of Taylor's system of rational wages; instituting bonuses.

WOMEN. The Employment of Women in Acetylene Welding, Helen G. Fisk. Jl. Acetylene Welding, vol. 2, no. 7, Jan. 1919, pp. 348-354. Abstract of preliminary report of Chicago district ordnance office on activities of women in acetylene-welding field during the war.

The employment of Women in the Machine Tool Industry, Alfred Herbert. Eng. Rev., vol. 32, no. 6, Dec. 16, 1918, pp. 161-163. Scope for their employment after war; plea for fixing minimum wage or maximum working hours. Text of memorandum submitted by Machine Tool & Eng. Assn. to War Cabinet Committee on Women in Industry.

Mental Function in the Work of Women (La fonction mentale dans le travail féminin). Jule Amar. Comptes rendus des séances de l'Académie des Séances, vol. 167, no. 22, Nov. 25, 1918, pp. 788-791. Psycho-motor reactions in women; physiological examination of their endurance.

Women a Fixture in Electrical Industry. Iron Age, vol. 103, no. 6, Feb. 6, 1919, pp. 353-354, 3 figs. Special provision for employment, welfare and safety are made by the Westinghouse Co.; shop and thecnical courses courses are provided.

Women Workers — Have They Made Good? Mary N. Winslow and Edgar E. Adams. Am. Drop Forger, vol. 5, no. 1, Jan. 1919, pp. 12-16, 5 figs. Records of past year; part played by women in war-time industries; presented problems; fact concerning employment of women in various plants.

LEGAL

ACCIDENT COMPENSATION. When is an Industrial Accident? Business Digest & Investment Weekly, vol. 23, no. 3, Jan. 21, 1919, pp. 92-93. Phraseology of compensation insurance laws in various states and legal decisions by different courts in United States and Great Britain.

"Pre-Existing" Condition of the Workman and Its Relation to Compensation for Injury, Chesla C. Sherlock. Am. Mach., vol. 50, no. 2, Jan. 9, 1919, pp. 67-69. Explanation with citations of zone court decisions.

PATENT LAWS. United States Patent Law and Procedure, E. E. Huffman. Jl. Engrs. Club St. Louis, vol. 3, no. 6, Nov.-Dec. 1918, pp. 335-351. Outline of patent system; suggested changes. Address delivered at joint meeting of Assoc. Eng. Soc., St. Louis.

The Rights to Patents and Inventions, Chesla C. Sherlock. Am. Mach., vol. 50, no. 3, Jan. 16, 1919, pp. 115-118. Quotes some notable decisions in respect to patent rights.

The New Patent Law Drafted for Hungary and its Influence Upon Engineers (Der neue ungarische Patengesetzentwurf mit besonderer Ruecksicht auf die Stellung der Techniker), Dr. Rudolf v. Schuster, President of Patent Court. Zeitschrift des Oesterr, Ingenieur, und Orchitekten-Vereines, Vienna, vol. 70, no. 37, Sept. 13, 1918, pp. 399-402. Defends the provisions of the proposed patent law for Hungary. Advocates cooperation of engineers and lawyers.

The Crucial Question of Patents, Robert Hadfield. Eng. Rev., vol. 32, no. 6, Dec. 16, 1918, pp. 157-160. How Board of Trade can provide strong stimulus to British scientific and engineering progress by applying its present powers to effect modification of patent law.

Patent Law Amendment. Jl. Instn. Elec. Engrs., vol. 57, no. 277, Dec. 1918, pp. 64-71. Report of patent-law committee adopted by conference of representatives of 30 leading scientific and technical societies, convened by Instn. Mech. Engrs.

The Patent Situation in the United States. Mech. Eng., vol. 41, no. 2, Feb. 1919, pp. 147-149 and 199. Report of Patent Committee to the National Research Council.

LIGHTING

INDUSTRIAL LIGHTING. Artificial and Natural Industrial Lighting, C. E. Clewell. Elec. World, vol. 73, no. 1, Jan. 4, 1919, pp. 22-25, 8 figs. Their interrelations considered; predetermination of artificial lighting requirements; variation in natural lighting intensities; importance of daylight factor; methods of measurement.

Engineering Aspects of Industrial Lighting, C. E. Clewell. Elec. World, vol. 73, nos. 2 and 6, Jan. 11 and Feb. 8, 1919, pp. 68-71 and 260-262, 7 figs. Jan. 11; Industries should take advantage of studies made under stress of war conditions to promote efficiency of production; specific data now available which aid in selection aud location of lighting units. Feb. 8; Ecomomic considerations of the accident rate; relation to coal conservation; well-lighted versus poorly-lighted aisles; desirability of more widespread and intelligent use of reflectors for all lamps.

MILL LIGHTING. Modern Lighting and Power Installation for Canadian Knitting Mill. Elec. Rev., vol. 74, no. 4, Jan. 25, 1919, pp. 127-130, 7 figs. Electrical equipment complete and designed to minimize fire and accident hazards; details of lighting and power facilities.

Progress in Mill Lighting Practice, H. H. Magdsick. Textile World, Jl., vol. 55, no. 2, Jan. 11, 1919, pp. 401 and 403, 5 figs. State and Federal regulations; development in accessories.

STREET LIGHTING. The Street Lighting of the City of Buffalo, W. F. Schwartz. Am. City, vol. 20, no. 1, Jan. 1919, pp. 48-50, 4 figs. System comprises type C nitrogen-filled lamps, luminous arcs, pendent magnetite arcs, and enclosed carbon arcs, as well as gas lamps of Welsbach boulevard and ornamental types, and gasoline lamps. Number and cost of each type are given.

YARD LIGHTING. Light as an Aid to the Movement of Materials, A. L. Powell and R. E. Harrington. Ry. Elec. Engr., vol. 10, no. 1, Jan. 1919, pp. 9-13, 7 figs. Expedition of freight handling at transfer platforms and piers. Abstract of paper before Illum. Engr. Soc.

PUBLIC REGULATION

PLANT MANAGEMENT. Industrial Economy (Economia Industrial), V. Posada Gavira. Boletin de Minas, vol. 10, nos. 7-9, Sept. 30, 1918, pp. 129-149, 1 fig. Coordination and harmonization of the technical ,economical and human elements in industry by central administration, standardization and specialization.

PUBLIC WORKS. A National Department of Public Works, C. E. Grunsky. Jl. Elec., vol. 42, no. 1, Jan. 1, 1919, pp. 16-17. Advisability of creating department of public works to be represented in President's cabinet. Gain in efficiency is claimed over present distribution of engineering work under five different departments.

STREET CARS. The National Aspect of the Public Utility, Franklin T. Griffith. Jl. Elec., vol. 42, no. 2, Jan. 15, 1919, p. 78. Question of higher street-car fare discussed from standpoint of what may legitimately be done to keep them low.

RECONSTRUCTION

BRITISH PLANS. England's Vast Plans for Peace Work, Carroll E. Williams. Mfrs. Rec., vol. 75, no. 3, Jan. 16, 1919, pp. 90-92. New shipyards built in record time; building of concrete ships; recommendation of British reconstruction committee on relations between employers and employees; reconstruction of iron and steel business.

ENGINEERING PROBLEMS. The Economic Duties of the Engineer, W. R. Ingalls. Eng. & Min. Jl., vol. 107, no. 4, Jan. 25, 1919, pp. 184-190. Engineering problems in reconstruction.

ENGINEERING SOCIETIES. What Engineering Societies Should Do to Assist in Providing Work for Soldiers and Others Who Will Soon Be Out of Work. Bul. Affiliated Eng. Societies Min., vol. 3, no. 12, Dec. 1918, pp. 221-222. From Eng. & Contracting.

FRANCE. America and Reconstruction in Europe. Jl. Elec., vol. 42, uo. 1, Jan. 1, 1919, pp. 18-19. Plans of directors and representatives of large power stations and electric lighting plants situated in devastated regious of France; work done by British Ministry of Reconstruction; post-war preparations in Spain.

Helping France an Aid to America, Jahn V. Schaefer. Iron Trade Rev., vol. 64, no. 3, Jan. 16, 1919, pp. 207-208. Sending of vast stores to army construction material and experts to help rehabilitate country urged as a means of solving our labor problem, securing war loan and laying foundation of future trade.

RECONSTRUCTION PLANS. Industrial Relations After the War, Henry P. Kendall. Textile World Jl., vol. 55, no. 2, Jan. 11, 1919, pp. 121, 247 and 249. Need of constructive plan acceptable to all; basic principles that should control.

The Human Factor in Industry, A. P. M. Fleming. Jl. Instn. Elec. Engrs., vol. 57, no. 277, Dec. 1918, pp. 47-56. Means which make for improvement in material prosperity of those engaged in industry; pressing problems in industrial reconstruction.

RESEARCH. Science and the After-the-War Period, George K. Burgess. Jl. Wash. Acad. Sci., vol. 9, no. 3, Feb. 4, 1919, pp. 57-70. Importance, during transition period, of proper balance and distribution of scientific forces; advisability of retaining more than a nucleus of an organization of scientific men in service of Government and especially in military and naval establishment.

SCIENTIFIC LEADERSHIP. Human Instincts in Reconstruction ,William Henry Smyth. Indus. Managment , vol. 57, no. 2, Feb. 1919, pp. 89-91. Suggests leadership of a national council of scientists as means for directing forces of human instincts.

STEEL TRADE AND SHIPBUILDING. The Steel Trade and Shipbuilding Competition, E. T. Good. Cassier's Eng. Montly, vol. 54, no. 6, Dec. 1918, pp. 342-345. Interdependence of steel trade and shipbuilding industries; warning against separation of their common interests and against German dumping methods.

WAR DEVELOPMENTS. War Developments in Industry, Kellaway. Engineering, vol. 103, no. 2763, Dec. 13, 1918, pp. 672-673. Address before Industrial Reconstruction Council, November 1918.

SAFETY ENGINEERING

ACCIDENTS AND OUTPUT. Welfare and Safety. Cassier's Eng. Monthly, vol. 54, no. 6, Dec. 1918, pp. 316-324, 4 figs. Effect of industrial accidents upon output; means whereby incidence of industrial casualties may be considerably diminished.

CEMENT INDUSTRY. Safety Hazards of Cement Industry, O. C. Soderquist. Concrete Mill Section, vol. 14, no. 1, Jan. 1919, pp. 11-12. Itemizes cement-mill dangers and suggests safety principles and rules.

FIRE PROTECTION. Automatic Sprinklers for Fire Protection. Arthur Bateman. Domestic Eng., vol. 86, no. 2, Jan. 11, 1919, pp. 81-83, 4 figs. Notes on their construction, installation and operation.

GRAIN DUST EXPLOSIVES. Experiments with Grain Dust Explosions, Earle William Gage. Am. Miller, vol. 47, no. 2, Feb. 1, 1919, pp. 137-138, 4 figs. Investigations to determine possible cause of explosion and to test various preventive measures.

LIGHTING. Relation Between Light Curtailment and Accidents, R. E. Simpson. Nat. Engr., vol. 23, no. 1, Jan. 19, 1919, pp. 6-8. Survey of accidents due to improver or inadequate illumination; effect of diminished lighting; suggestions. Paper presented at convention of Illum. Eng. Soc.

Overheating Workmen. The Problems of Overheating Workmen, Chesla C. Sherlock. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 506-507. Methods of protecting workmen who are in contact with high temperatures; liabilities of employer.

Safety Fuse. Use and Abuse of Safety Fuse. Eng. & Min. Jl., vol. 107, no. 5, Feb. 1, 1919, pp. 229-231. Abstracted from bul. 9 of Indus. Accident commission, Cal.

SALVAGE AND WASTE PREVENTION

High-Speed Steel. The Salvage of High-Speed Steel Tools. J. H. Vincent. Am. Mach., vol. 50, no. 4, Jan. 23, 1919, pp. 169-170, 4 figs. Salvaging milling cutters at comparatively small cost by method of grinding without drawing temper of cutter.

Rust Prevention. Rust Prevention as a Steel Conservation Measure, Denis O'Brien, Elec. Ry. Jl., vol. 53, no. 5, Feb. 1, 1919, pp. 243-244. Writer's experiences in removing rust from steel cars and preventing its spreading to a damaging extent.

Scrap. Saving the Waste with an Electric Furnace, C. B. Merrick. Jl. Elec., vol. 42, no. 1, Jan. 1, 1919, pp. 30-31, 5 figs. Installation of a two-phase Rennerfelt furnace of 750-lb. capacity by Pacific Foundry Co. to utilize small pieces of waste iron such as nails, borings, ect.

Scrap Organization and Scrap Salvaging, CharlesA. Reagan. Jl. Soc. Automotive Engrs., vol. 4, no. 1, Jan. 1919, pp. 47-4R. Work of the Stores and Scrap Section of Ordnance Department; suggestions in regard to scrap segregation.

Waste Utilization. Possibilities in Saving and Utilizing Industrial Wastes, H. E. Howe. Indus. Management, vol. 57, no. 2, Feb. 1919, pp. 92-96. Points out three responsibilities of manufacturers: To use material of no higher grade than necessary for proper production of goods; to reclaim every particle where a salvaging process in known; to search for means to utilize wastes now thrown away.

TRANSPORTATION

Electric Trucks. Electric Truck as a Means of Shop Transportation. Can. Machy., vol. 21, no. 5, Jan. 30, 1919, pp. 103-105, 4 figs. Illustrates uses of electric storage battery trucks in industry for automatic transportation in loading and unloading ships and railway cars, and in the machine shop, tire factory, textile mill aud electric wire insulating and maufacturing plants.

Industrial Electric Trucks, Tractors and Narrow-Gage Locomotives, Raymond J. Mitchell. Elecn., vol. 82, no. 2121, Jan. 10, 1919, pp. 51-57, 16 figs. Conditions under which electric trucks are to be desired; rapidly with which goods may be handled; main features of electric trucks now on the market; results achieved at the Natua Transfer Station of Pennsylvania Railway.

VARIA

Acceptances. Trade Acceptances in the Forging Trade, M. A. McCann. Am. Drop Forger, vol. 4, no. 12, Dec. 1918, pp. 475-477. Presents different phases of subject from viewpoint of salesman. Method of procedure explained.

Engineering Societies. American Engineers Locally and Nationally Associated, Alfred D. Flinn. Jl. Cleveland Eng. Soc., vol. 11, no. 3, Nov. 1918, pp. 163-173 and (discussiou) pp. 173-178. Plea to engineering organizations to give earnest consideration to problem of co-operation; brief account of growth of Founder Societies and creation of Engiueering Foundation; service given by the Engineering Societies Library; advisability of publishing an Engineering Societies periodical.

Engineers. What the War Has Done for Engineers, and the Part Engineers Have to Play in Reconstruction. Engineer, vol. 127, no. 3289, Jan. 10, 1919, pp. 41-42. Abstracted from the Presidential Address of R. E. B. Crompton before the Junior Institution of Engineers.

International Chapters. A New Factor in World Commerce, Richard S. Harvey. Textile World Jl., vol. 55, no. 2, Jan. 11, 1919, pp. 127 and 197. Considerations on advisability of forming international chapters for commercial corporations.

Social Problem. Organizing the State to Assist Individuals — A War Lesson (Die allegemeine Naehrpfiicht iu Licht der Kriegserfahrung), Max Singer, Zeitschrift des Oesterr. Ingenieur-und Architekten-Vereines, vol. 70, no. 38, Sept. 20, 1918, pp. 409-411, Part 1, Indorses the principles propounded by Josef Popper-Lynkeux, that it is the duty of the State to enable each individual to make a fair and useful living. Discusses solutions of the social problem. Part 2 in no. 39. concluded in no. 40, Oct. 4, 1918.

GENERAL SCIENCE

CHEMISTRY

Analytical Chemistry. Method of Least Squares Applied to Estimating Errors in Coal Analysis J. D. Davis and J. G. Fairchild. Department of Interior, Bur. of Mines, Tech. Paper 171, 36 pp., 6 figs. Following limits of error are calculated; for sampling 0.20 per cent; for ash determination, 0.40 cent; for moisture determination, 0.20 per cent; for heating-value determination, 0.75 per cent. Thus writers conclude that limits allowed by committee on coal analysis of Am. Soc. Testing Materials represent values within which a large percentage of errors will actually fall.

Flame Reactions. Flame Reactions; Selenium and Tellurium in the Hydrogen-Air Flame, Jacob Parish. Jl. Phys. Chem., vol. 22, no. 9, Dec. 1918, pp. 640-646. Extension of writer's previous experiments (Jl. Phys. Chem., 22, 430, 1918) to behavior of selenium dioxide, tellurium dioxide, hydrogen telluride, and of elements themselves, in hydrogen-air flame.

Physical Chemistry. Physical Chemistry and Its Bearing on the Chemical and Allied Industries. James C. Philip. Jl. Roy. Soc. Arts, vol. 67, nos. 4503 and 3452, Jan. 3 and 17, 1919, pp. 94-102 and 122-131, 1 fig. Jan. 3: Factors which determine equilibrium in a reversible reastion; thermodynamic equation expressing influence of temperature on equilibrium constant of a reaction, and its relation to heat effect of reaction. Jan. 17; Laws and principles governing absorption of gases and disolved substances.

Structure of Matter. The Atomic Weight of Lead from Samarskite, Arthur L. Davis. Jl. Phys. Chem., vol. 22, no. 9, Dec. 1918, pp. 631-639. Separation of lead from samarskite, its purification, and determination if its atomic weight by analyses of lead chloride obtained; parallel experiments with ordinary lead and comparison of relative values under same conditions of experimentation; correlatiou of results with theory of radioactive changes involved by determination of percentages of uranium and thorium.

The Determination of the Molecular Complexity of Liquid Sulphur, Alex. Mitchell Kellas. Jl. Chem. Soc., vols. 113 and 114, no. 674, Dec. 1918, pp. 903-922, 4 figs. Series of experiments to determine surface tension of liquid sulphur between melting point and boiling point by means of capillary tubes.

Utra-Violet Light. Ultra Violet Light. Its application in Chemical Arts — XX, Carleton Ellis and A. A. Well. Chem. Engr., vol. 26, no. 13, Dec. 1918, pp. 505-506 and 521. Ultra violet absorption of aliphatic ketones and aldehydes. Compilation of researches by different experiments.

MATHEMATICS

Continuous Fraction Algorithm. On Jacobi's Extension of the Continued Fraction Algorithm, D. N. Lehmer. Proc. Nat. Academy Sci., vol. 4, no. 12, Dec. 15, 1918, pp. 360-364. Instead of starting with cubic irrationality and finding expansion to fit it, writer starts with periodic expansion and finds associated with it a definite cubic irrationality.

Coronoid. On the Theory of the Coronoid (Sur la théorie du couronoide), C. Cailler. Archives des Sciences Physiques et Naturelles, vol. 46, Oct. 1918, pp. 191-209. Aims to prove that the fundemental principles of Riemaun's non-Euclidean geometry are identical with the kinematic conceptions of motion of spherical figures on the surface of a sphere. Supplementary to article in Arch. 1918, vol. 46, pp. 119-150.

Elliptical Functions. Elementary Solution of the Inversion of Elliptical Functions (Solution élémentaire du problème de l'inversion des fonctions elliptiques), René Garnier. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 22, Nov. 25, 1918, pp. 748-750. Genarlization of Landen's transformation.

Hyperspace. Note on Rotations in Hyperpace, Edwin Bidwell Wilson. Jl. Wash. Acad. Sci., vol. 9, no. 2, Jan. 19, 1919, pp. 25-28. Method of investigation based on general reduction of homogeneous strain to canonical form. Supplement to writer's paper; Note on Multiple Algebra; the Reduction of Real Dyadics and the Classification of Real Homogeneous Strains, published in Jl. Wash. Acad. Sci., vol. 7, 1917, pp. 173-177.

Integration On the complex rational groups and integration by quadratures (Sur les groupes complexes de rationalité et sur l'intégration par quadratures), Jules Drach. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 22, Nov. 25, 1918, pp. 743-746. Integrability of equations decomposable into Lie's infinitesimal transformations.

Integration of a Partial Derivative Equation Occurring in Dynamics of Fluids (Intégration d'une équation aux dérivées partielles de la dynamique des fluides), Jules Drach Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 24, Dec. 9, 1918, pp. 943-945. Motion of a fluid when speeds of particles are parallel to fixed plane and independent of distance to plane studied by Euler's equations in combination with equatiou of continuity and complementary relation.

Laplace Coefficients. On Certain Polynomials which Approach Laplace Cœfficients (Sur certains polynomes se rattachant aux cœfficients de Laplace), Armand Lambert. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 24, Dec. 9, 1918, pp. 948-949. Linear relations between hs (k) functions.

Logarithms. Logarithms of Hyperbolic Functions to Twelve Significant Figures, Frederick E. Pernot and Baldwin M. Woods. Univ. of Cal. Publications in Eng., vol. 1, no. 13, Nov. 16, 1918, pp. 297-467. Tables of logarithms to base 10 of three principal hyperbolic functions for range form 0 to 2 with tabulat interval of 0.0001, and auxiliary tables of log (sink x/x) and log (x/tanh x) for range from 0 to 5 with same tabular interval.

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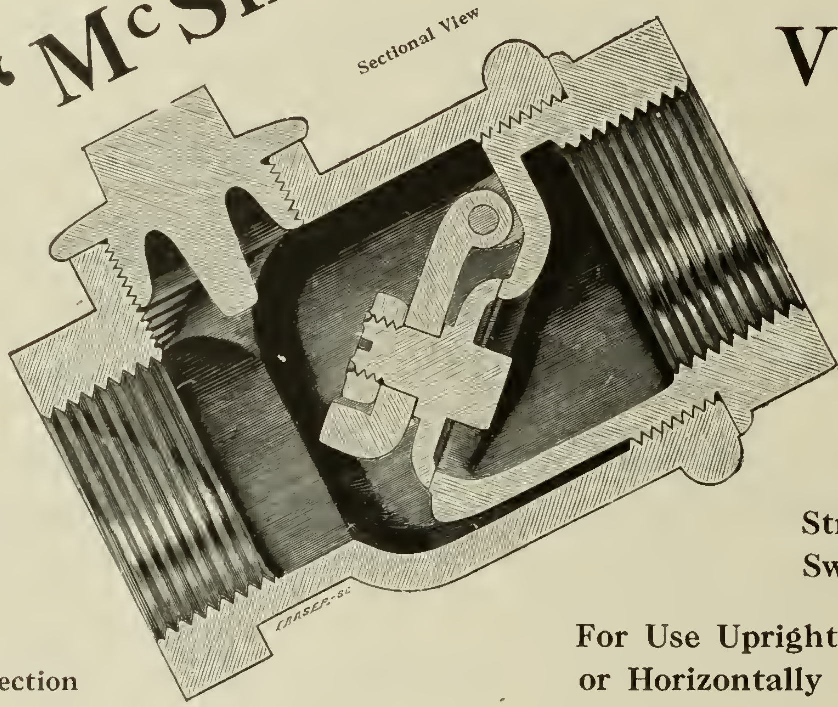
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THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

"TO FACILITATE THE ACQUIREMENT AND INTERCHANGE OF PROFESSIONAL KNOWLEDGE AMONG ITS MEMBERS, TO PROMOTE THEIR PROFESSIONAL INTERESTS, TO ENCOURAGE ORIGINAL RESEARCH, TO DEVELOP AND MAINTAIN HIGH STANDARDS IN THE ENGINEERING PROFESSION AND TO ENHANCE THE USEFULNESS OF THE PROFESSION TO THE PUBLIC."

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The Mount Royal Tunnel *

A Description of the Construction of the Tunnel and Terminal built by the Mount Royal Tunnel & Terminal Company for the Canadian Northern Railway at Montreal.

By

J. L. Busfield, B.Sc., A.M.E.I.C.

INTRODUCTION

History of the Tunnel Project

Previous to the recent opening of the Mount Royal Tunnel for through passenger traffic the Canadian Northern Railway was unfavourably situated in the City of Montreal, only having a small passenger and freight station at Moreau Street in the east end of the City. This station was inadequate even for the handling of the local traffic between Montreal and Quebec, and with the growth of the Canadian Northern to a ten thousand mile transcontinental system it became more than ever essential that adequate and suitable terminal facilities should be provided.

Speaking generally, the City of Montreal proper covers a long narrow area with the central portion confined between two natural barriers, the St. Lawrence River to the south and Mount Royal to the north, with the result that surface railways could only reach the centre of the City after passing through a number of miles of city property which has been rapidly becoming more and more congested. Mount Royal was looked upon as an impassable barrier as far as railway location was concerned until the Canadian Northern put into effect the idea of tunnelling the heart of the mountain in order to reach the most desirable location in the City for both a passenger terminal and also for freight connections. The credit for the conception and elaboration of this project must be given to Mr. H. K. Wicksteed, M.E.I.C., Chief Engineer of Surveys for the Canadian Northern Railway System, who worked out the preliminary location for the tunnel and terminals, and who is generally looked upon as the " father " of the whole project.

Before any publicity was given to the proposition, active steps were taken in the way of quietly acquiring the necessary rights and lands on both sides of the mountain. On the north side a large number of farms between the mountain and St. Laurent were purchased outright with the object of developing a model city to be served by rapid transit through the tunnel; in the City itself properties were acquired forming the nucleus of desirable areas for passenger and freight terminals and connecting right-of-way. Preliminary surveys were commenced late in 1911 and carried on during the early part of 1912, and early in that year Mr. S. P. Brown, M.E.I.C., who had had considerable experience in tunnel construction in the United States was engaged as Chief Engineer. At this date the sale of " Model City " lots was opened to the public, and the survey and the preliminary organization work was earnestly taken in hand, with the result that in June, 1912, the first excavation work was commenced by the Tunnel Company's own forces in the West Portal of the tunnel. Construction was rapidly pushed ahead, the first connection being made through the mountain by the meeting of two bottom headings in

* Read by the Author before the Professional Meeting at Ottawa on February 13th, and before the Montreal Branch on February 20th, 1919.

December, 1913. The work of widening the tunnel to full size proceeded steadily until after the outbreak of the war, when expenditures were necessarily reduced to a minimum and it was not until February, 1916, that the tunnel excavation was completed, and December, 1916, that the concrete lining was entirely in place. After that date the excavation for the station site and temporary terminal in Lagauchetiere Street was proceeded with until the consummation of the project was reached on October 21st, 1918, by the running of the first passenger train carrying the general public.

almost entirely through farming country with comparatively small population. In addition to the above line it was also proposed to provide an easterly connection crossing the Canadian Pacific Railway Quebec line near Jacques Cartier Junction, and joining the existing Canadian Northern Quebec line at a point east of Moreau Street Station. From the point at the north side of Mount Royal a tunnel through the mountain was to give access to a passenger terminal at Dorchester Street and also to a freight terminal in the wholesale district and to the tracks of the Montreal Harbour Commission.

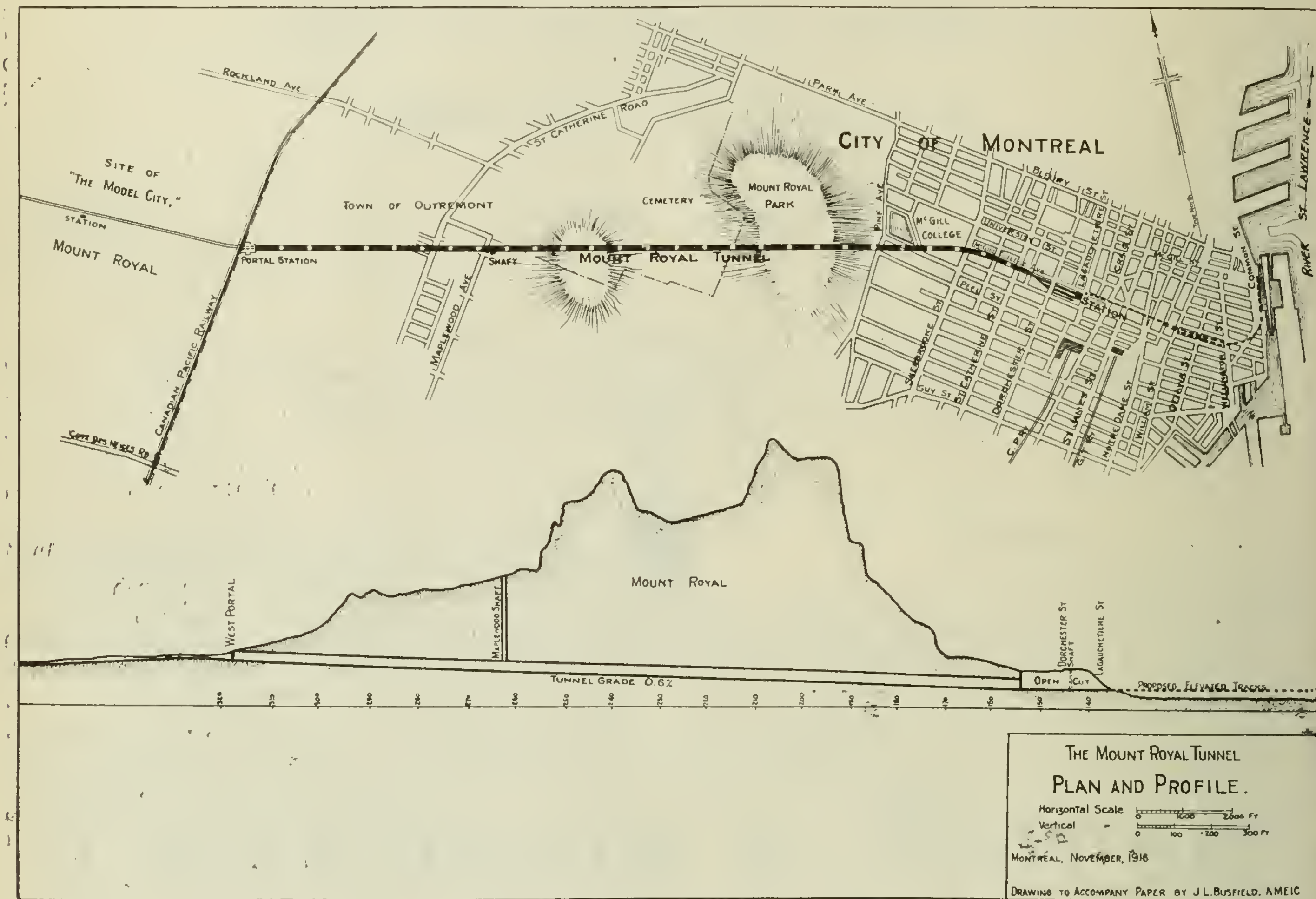


Fig. 1.

General Description

Briefly stated the scheme developed by Mr. Wicksteed and most of which has been carried out with little change, was to build a line of railway from Grenville Junction on the Ottawa-Quebec line to St. Eustache, thence crossing the Back River near Ile Bizard and parallel to the south side of the river to Cartierville and across the Island of Montreal to the north side of Mount Royal, crossing the Canadian Pacific Railway's belt line at a point about one mile west of Mile End Station. This location passed

After studies had been made of a number of alternative schemes, the site for the passenger terminal was located in the two blocks bounded by Cathcart, Lagauchetiere, Mansfield and St. Monique Streets, intersected by Dorchester Street, one of the main east and west thoroughfares of the City as shown on the general plan and profile, Figure 1. From this site the tunnel line was laid out following the centre line of McGill College Avenue to a point near Burnside Place, from which point it curved to the west, to a long tangent passing under the highest part of Mount Royal, while the West Portal was located adjacent to the Canadian Pacific Railway's belt line track connecting Mile End and Montreal West. This location was chosen in order that the tunnel might pass under the minimum amount of built-on property, particularly in the City where the amount of cover was small. From the West Portal the tracks were located in an open cut across the Model City "Mount Royal," and a large sorting yard, engine terminal and engine changing station were located at Cartierville. The original plans provided for a double track tunnel to be operated by electric traction; a large passenger terminal with large office and other buildings situated over the tracks on both sides of Dorchester Street; ample trackage in the city and Cartierville terminals for handling a large amount of suburban traffic in addition to heavy main line taffic, both to the east and to the west; and all the necessary equipment such as electric locomotives, and multiple-unit cars essential for high class service. To the east or south of the passenger terminal provision was made for building a viaduct across the downtown streets to a large elevated freight terminal to be situated on Nazareth Street between William and Wellington Streets with an elevated connection from there to the proposed high level tracks of the Harbour Commissioners' railway. Owing to war conditions, however, these plans have not as yet been carried out in their entirety.

SURVEYS

Preliminary Work

Before describing the nature of the survey work, the general method of the tunnel excavation must be outlined. Briefly stated, this was carried out by sinking a shaft at Dorchester Street to subgrade level so that a heading could be driven towards the mountain without waiting for the general excavation of the station site; by making an open cut excavation at the West Portal, and driving a heading below the C. P. R. tracks towards the city; and thirdly by sinking an intermediate shaft at Maplewood Avenue (about one mile from the West Portal)from which headings were driven in each direction. From these four headings, in turn, breakups were made at intervals, providing a large number of working faces, few of which would be more than a mile from the nearest outlet. Details of the various methods used for the various forms of construction will be described later.

In order to have plans of sufficient accuracy for even preliminary studies of location and alignment a rapid survey was made of the territory on either side of the proposed railway from the water-front to the "Model City," by which streets, railway tracks and other prominent features were located. Sufficient elevations were also taken for the preparation of a working profile over the whole route. This survey was carried out by one party using ordinary methods, the survey lines being laid out principally on the streets but partly over the mountain and through Mount Royal Park. The party consisted at the most of seven men, namely, a chief of a party, two instrumentmen, one rodman, two chainmen, and an axeman. The field notes were plotted partly by the instrumentmen and partly by the office staff, although, as a general rule throughout the whole of the construction work, the field staff prepared their own plans and plotted their own notes.

Another phase of the preliminary work was the preparation of plans showing underground structures and utilities, such as sewers, water mains, electric and telephone conduits, and so forth, in the immediate neighbourhood of the proposed construction work. This involved lengthy studies of plans at the City Hall and other offices, but in many cases the information there available was so meagre that, for example, sewer connections had to be actually traced by experiment on the ground. However, the importance of having correct and reliable plans of these structures could not be over estimated.

The condition of all buildings within reasonable distance of the tunnel line was very carefully determined before the actual commencement of construction work, both by very accurate levelling, and also by plumb lines on the fronts and rears of the various houses. Extensive photographic work was also carried out in order to have a complete record of the condition of all adjacent property.

Precise Surveys

The steep slopes of the mountain made it inadvisable to make direct measurement along the line of the tangent, so it was decided to run accurate traverses around the side of the mountain. Suitable routes were chosen and angle points selected and permanently marked as far apart as possible, keeping away from hills and rough ground. Each angle point was preserved by drilling a ¼-inch hole into the stone or concrete of the sidewalks about half an inch deep, and hammering into this hole a piece of ¼-inch hollow brass tubing. A copper rivet was then hammered into the tube and a punch mark or knife scratch marked the precise point. Ten to fifteen minutes was found to be ample time for the setting of one of these points and many of them are still in place. In the city itself, in order to hold the survey lines even more permanently, monuments were set at a few important locations, and in order to insure that they would not be disturbed by frost, the foundation of each was set down about 7 feet below the ground surface. The type of monument used is illustrated by Figure 2a.

In order to make the traverse around the mountain sufficiently accurate, the length of the route being about four miles, it was necessary to adopt some form of precise measurement. A large proportion of the lines to be measured came on sidewalks or roads so it would have been impossible to use any form of measurement requiring stakes, and a form of portable measuring point, called a "spider," was, therefore, used. It was made of a cast iron wheel carried on screw legs and supporting a vertical member with a brass head on which is the cross scratch to which measurements are made, the details being shown in Figure 2b. Four of these spiders were used, each weighing about forty-four pounds.

Previous to making the precise measurements, "spider points" were marked on the sidewalks by means of a chiselled cross every 99 feet on the lines of the traverse, being put on line either by eye or by a transit. Where the lines were not on sidewalks the spider points were marked by driving ship spikes into the ground. While these were being marked by one party of four men at the rate of about two miles per day, a second party consisting of a leveller

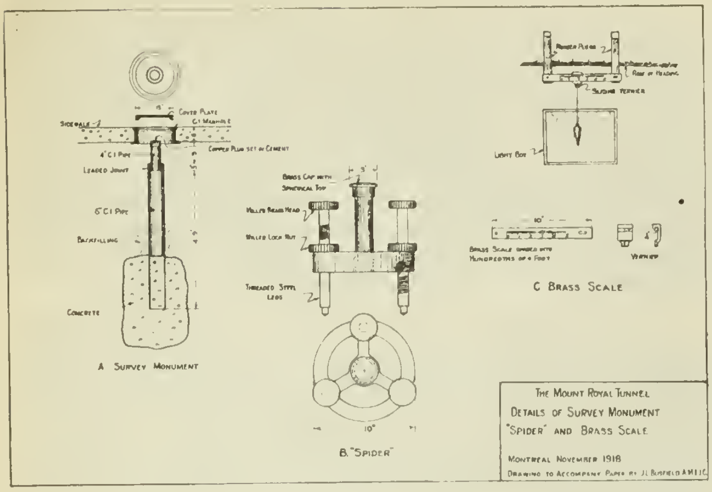


Fig. 2.

and rodman was following and taking the elevations of all the spider points and entering them in a book specially provided for that purpose.

Before any of the actual measurements were made all the tapes that were used were compared with a tape standardized by the Washington Bureau of Standards under the same condition as were to be employed in the field, namely, under a tension of 12 pounds and supported at intervals of 20 feet. Corrections were also made to a temperature of 62° Fahrenheit. Chesterman steel tapes 100 feet long and ¼-inch wide, divided into hundredths of a foot, were used, the observer estimating to thousandths.

The actual modus operandi of making the measurements (illustrated in Figure 3) was as follows: two spiders would be set up at adjacent spider points and the tape stretched across their tops, attached to a forestay at the front end and to a cord passing around a bicycle wheel with a 12 pound wieght attached at its rear end. Four wooden standards were then lined in by eye at 20 feet intervals, and the hooks for supporting the tape set on a straight line between the tops of the spiders so that when hooked up and with tension applied the tape would practically conform to a straight line between the tops of the spiders. The height of each spider above its spider point being measured and the elevation of the spider point being known, the difference in elevation of the two ends of the tape could then be obtained and hence the correction to horizontal. Thermometers were suspended from the standards and readings taken for every set up so that the proper correction for the expansion or contraction of the tape could be made. When the tape was properly hooked up and had the tension applied, readings of the intersection of the cross scratches on the two spiders were taken by the two observers at either end of the tape and called out to a recorder, who entered them in the field notebook and rapidly subtracted the two readings. The tape would then be allowed to slide over the tops of the spiders so that a different pair of readings would be obtained and again called out to the recorder. At least four pairs of readings would be taken in this way, but if the difference thus obtained varied more than one or two thousandths, the readings were continued until a reliable measurement was obtained. In addition to the tape readings the recorder also booked the height of the spiders and the mean temperatures. Corrections to horizontal and for temperature were later made in the office from special tables and charts. After a set of readings had been completed the whole apparatus was carried ahead and a new measurement made in the same way, but one spider was always left in place behind the one actually being measured from, so that in case of a spider being accidentally moved the other could be used again, thus saving the party from having to go back to the nearest angle point and, therefore, over the same ground twice. At the starting point and at all rivet stations instead of one of the spiders being placed over the rivet it was set up merely as a support for the tape, the reading on which was obtained by transferring the point on the rivet vertically up to the tape by means of a transit placed a short distance away from, and at right angles to the tape.

This method of measuring required ten men, namely, a chief of party, a transitman, a recorder, two chainmen, two spider-placers, a thermometer reader, a man for forestay, a man for tension wheel. Under favourable conditions as much as 1,500 to 1,800 feet was measured per hour, but ten spider points per hour made a good average for a day's work on sidewalks. The majority of the work was done in the daytime but in the busy sections of the city it was necessary to work during the night, small acetylene lamps being used for illumination. Great care having to be taken in reading the angles of the traverse, a Berger transit, 7¼-inch plate, reading to ten seconds was used. In setting the instrument up over the angle points a second transit was used to insure the placing of

Fig. 3. Survey Party making Precise Measurements.

the vertical axis of the large instrument exactly over the centre of the cross on the rivet, thus eliminating any error due to inaccurate centering of the plumb-bob. At the two points sighted at, wooden targets were used, being set up vertically and precisely over the points by means of a transit. In reading the angle one observer would read the angle once, " wrap it up " five times, and then reverse until zero was again reached on sighting at the foresight target. This method would give a very close approximation of the angle to two seconds, and this process being repeated by an independent observer a reading reliable to about one second could be obtained. This part of the work was necessarily slow and tedious, requiring a party of four men, who were only able to read about five or six angles per day.

A very important part of the preliminary work was that of establishing over the mountain a tangent in the same vertical plane as the tunnel centre line. The line was first run over the mountain in short stages and after the necessary cutting had been done through the wooded parts the transit points were reduced to three in number. At one of these bed rock was obtained but at the other two, concrete monuments had to be built to hold the line permanently.

Underground Alignment

The headings were completely holed through from end to end in December, 1913, with an error in alignment of less than one inch, and in grade of one-quarter of an inch at the final meeting point, which was below the highest point of the mountain. Throughout the work at the western end the tunnel centre line was determined and permanently marked in the floor of the headings by monuments, but at the eastern end it was found advisable on account of the curve to run an engineers' line independent of the tunnel centre line, with tables giving the relation of the latter to the former.

Before proceeding with a description of the methods used in laying out the lines described above, note must be made of a piece of apparatus used very frequently and found almost invaluable in the alignment work. This was a brass scale fitted with a sliding vernier as shown by Figure 2c. Whenever it was necessary to obtain an average of a number of points set by a transit one of these scales was used. It was rigidly attached to the roof timbers or to plugs set into the roof, as shown in Figure 2c, and the instrument man sighted on to a plumb-bob suspended from the sliding vernier in front of a light box or illuminated screen. They were used as a means of obtaining averages and for temporarily holding the engineers' line, and as soon as a good average reading was obtained the line was, in most cases, transferred to a permanent monument set in the floor of the heading. Different types of monuments were used but the one found most satisfactory was made from a two feet length of 1½-inch gas pipe with a piece of brass solidly riveted into the top on which the centre mark was made. The pipe was cemented into a hole drilled down into the floor of the heading. For giving centre line and grade at the working face, " spads " were set in the roof every fifty or sixty feet throughout the length of the tunnel.

At the West Portal the heading was driven direct from an open cut so the alignment was readily transferred into the heading by setting up a transit in the cut and sighting directly on to a scale placed as far into the heading as possible. At the Dorchester Street shaft the line had to be transferred down the shaft, which was 20 feet long by 10 feet wide, and before the main tunnel tangent was reached four angles had to be turned, two on account of the curve at McGill University, and two because the shaft had to be located 30 feet to the north of the tunnel centre line. The whole tunnel alignment from the east end depended entirely on the accurate location and deflection of these angles. In order to secure the requisite accuracy, the chainage was carefully transferred down the shaft by means of a plumb line, and from there to the last angle point base line measurements were made in the same way as already described for the surface surveys.

The Maplewood shaft had to be located about twenty feet to the south of the tunnel centre line, consequently the lines for driving the headings had to be transferred down the shaft and then offset to the centre line, and run east and west. Great accuracy was not so essential in this part of the work as the heading only had to be driven a little over two thousand feet before meeting the heading from the West Portal, after which the line was carried through from the portal. However, when the headings were actually holed through the error in alignment was less than the thickness of a plumb-bob cord, while between the West Portal and the City the error was less than one inch.

For transferring the survey lines down the shafts, No. 8 steel piano wires were used, suspended as far apart as possible. They were hung from reels attached to heavy wooden frames and at the surface were passed over a notch in a tangent screw on the front of the frame by means of which screw they were finally adjusted to their precise position. The two wires were very carefully set on line at the surface and an instrument man was continually on watch during any series of observations, a precaution which was fully justified, as frequently the wires would be jarred off line by some careless labourer or by the vibration caused by the nearby hoisting engine or by passing traffic. At the lower ends of the wires 12 and 30-pound weights were suspended at the Dorchester and Maplewood shafts respectively, and immersed in pails of water to reduce the swinging and oscillation to a minimum. In producing the line into the heading the transitman would set up the transit about ten feet away from the nearest wire and would then " buck " into line until the transit cross hair would bisect each wire. The view in Figure 4 shows the instrumentman with a transit set up under a scale, in the act of bucking into line. When the transitman had got on line he would sight ahead onto a scale which had been previously set up as far away from the instrument as possible, an observer at the scale taking the reading of the vernier as it was set. The operation was repeated a large number of times and continued until enough readings had been obtained on the scale to leave no room for error. The observers at transit and scales were frequently changed. The transit was also always reversed and set off line between all readings, and the whole process of shaft plumbing was carried out on a number of different days.

It has already been mentioned that in the heading from the Dorchester shaft it was necessary to turn off four angles very precisely as the exactitude of the main tangent depended largely on the accuracy with which these angles were turned off. The ten second transit already referred to was used, and as on the surface it was set up over an angle point by means of a second transit. The angle was then turned off roughly and a small mark made on the foresight monument, the precise angle to this point being obtained by wrapping up the angle five times and taking the mean. By taking the difference between the angle thus obtained and the angle as it should be, the distance between monuments being known, it was then possible to calculate the distance the true point should be to the right or left of the preliminary point. After a new point had been taken in this way the angle was again wrapped up five times, by different observers, and the operation repeated until there was no possibility of an error of even one second.

After the last angle had been turned off to a point as far away as possible, it was necessary to produce the tangent westwards and at the same time the tangent was gradually being produced eastwards from the west portal.

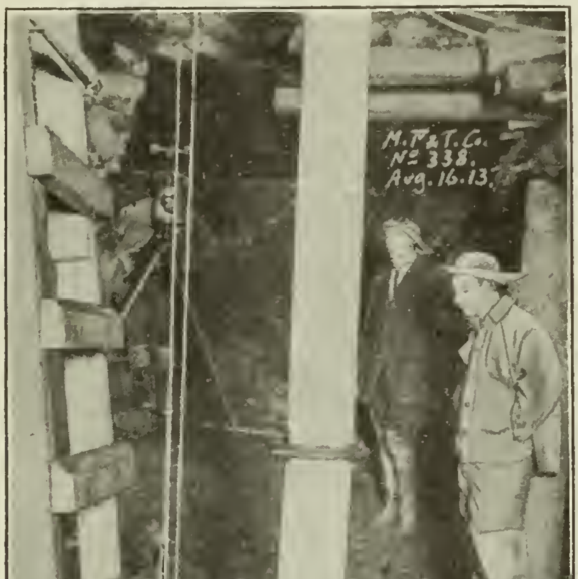


Fig. 4 Shaft Plumbing. - "Bucking" into line.

In order to produce the line from any two monuments a scale was set up at the foresight and instead of setting up the transit immediately over the intermediate monument it was set up about ten feet away and bucked into line between the adjacent monument and the backsight, thus eliminating the use of a plumb-bob. A large number of readings would be taken on the scale and the average transferred to the monument below by means of a transit. In making some of the long sights necessary on the tangent the ordinary plumb-bob was not satisfactory as a sighting point and some special targets were used.

A great deal of the precise alignment work had to be carried out on Sunday nights as this was the only time at which the heading was clear of smoke and at which the work could be carried on without interruption from the construction work. For the actual alignment of the headings alone great precision would not have been necessary, as an error of even two or three feet in line would have caused no serious effects, but a great deal of excavation work was being done back of the headings, in breakups, and it was essential that the alignment should be fairly accurate for this part of the work.

Levelling

It was of equal importance that correct elevations should be adhered to throughout the work as lines and distances. Accurate elevations of bench marks throughout the construction territory were determined by independent observers, each using numerous set-ups at each turning point, and taking every known precaution to eliminate errors. Eighteen-inch Berger Y levels were used for this work. Elevations were transferred down the shafts with steel tapes, applying the same tension as that under which they were standardized, and also making correction for temperature. In the tunnel itself, the elevations were carefully determined of each monument as it was set, while for the actual driving of the heading the elevation of the alignment spads were taken, from which the inspectors were able to mark a point on the face so many feet above subgrade for the guidance of the drillers. The error in elevations at the meeting point was less than one quarter of an inch.

GEOLOGICAL CHARACTERISTICS

Generally speaking the central part of Mount Royal is formed of an igneous volcanic instrusion throught what was originally a bed of Trenton limestone, the relative locations being such that the east and west ends of the tunnel were driven through limestone while the central portion was through the large body of igneous rock called essexite. The relative positions of the different rocks are shown at the foot of the progress diagram, Figure 7.

The Trenton limestone at a considerable depth was found to be excellent tunnelling rock, being crystalline and hard, but difficulties were encountered owing to the limestone bed being broken up by the igneous intrusion causing numerous dykes and fractures running in all directions. These dykes, varying from a few inches to many feet in thickness, were generally extremely hard, consisting principally of nepheline syenite, camptonite and bostonite. In some cases drill steels of two different tempers had to be used in the one heading on account of the variation in the hardness of the rock, and the general unevenness in such places caused no little difficulty in drilling. At the junction between the limestone and essexite on the east side the former was found to be in a partly marmorized condition heavily impregnated with quartz, and was not only hard to drill and shoot, but owing to its cementing nature caused considerable delay by setting in the heading and muck-cars. Numerous cavities filled with calcite crystals were found, as were also gypsum, arsenic and feldspar in small quantities.

The essexite was an extremely hard rock to drill, but even with this objection, was a good tunnelling rock. It of the tunnel, and at St. Catherine Street was down as low as sub-grade; the earth above consisted of different forms of clay with layers of fine sand and hardpan. A special form of construction was used in this locality.

EXCAVATION

Tunnel Cross Sections

From the station site to the neighbourhood of Pine Avenue a number of borings were made to determine the nature of the ground through which the tunnel was to be driven. From the information thus obtained, and from

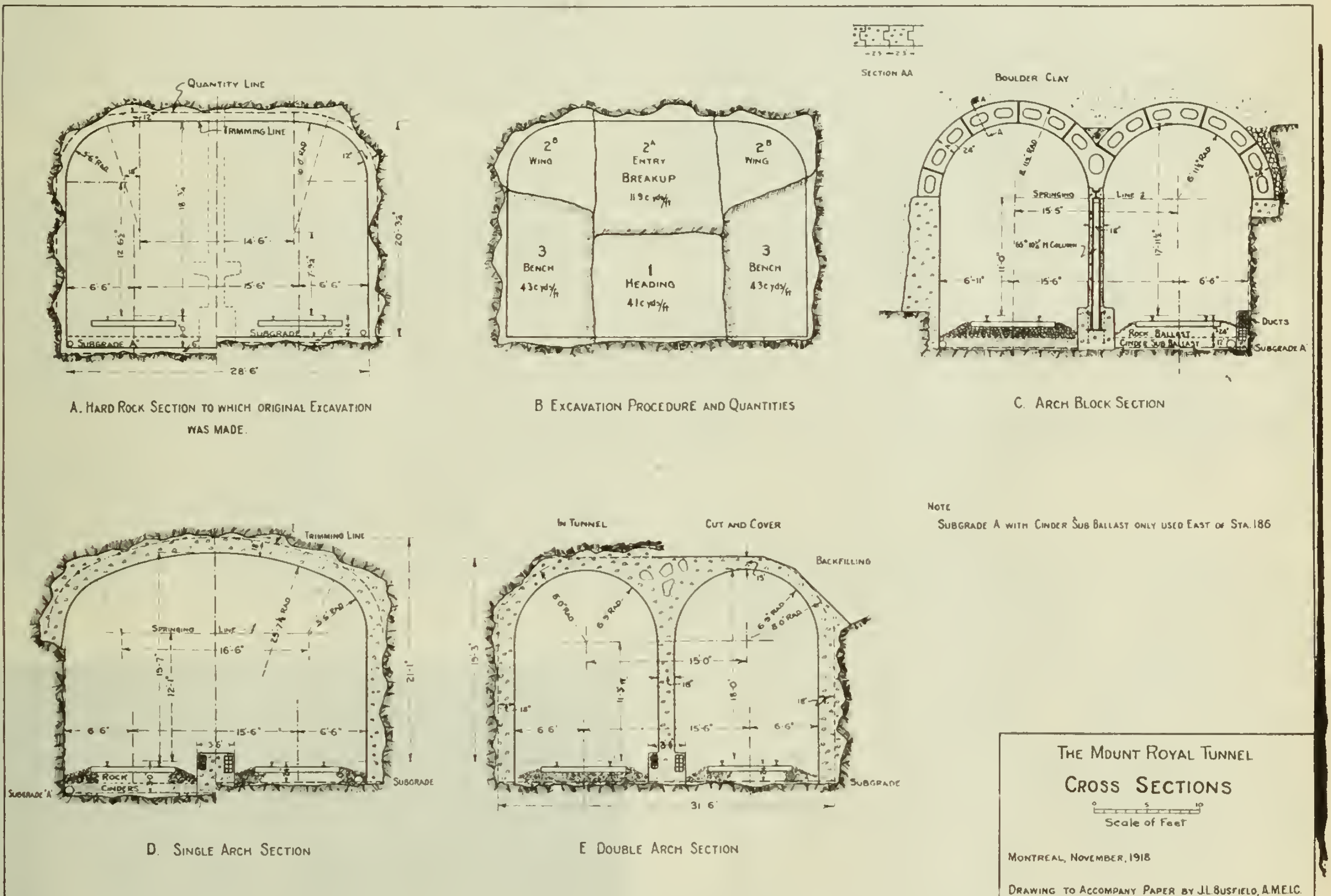


Fig. 5

was found to contain pyroxene, magnetite, hornblend and feldspar, all in small quantities.

Although the tunnel was driven through these hard rocks there were only short distances where a concrete lining could be dispensed with. By far the greater portion had to be lined and some parts timbered immediately after excavation owing to the distortions and internal strains in the rock caused by the igneous intrusion.

From the station site to a point below McGill Campus the surface of the limestone was generally below the roof

general knowledge of the geological characteristics of the mountain preliminary designs for the tunnel cross sections were prepared. Advantage was taken, however, of the work being carried out by Mackenzie, Mann & Company's own forces to leave the final design until such time as the tunnel excavation was approaching completion, and a careful study could be made of the actual conditions underground. In figure 5A is shown the cross section which was used during the greater part of the excavation work. In figure 5B is shown the sequence of excavation for this same section. The relative yardage of the headings, breakups and benches varied considerably in different parts of the tunnel but the figures given represent average conditions. In some cases only one wing of the breakup was excavated, leaving the other to be removed with the bench, and also for some distance the benches were not removed simultaneously. From the station site to Sherbrooke Street the roof of the tunnel was in soft ground and a special section using O'Rourke interlocking concrete arch blocks was adopted as shown in figure 5C. A total of 1650 linear feet of this type of construction was used.

After the excavation of the breakups was completed a series of cross sections of the tunnel roof and sides as actually excavated was made, and from the information thus obtained the single arch section in figure 5D was designed so as to require the minimum amount of trimming and at the same time, the smallest amount of concrete. This section was used for a distance of 12,322 feet between the arch block section and the twin arch section at the West Portal leaving a distance of 2,063 feet unlined. In the neighbourhood of the West Portal where the depth of cover was comparatively small, 300 feet were built in the form of a twin arch as shown in figure 5E. Part of this section was built on the cut and cover principle. Between this section and the West Portal special construction was adopted for the Portal Heights Station.

The tunnel cross sections throughout were designed with the idea of using a centre wall as shown dotted in Figure 5A, which, if found desirable, can be built into the section actually used for the major part of the tunnel. The object of the centre wall was to facilitate ventilation and provide greater safety in case of a derailment, and also to provide a roof support.

Shafts

In order that the tunnel excavation might proceed at the city end without waiting for the excavation of the open cut for the station site, a shaft 20 feet long by 10 feet wide, inside the lining timbers, was sunk immediately east of Dorchester Street with a total depth of 58 feet. Until a depth of about 45 feet was reached only soft ground was encountered and as the excavation proceeded heavy sheathing was placed around the sides, kept in place by heavy timbers. Below this depth limestone rock was encountered. Hand-drills were used, and the excavated material was hoisted out by a skip and steam derrick. The excavation of this shaft was commenced on August 3rd and completed on August 28th, 1912.

A second shaft was located adjacent to Maplewood Avenue at a point about 2¼ miles from Dorchester Street, and one mile from the West Portal. This location was not only convenient to roads and the Montreal Tramways lines, but also occurred at the bottom of the main part of the western slope of the mountain, thus giving the minimum depth obtainable at a reasonable distance from either of the portals. This shaft was excavated through solid rock for practically its entire depth of 238 feet and was made 21 feet long by 10 feet wide at the top, but reduced to 16 feet in length in the solid rock a short distance below the surface. For a number of reasons it was decided not to excavate the shaft immediately over the tunnel but at a distance of about twenty feet to the south, the only objection to this offset being the difficulty of transferring the alignment into the headings, but this was overcome in the manner already described, and the distance the heading had to be produced from this line was in any event not great. The Maplewood shaft was commenced on July 22nd and completed on October 12th, 1912.

Two additional shafts were sunk, one near Sherbrooke Street, in the grounds of McGill Campus, and the other adjacent to Cathcart Street. The former of these, which was about ten feet by twelve feet, was used for the ventilation of the heading and for the passage of drainage pipes. It was also found convenient as a check on the alignment although it was too small to obtain a line with any greater accuracy than was already laid out from the Dorchester Street shaft. The Cathcart Street shaft (14 feet long by 12 feet wide) was used for lowering the H columns and steel used in connection with the arch block construction, and later for dumping the material from the Terminal site excavation.

Heading Excavation

A number of alternative schemes for the tunnel excavation were studied but finally the method of using bottom headings and breakups was adopted as being most suitable for the particular conditions encountered. The advantage of this method was considered to be that the action of gravity could be utilized in the loading of the breakup excavation into cars handled on tracks in the bottom heading, kept clear throughout its length for transportation purposes. The excavation procedure, therefore adopted has been shown in Figure 5B.

A bottom heading was driven on the centre line of the tunnel throughout its entire length by four different workings. From the Dorchester Street shaft a heading averaging eight to nine feet high and twelve to thirteen feet wide was driven west a distance of 6,365 feet, with a total excavation of 23,442 yards of rock. From the Maple-

Fig. 6. Drilling Gang in Heading.

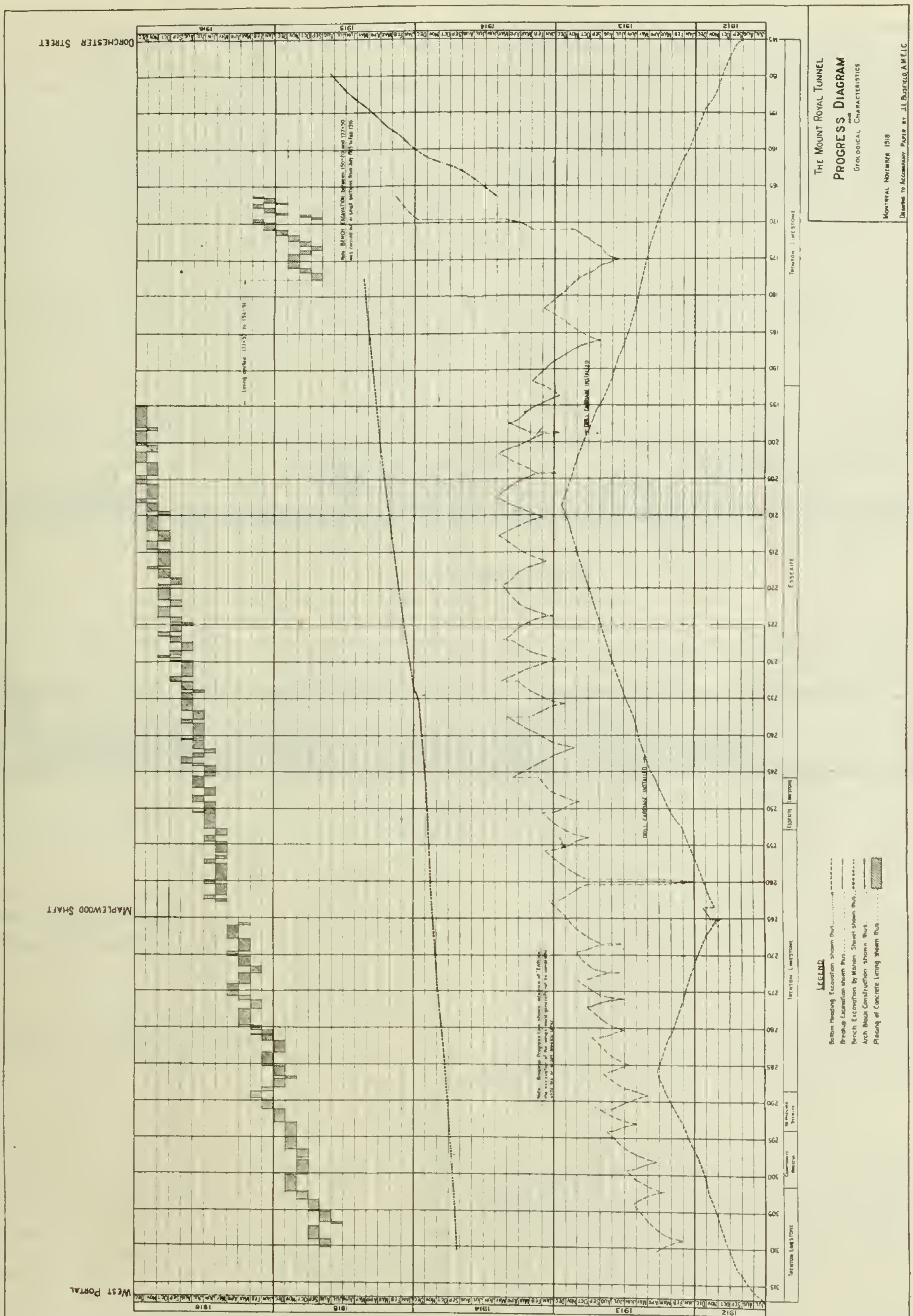

THE MOUNT ROYAL TUNNEL
PROGRESS DIAGRAM
GEOLOGICAL CHARACTERISTICS
DORCHESTER STREET
MAPLEWOOD SHAFT
WEST PORTAL
LEGEND

Fig. 7.

wood shaft headings were driven east and west measuring about nine to ten feet high and thirteen to fourteen feet wide, for distances of 5,560 feet and 2,150 feet respectively with corresponding excavations of 25,424 and 6,915 yards of rock. Similarly a heading was driven east from the West Portal averaging nine to ten feet high by thirteen to fourteen feet wide for a distance of 3,126 feet, with an excavation of 10,538 yards of rock, making a total of 17,201 linear feet of heading with 66,319 yards of excavation.

By the first method 13,000 feet of heading was driven, being 76% of the total. Four drills were carried on a horizontal quarry bar firmly wedged across the end of the heading about midway between the floor and the roof, and during each set up 20 to 25 holes, varying from five feet to eight feet in depth, were drilled in the face. A view of the drilling gang is shown in Figure 6. Different procedures were adopted in the " shooting " of the face. One practice was to fire four independent rounds using electric detonators connected with the tunnel lighting circuit

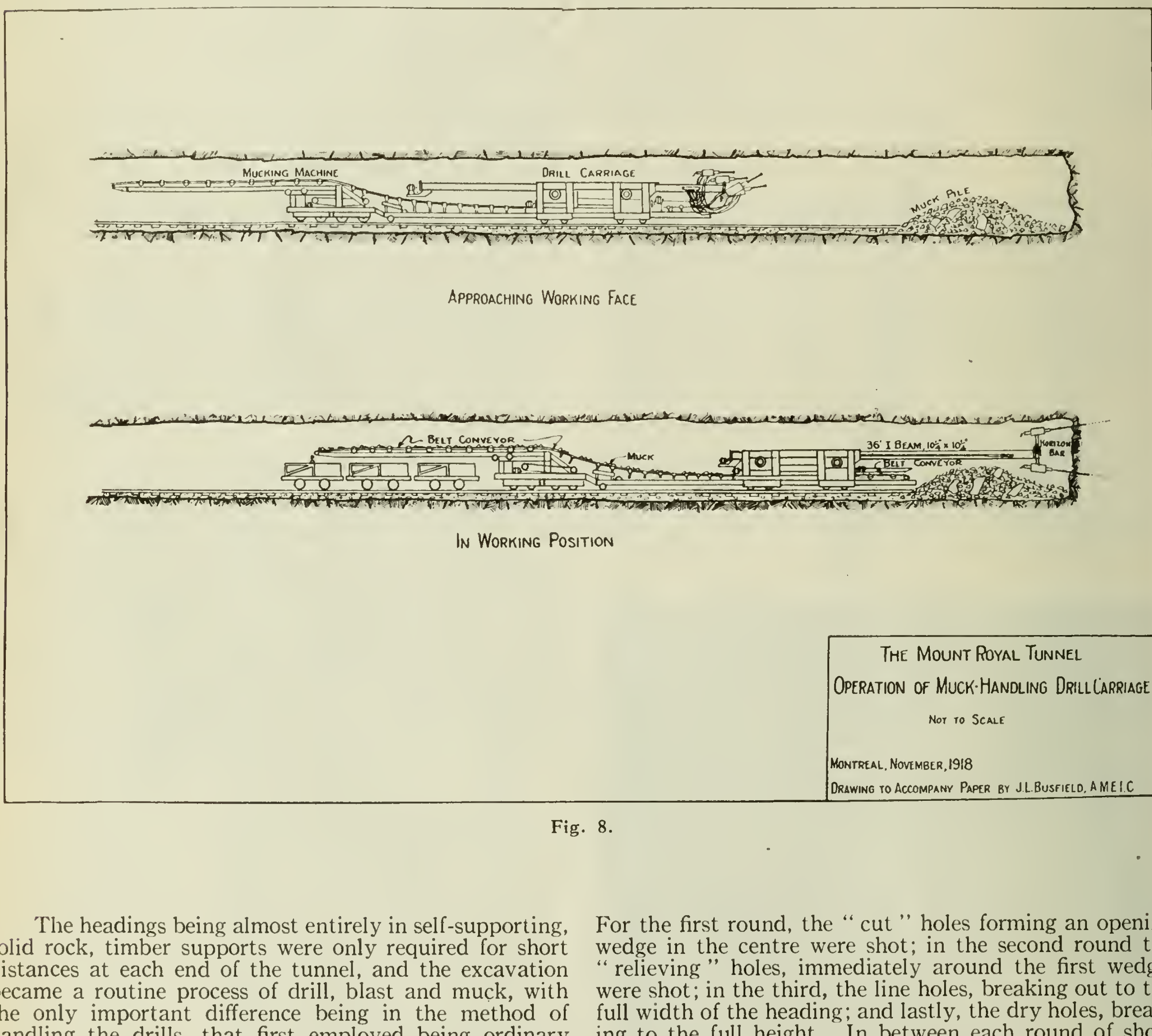


Fig. 8.

The headings being almost entirely in self-supporting, solid rock, timber supports were only required for short distances at each end of the tunnel, and the excavation became a routine process of drill, blast and muck, with the only important difference being in the method of handling the drills, that first employed being ordinary hand work with horizontal quarry bar, replaced later by a muck-handling drill carriage at the westerly end and a simple drill carriage at the easterly working.

For the first round, the " cut " holes forming an opening wedge in the centre were shot; in the second round the " relieving " holes, immediately around the first wedge, were shot; in the third, the line holes, breaking out to the full width of the heading; and lastly, the dry holes, breaking to the full height. In between each round of shots the loading gang would penetrate the smoke caused by the previous blast and load the next series of holes. In order to eliminate the loss of time and also the ill-effects on the men, of this intermediate loading, time fuses were put into use with satisfactory results. In this case the cut holes were loaded and fired first, and then the remaining holes were all loaded at the same time, but time fuses, cut at two inch intervals were used to insure the proper sequence of shots, the fuses being ignited simultaneously by electric detonators.

After shooting, the muckers immediately made their way to the face to clear a space for the drill gang, while at the same time pipefitters and electricians attended to the connecting up of the air and water pipes and electric lighting wires. As soon as sufficient space was cleared the drill runners set up the horizontal bar, mounted their drills, and again set to work. The muckers continued the removal of the blasted rock, three men shovelling from the pile onto "slick sheets" (sheets of metal placed on the floor of the heading to facilitate shovelling) from which four other men loaded the muck into cars. During periods when the work progressed at such a rate that two complete rounds of drilling, blasting and muck were carried out per shift each man would handle from 10 to 15 cubic yards of rock in about six hours of working time, the other two hours of the eight hour shift being lost during the shooting. A double track was always maintained close to the working face to facilitate the handling of the muck cars, and to insure that the muckers should not be delayed through lack of cars.

Contrary to expectation very little trouble was experienced with water in the tunnel. The only place where water was encountered to any extent was at a point about midway between the West Portal and the Maplewood Shaft. At no time, however, was there any more than could be readily taken care of by air-driven Cameron pumps. The tunnel grade descending towards the city enabled the water above referred to, to be collected in a sump at the Maplewood Shaft and pumped from there to the surface.

The rate of progress of driving the headings naturally varied under different conditions, but the maximum reached was 810 feet in the 31 working days commencing May 1st, 1913. This constituted an average of over 26 feet per day and was carried out in hard Trenton limestone. It was claimed to be the record for heading excavation in hard rock for the American Continent, but this has since been exceeded at the Rogers Pass Tunnel. Throughout this period the gangs were organized to perform perfect teamwork and with only one exception two rounds of drilling and shooting were maintained in each shift. Progress, however, throughout the main portion of heading excavation was naturally considerably less than this figure and is shown in detail in Table 2 (see Appendix), and also on the progress diagram, Figure 7. It is noticeable from the diagram that notwithstanding the extremely hard essexite encountered in the central portion of the mountain steady progress was maintained, largely due to the use of heavier equipment carried on drill carriages to be described later.

Sullivan water drills were used throughout the work. In the heading excavations described above the 2⅝-inch size were almost entirely used, but in the very hard rock the 3⅝-inch size was required. The machines employ a hollow drill steel, through the centre of which an emulsion of air and water is automatically forced, having the effect of cleaning out the hole as it is drilled. For light trimming work Hardy "Simplex," 25 pound self-rotating hammer drills were used with satisfactory results. In the essexite rock five to seven steels had to be used per foot of hole, while as many as one thousand drills had to be sharpened per day; special Ward drill sharpeners, operated on the steam hammer principle, located in the blacksmith shops on the surface, being used for this purpose. The drills were operated by compressed air supplied to a 10-inch pipe line at 100 pounds per square inch. A manifold was carried up close to the working face, to which the drills were individually connected.

Sixty per cent dynamite (Forcite) was used almost entirely, an average round requiring about 100 pounds or as much as 150 pounds for very hard rock, about fifteen to twenty cubic yards of solid rock being loosened each round.

In the heading procedure described above it was unadvoidable that there should be considerable time lost every round by the dismantling and re-assembling of the drills. With the 3⅝-inch heavy type of drill used in the very hard rock it became very difficult to handle the drilling equipment, consequently a form of drill carriage was designed to carry the frills along the headings away from the immediate working face without the necessity of dismantling and disconnecting them.

Drill Carriages

The type of drill carriage first installed in the heading being driven towards the city was evolved by the tunnel engineers and designed to suit the particular conditions to be contended with. As in the ordinary heading work, the four drills were carried on a horizontal bar which, however, was mounted at the end of a 10¾-inch I-beam, 36 feet long, supported by an H frame carried on wheels. Electric motors were provided to give three motions to the I-beam, namely, longitudinal, vertical and horizontal, so that the horizontal bar, carrying the drills could readily be adjusted to the correct position at the face. In operation the carriage was run as close to the muck pile as possible, the last few feet of track being portable and combined with slick sheets. The length of the I-beam permitted the passing of the drills over the top of the muck pile. A muck handling machine was combined with the drill carriage, in order to overcome the difficulty of the heading being blocked by the latter. A belt conveyor passing under the H-frame, as close to the ground as possible, elevated the muck and dumped it into the tunnel cars below. The diagram in Figure 8 shows the method of operation of this carriage, while the photographs in Figures 9 and 10 show the general appearance of the machine before it entered the heading.

This drill carriage and muck-handling machine was built in the tunnel company's own shops and when put into operation fully met with expectations. It was used for a period of over six and a half months, during which time about three thousand feet of heading was driven. The advantages over the ordinary method of heading excavation were many. The time of assembling and dismantling the drills at each round was very materially reduced; the saving of wear and tear on the drills was considerable; the massiveness of the whole equipment reduced vibration, and consequently gave a greater

Fig. 9. Front View of Muck-Handling Drill Carriage.

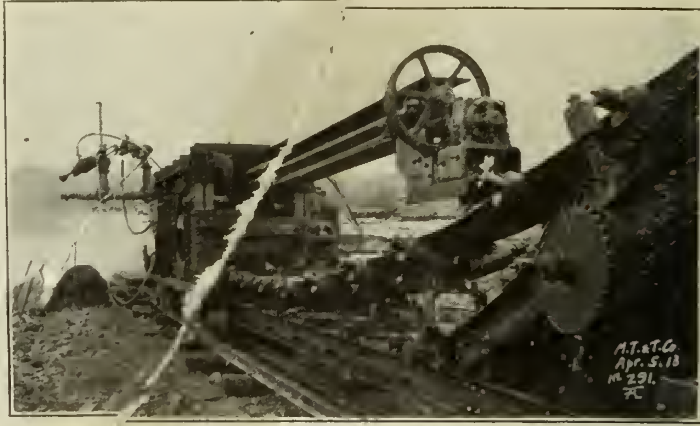


Fig. 10. Rear View of Muck-Handling Drill Carriage.

drilling rate; and the low belt conveyor facilitated the work of the mucker. There was no actual saving of labour with this machine, but the rate of progress was increased as shown by the fact that during the five months previous to the installation of the machine, December to May, inclusive, the progress averaged 346 feet per month, whereas from July to December inclusive the average progress was 484 feet per month, an increase of nearly 40 per cent, notwithstanding the fact that the rock was very much harder. The extreme regularity of the progress of the drill carriage was very striking, and is well illustrated in the Progress Diagram, Figure 7.

The drill carriage described above proved so satisfactory in operation that it was decided to install a machine in the heading being driven west from the city. By this time, however, there was comparatively little heading work remaining to be done, and the expense of an elaborate machine was not warranted. A simple form of drill carriage was, therefore, devised, with the object of producing the same results as the heavy electrically equipped machine, but at a more or less nominal cost. In this machine the drills were carried as usual on a horizontal bar, which mounted at the end of an 11 inch I-beam, 36 feet long, by means of a swivel joint, so that the bar could be swung around parallel to the heading during the movement of the carriage. The beam was carried on two small trucks with no other mechanical equipment than jacks, the latter being used to move the beam vertically to its working position. In operation, the carriage was pushed forward as soon after a blast as possible, the I-beam projecting the drills over the top of the muck pile up to the working face. In order that the heading might be left clear for mucking the rear end of the I-beam was then jacked up close to the roof of the heading and supported by wooden A-frames on each side of the heading and spanned by a piece of iron pipe. The two small trucks were then withdrawn by the locomotive and put on a siding until again required to withdraw the I-beam and drills. This carriage was only used for a period of two months, driving about nine hundred feet of heading, but practically all the advantages of the muck-handling drill carriage were obtained, including the remarkably uniform rate of progress. In fact for the last few weeks before the meeting the progress in the two headings were almost identical. The general scheme of operation of this carriage is shown in figure 11.

Breakups

At intervals of 500 to 800 feet the excavation was opened up to its full height and to the full width of the upper half of the tunnel by means of "breakups." (See Figure 5B). In order to preserve the continuity of the heading at each breakup a temporary roof was built of heavy "jumbo" timbers spaced about two feet apart, which were planked over so as to form a working floor for the breakup, small openings being left between the planks through which the muck was shovelled into cars spotted on a siding below. The general appearance of a breakup is shown in Figure 12 which also shows the heading and jumbo timbers.

The breakup was first "stoped" to the full height of the tunnel for a length of about fifty feet before the wings were excavated and as the complete breakup was continued east and west "entries" were excavated the same width as the heading to the full tunnel height and kept about fifteen or twenty feet ahead of the wings. In drilling the entry the horizontal bar was first set up at such an elevation that the drillers were able to stand on the plank floor over the jumbo timbers, and after shooting the lower half thus drilled they would stand on the muck pile and set their drills in position for the upper half of the entry. While this operation was being carried on the wings were also drilled by means of single drills set up on vertical columns. The rate of excavation of the breakups, per cubic yard, was naturally very much in excess of that in the headings, conditions all being very much more favourable. The blasting was always against two open faces and the handling of the muck was very much simplified.

By far the greater part of the breakup excavation was in sound rock requiring no support even when excavated to the full width of thirty feet but there occurred a few places where bad rock and internal strains in the roof required heavy timber supports until such time as the permanent lining was installed. The rate of progress has been shown diagrammatically in Figure 7 which also shows the relation of the breakup to the heading work. It must, however, be remembered that a linear foot of breakup was equivalent in yardage to nearly three feet of heading excavation. The actual yardage removed monthly is given in the excavation table No. 3.

haunch provided at the springing line for the concrete arch, it was not necessary to mount the machines for drilling the vertical line holes very close to the outside limit of the excavation.

In order to facilitate drilling under these conditions two drill carriages of the form shown in Figure 13 were built and used for this work. Each carriage was thirty feet in length and built up of heavy timbers, mounted on double flanged wheels. Four to six drills were mounted on each of the two horizontal quarry bars, held by four outriggers from the body of the carriage. At the ends of the outriggers jacks were provided for the purpose of rigidly holding the carriage in place. A clear opening was provided below the carriage for the passage of cars on the narrow gauge tunnel track. The quarry bars were held in such a position that with the drills set on the outside they were in position for the line holes, while from the inside of the bar the break holes were drilled. Advantages similar to those of the heading drill carriages were obtained with particular reference to the saving of time due to not having to dismount the drills while moving, and the rigidity of the carriage.

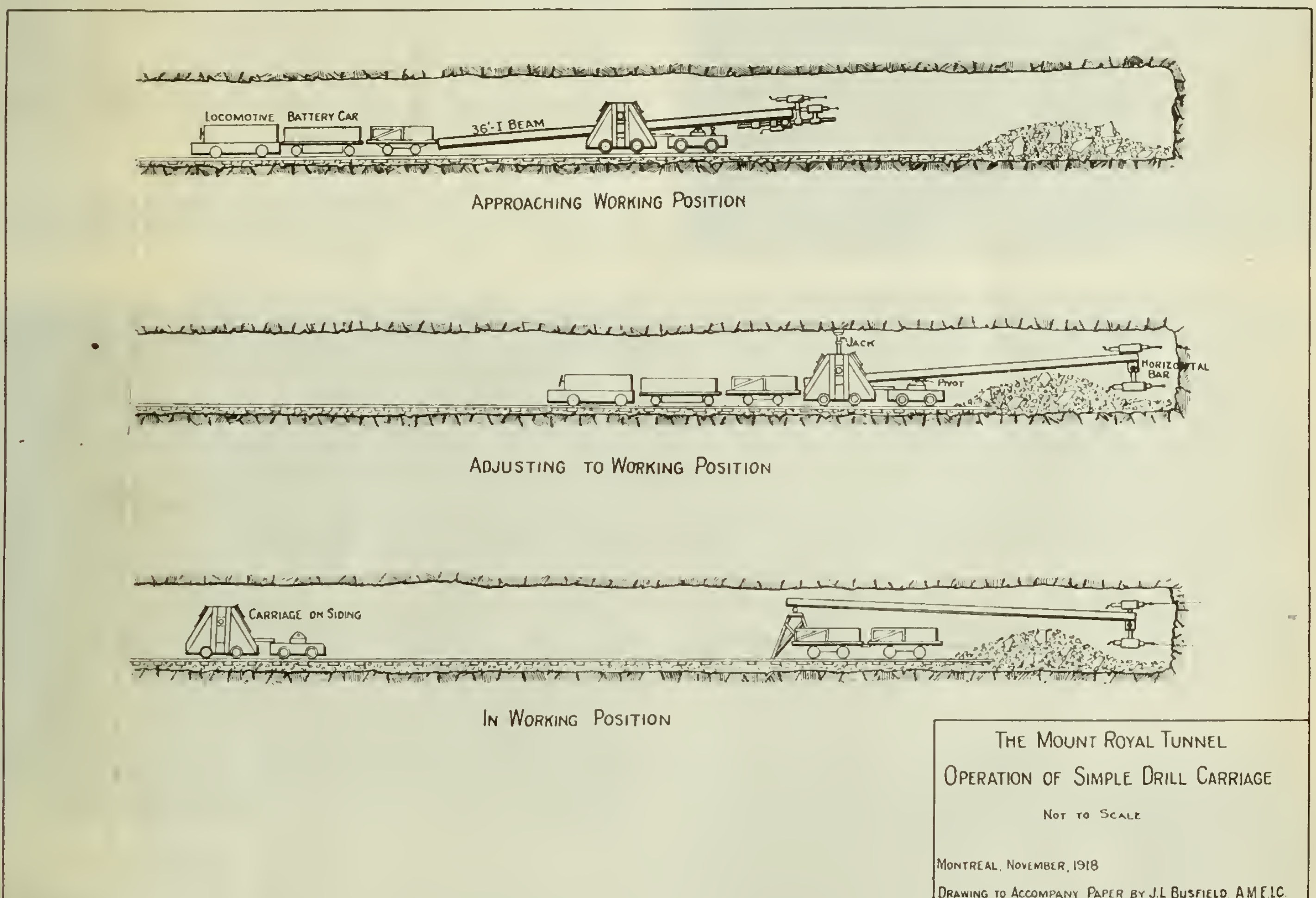


Fig. 11.

Benches

The third stage in the tunnelling operation was the removal of the benches. A condition somewhat different from either the heading or breakup excavation had to be contended with, and new factors had to be studied before a satisfactory method of attack could be evolved. Financial and labour conditions were also very much disturbed at that time by the outbreak of the war. The benches contained between eight and ten cubic yards of rock in place per linear foot and were very irregular both with regard to height and also in the sloping top, the latter making it difficult in many places for a man to keep his footing. Fortunately, however, on account of the

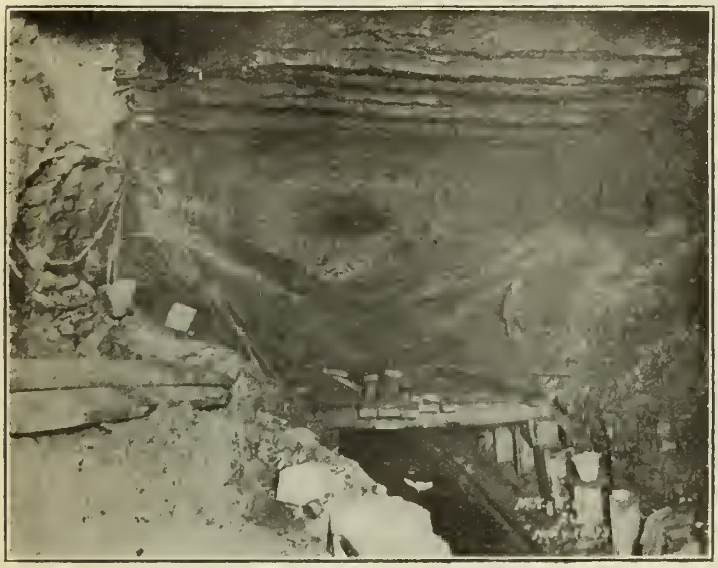


Fig. 12. Breakup showing Heading and Jumbo Timbers.

Progress reached as much as 1,500 feet per month, there being no interference from blasting as this was always done at a considerable distance behind the drill carriage. In addition to the eight to twelve drill-runners two helpers were required, while the services of an electrician and pipe fitter were distributed over the twc carriages which were used.

The removal of the rock was only performed at a considerable distance behind the drilling and shooting, again eliminating delay from the latter source. The blasted rock was entirely removed by a No. 41 Marion shovel operated by compressed air and equipped with a 1¼ yard bucket. In a working day of two ten-hour shifts over one thousand cars of muck would be handled and under average conditions 1,400 to 1,800 cubic yards of loose rock was removed from the tunnel per day. The view in Figure 14 shows the shovel in operation, while the diagram, Figure 7, shoes its progress, and table 3 gives the monthly quantities excavated.

In blasting the benches the break holes were first shot, and then the line holes, as little as one pound of dynamite being used per cubic yard of rock. In fact the removal of the benches was performed so economically throughout that the rock obtained from them was crushed and then sold for more than the actual cost of excavation and crushing even allowing for overhead charges for the plant and equipment.

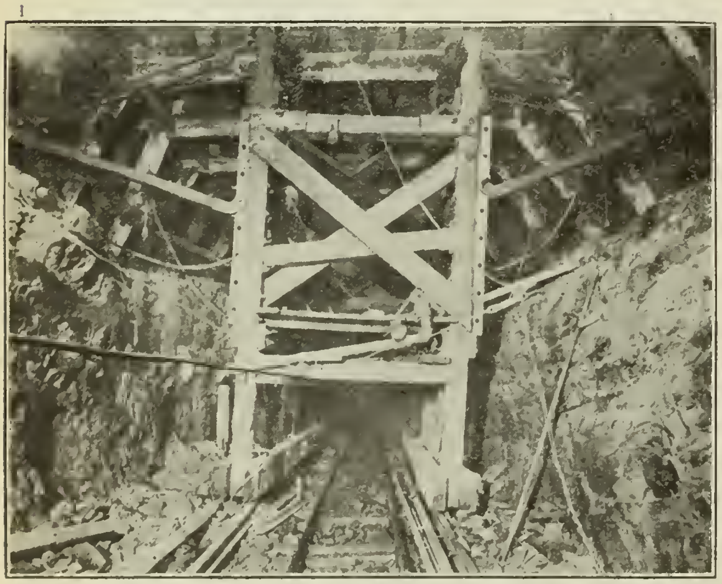


Fig. 13. Bench Drill Carriage.

Trimming

The final process in the tunnel excavation was the trimming. It is invariably found more desirable to have a special gang carry out this operation rather than hold up the breakup and bench gangs in order to make them clean out to the next excavation line. In this particular case, also, the tunnel section was not finally decided upon until after the completion of the breakup excavation, and a certain amount of additional trimming was necessitated by the final design. The greater part of the trimming, however, was required at the bottom corners of the tunnel where the drill steels from the benches had not been able to reach.

Fig. 14. Marion Shovel excavating Benches.

In order to facilitate the trimming work a carriage as shown in Figure 15 was built. It was made twenty feet in length and similar in design to the bench drill carriage. Quarry bars (as shown in Figure 15) were carried by outriggers near the bottom of the carriage so that heavy drills could be used for the corners referred to above. Hand drills were used for the sides and top, the drill-runners standing on platforms built up at suitable places on the carriage. A unique feature of the trimming work was the use of the "travelling jumbo" shown in Figure 16, which fulfilled the object of catching the blasted rock, thus keeping the track clear. The rock was dumped into cars through trap-doors in the centre.

Summary of Tunnel Excavation

The following table gives the quantities of rock excavated in the manner described above in that portion of the tunnel, comprising a length of 14,645 feet or 2¾ miles, situated between the arch block section and Portal Heights station.

	Cubic Yards	Yards per Foot	Percentage
Bottom Heading	60,667	4.1	15.3
Breakups	174,688	11.9	44.8
Benches	127,200	8.7	32.6
Trimming	19,561	1.3	5.0
Open Cut	7,150	....	2.3
Total	390,266	26.6	100.0

Disposal of Excavated Material

The muck brought out at the Dorchester Street shaft consisted of all the heading excavation between the city and the meeting point, and all the breakup excavation in this section which was made previous to the meeting of the headings in December, 1913. This excavated material was all deposited in the lower end of the station site, between Dorchester and Lagauchetiere Streets, being handled by means of side-dump cars hauled by an hoisting engine on the dump. The rock was eventually sold to a contractor who erected a crusher plant adjacent to the dump and disposed of the material as crushed rock.

Previous to the meeting of the headings between the West Portal and the Maplewood shaft, the muck was hoisted up the shaft, loaded into wagons and deposited as filling in a number of low-lying lots along Maplewood Avenue.

By far the greater part of the excavated rock was hauled to the crusher plant at the West Portal where it was disposed of in various ways.

Fig. 15. Trimming Carriage.

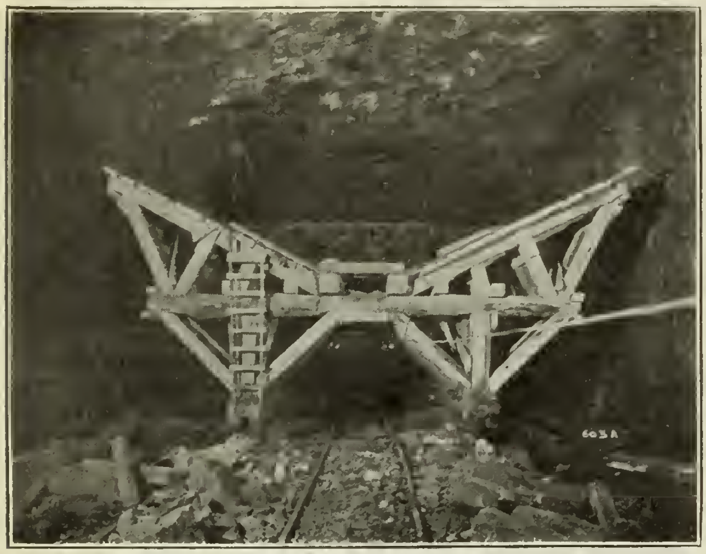


Fig. 16. Travelling "Jumbo" for Roof Trimming.

Open Cut Excavations

Excluding the open cut through the Model City west of the West Portal the first open cut excavation to be made was at the Portal Heights station site and for a short section of the tunnel in which the cut and cover system was adopted, immediately east of the station. This open cut was made by the No. 41 Marion shovel, and a total of 12,078 cubic yards of rock and 39,296 cubic yards of earth were removed. This work was commenced in March, 1914, and completed in October, 1914.

The largest open cut excavation, however, was made for the passenger terminal site, betwen Cathcart and Lagauchetiere Streets. This excavation was performed by contract, Norcross Brothers removing 20,173 cubic yards of earth from the site of the station building and Angus Sinclair 18,689 cubic yards of rock and 263,073 cubic yards of earth from the terminal yard site. Both contractors commenced their excavation in April, 1917, and Norcross Brothers completed theirs in July, 1917, and Angus Sinclair in September, 1918, although the last four months of this period were only occupied in trimming work.

The principal difficulty encountered in connection with this excavation work was the maintaining of Dorchester Street and the five feet circular brick sewer below the street. A trench was first dug along the street and the brick sewer replaced by two 48 inch cast iron pipes, side by side, connected to the sewer by concrete chambers clear of the proposed excavation. At the same time shafts were sunk down to the level of subgrade in which the steel columns for the viaduct were erected, Only one half of the street width was opened up at one time so that the remaining half was always open for traffic, with the exception of street cars which were diverted to St. Catherine Street. The main body of the excavation was commenced with a No. 20 Marion shovel ⅝ yard bucket. The earth was loaded into side dump-cars which were hauled to the Cathcart Street shaft by small steam locomotives. The material was dumped down the shaft to standard railway cars spotted below, baffles being inserted to break the fall of the muck, the drop being over forty feet. As the excavation proceeded a No. 60 shovel with a 1½ yard bucket was introduced into the cut, and as the depth increased it became possible to run a track direct from the tunnel into the cut.

The terminal site was only excavated to a sufficient width for a maximum of five tracks with three platforms, and in order to keep the top width within certain limits one to one slopes were made, while retaining walls of varying heights were built where necessary on each side. The banks were carefully graded and then covered with rip-rap 18 inches thick placed by hand. If found necessary the slopes may be given a coating of concrete in order to prevent scouring. Open tile drains are laid throughout the station site, all being connected, together with the drain from the tunnel to the city sewers.

ROOF SHIELD CONSTRUCTION

As already stated that portion of the tunnel between the terminal station site and a point below McGill College Campus, comprising a length of 1650 feet, had to be constructed with the roof above the rock surface, and it was, therefore essential that a form of construction should be adopted which would at no time leave unsupported the earth above the tunnel. After considerable study had been given to alternative methods of dealing with this condition it was decided to use a roof shield together with O'Rourke patented interlocking concrete lining blocks.

The tunnel cross section for this type of construction has been illustrated in Figure 5 C. It will be noted that the Section is of the twin arch form, the centre wall consisting of 65 pound, 10¼ inch Bethlehem H columns, spaced 2 feet 3 inches centre to centre, embedded in a continuous concrete wall. The columns were spanned by built-up steel lintels, which, in turn, carried the centre block of the twin arches. The concrete blocks were 2 feet thick radially and 2 feet 8 inches long in the direction of the tunnel. The oval tenons 12 inches by 20 inches by 7 inches deep were cast on one side of each block, while corresponding depressions were cast on the opposite side to engage the tenons on the blocks in the adjacent ring of the arch. At the side of the tunnel the arch blocks rested on concrete walls built into the solid rock.

A special plant was installed between Dorchester and Cathcart Streets for the casting of the concrete blocks. The plant consisted of travelling cranes with hand hoists for handling the forms and blocks, and with an elevated runway for the concrete mixing plant, from which the concrete was fed to the forms by gravity. The forms themselves were built up of flanged cast iron sections mounted on a steel plate. The tenons were filled to overflowing and smoothed off to correct level when the concrete was commencing to set. A tapered steel mandrel through the centre of the form held a special 2-inch nut in such position that it was cast into the centre of the block and could be reached through the hole left by the mandrel. This nut was used for attaching the block to the erector on the shield. A general view of the block plant is shown in Figure 17.

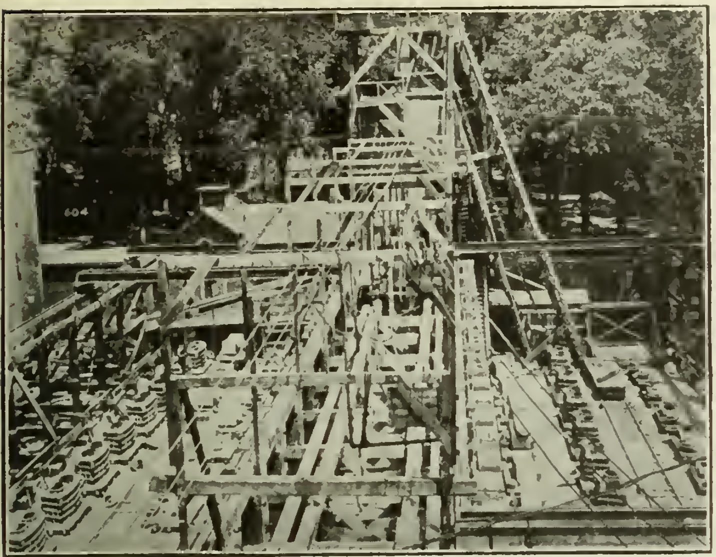


Fig. 17. Plant for casting Concrete Arch Blocks.

The roof shield, as shown in Figure 18, was built up of structural steel, the two semi-circular arches being made of 1⅛ inch steel plates stiffened by structural steel diaphragms and girders, which also contained the operating galleries. The cover plate was made of sufficient length to project forward of the girders to form a cutting edge, and to extend back over two or three of the arch rings last placed. Horizontal motion was obtained by means of seventeen 8½ inch hydraulic jacks placed around the circumference of the steel girders. The jacks pushed against the arch blocks, a maximum pressure of 6,000 pounds per square inch, or a total of over three hundred thousand pounds, being available to force the shield ahead. For the majority of the distance through which the shield travelled, the rock line although below the crown was above the bottom of the shield and it had to be drilled and blasted before the shield could be moved. Very small shots were used in order to avoid damage to the shield or to the blocks immediately behind, and also to reduce the disturbance to the buildings at the surface to a minimum, the depth of cover varying from thirty to sixty feet.

At the rear of the shield two mechanical erectors were provided for placing the arch blocks in position. Each erector was pivoted under the working gallery and by means of hydraulic rams, racks and pinions, was able to make four distinct motions, namely, rotation about the central pivot, longitudinal motion along the axis of the pivot, radial motion, and rotation on its own axis. By this means the erector could pick up a block from a car in the heading, revolve it, and swing it until it was opposite its position in the ring, then push it into line so that the tenons fitted into the depressions in the blocks already in place. The block would then be held in position by the circumferential hydraulic jacks until the complete arch was erected. After the erection of the blocks, the joints, the bolt holes and also the space over the blocks left by the skin of the shield were all closed up with a cement gun and grouting machine.

In order that the shield should have suitable runways, and also that the blocks should be placed on their permanent foundation the erection of the columns and the construction of the concrete side walls had to be carried on ahead of the shield. For the former, the bottom heading timbers had to be removed and the centre of the heading raised high enough to permit the erection of the columns and lintels. In the case of the side walls special "side wall headings" three or four feet in width and of sufficient height to accommodate the wall were excavated and the concrete poured into forms built in these small headings. The appearance of one side of this type of construction partly completed is shown in Figure 19.

The rate of progress of the shield work was somewhat hampered by the disturbed conditions due to the outbreak of the war. For a great part of the time, however, one ten-hour shift per day was operated during which, as a general rule, three rings were erected, but it actually took fourteen months to travel the whole distance, being an average of 118 feet per month, equivalent to about two rings per working day. At the west end progress was necessarily slow because the excavation was entirely in rock, and for a short distance thin structural steel ribs conforming to the shape of the twin arches were erected between each set of rings on account of the tunnel passing under private property on which it might later be desired to erect large buildings.

As previously stated, the roof of the tunnel in the arch block section came within thirty to sixty feet of the ground surface, the intervening material being clay and sand. Notwithstanding every possible precaution there was some disturbance at the surface and immediately over the shield the ground sank from six to ten inches.

Fig. 18. Rear View of Roof Shield erecting Arch Block.

The depression followed the shield as it advanced with the greatest regularity, and daily observations were made to follow possible surface changes.

At the intersection of McGill College Avenue and St. Catherine Street there existed a network of underground utilities, consisting of two 24 inch water mains on McGill College Avenue connecting with two 30-inch mains on St. Catherine Street, a 12 inch high pressure water main, various sewers, Bell Telephone and high voltage electric conduits, gas mains and so forth, and on the surface the double track of the Montreal Tramways Company with very heavy traffic. It would, of course, have been disastrous to practically all of these structures

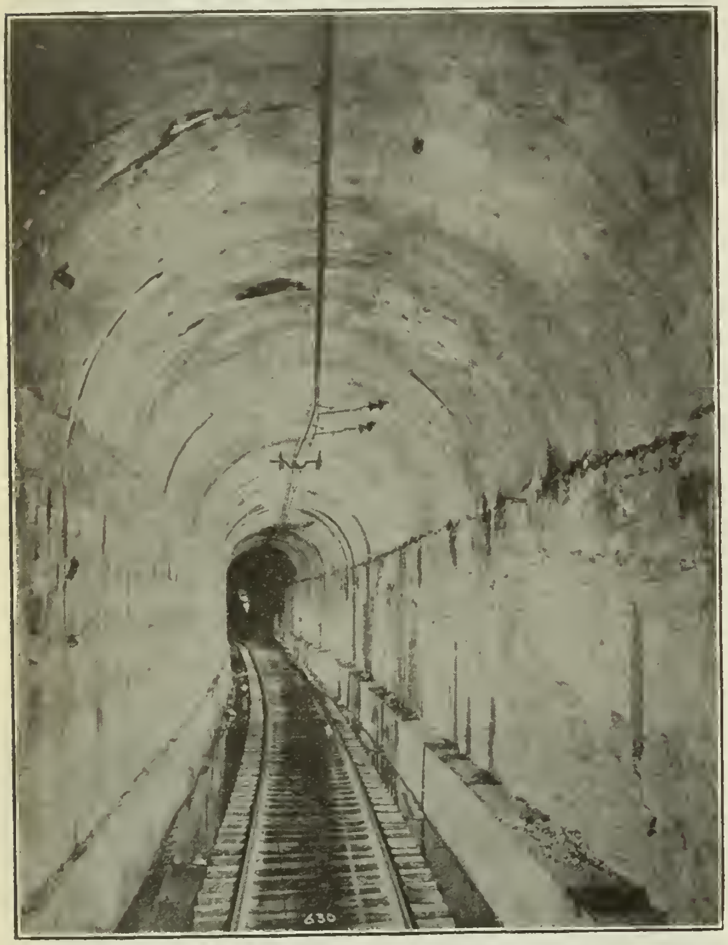


Fig. 19. Completed Arch Block Section.

to have allowed a depression of over six inches in a distance of less than thirty feet. An excavation was, therefore, made from the surface over the whole intersection, roadways being temporarily provided by planking carried on heavy timbers. All the structures were then supported on timbers, and numerous elevations taken of marked points and as the shield advanced, causing the shrinkage of the sub-soil, the timbers were jacked and blocked up to keep all the structures to their original elevation. In this manner the shield passed the complicated intersection causing practically no damage. The excavation was then filled in and the street surface restored with paving.

CONCRETE LINING

Between the west end of the arch block section and Portal Heights station, a total of 12,622 linear feet of concrete lining was placed, leaving 2,063 feet of unlined tunnel which, however, will in all probability eventually be lined to eliminate danger from scaling. Immediately east of Portal Heights station the cover was very small, and partly in earth. A double arch section as shown in Figure 5E was, therefore, built for a distance of 300 feet. Part of this section was built on the cut and cover principle, and the concrete was placed by chutes leading from a portable rotary mixer.

Immediately west of the arch block section the rock was in a very unstable condition and the concrete lining conforming to the single arch section, Figure 5D, had to be placed in very short stretches so that there should not be any very great length of roof unsupported either by timbers or concrete at any one time. There were 5,680 cubic yards, corresponding to 1,122 feet, of concrete placed under this condition. The main body of tunnel lining contained 58,360 cubic yards of concrete, and covered a distance of 12,322 feet, with an average quantity of 5.2 yards per linear foot. In placing the lining in the single arch section the depth of the side walls was made to suit local conditions regardless of obtaining a uniform appearance. For a great part of the distance they were finished off in hitches cut well into the sides a few feet below the springing line, but at other places they were extended down various distances to the level of subgrade.

Forms

The forms for the arch were built up of heavy timbers covered with planking and a steel skin plate, and were supported on carriages mounted on double flanged wheels running on a 13 feet gauge track, spanning the regular tunnel track, as shown in Figure 20. Each form was mounted rigidly on its own carriage at a height of about one and one half feet lower than the required elevation of the lining. After being placed in position the carriage and form were raised from the track by jacks and blocked up until the correct elevation was reached. They were built up in 5 feet lengths, the general practice being to use a form 30 feet long, but in the short bad rock section, lengths of 5, 10 and 15 feet were used. The side wall forms were hung from the same carriage, except in the short section where they were built up separately for each set up.

Mixing Plants

At the time the method to be used in placing the concrete lining was first discussed the pneumatic concrete placing machine was still comparatively in its infancy, but it seemed to have great possibilities for this class of work, and one machine was installed partly as an experiment before finally adopting this system on a large scale. It was found, however, to be capable of satisfactory development, and eventually two machines were used, one rated at half-yard, and the other at quarter-yard capacity. Unlike the more recent types of pneumatic mixers, these machines depended solely on the air pressure and shooting through the discharge pipe for the proper mixing of the concrete. As far as the mixer itself is concerned it is possible to handle two batches a minute, but in order to reach such a speed, very large quantities of raw materials have to be supplied to the mixer with considerable rapidity, and this constituted the principal problem to be dealt with in connection with this phase of

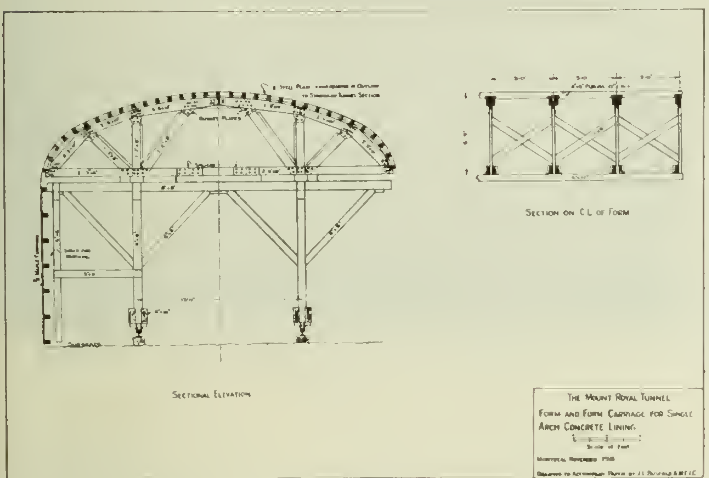


Fig. 20.

the work, and one made difficult on account of the restricted working space available.

The first plant that was put into operation was of a stationary type and was designed with the idea of shooting the concrete as far as possible in each direction, and then transporting the plant to a new location. In this plant sand and stone were hauled in the regular tunnel cars over an elevated track and dumped into pits, from which bucket elevators fed two storage bins, built as high and as large as the tunnel limits would allow. A batch hopper was placed below the bins and discharged by a single gate into the mixer, which in turn was placed as low as possible in the plant, with the discharge pipe or elbow practically resting on the subgrade. The half-yard capacity mixer was used and it was found impracticable to shoot more than one bag batch of 1: 2½: 4½ concrete with any degree of reliability. Two bag batches were attempted but they generally plugged the pipe. The 8-inch, mild steel discharge pipe was laid directly on the subgrade and connected to a vertical pipe at the form by two 45 degree steel elbows, 30 inches radius, with two similar elbows at the top, with a swivel connection to the nozzle. In placing the concrete, the side walls were first built up and then the arch filled in. The front end of the form was bulkheaded with the exception of an opening at the centre about twelve feet long through which the pipe was passed, and which was finally closed by means of sand bags.

The supply of sand and stone was obtained from the Tunnel Company's own crusher plant at the West Portal, special bins having been erected so that the tunnel cars could be loaded with the minimum of delay. Fines and screenings were used in the place of sand, and were found to answer the purpose fairly satisfactorily.

The second plant was built especially to meet the requirements in the bad rock section, where it would be impossible to run the mixer at anything like its full output capacity, owing to the short sections which it was possible to concrete at one time. The large storage bins were, therefore, not used, and the sand and stone was dumped directly into bins under a trestle over which the tunnel cars were run. The mixer which was of the quarter-yard capacity was loaded from the bins by means of a small shuttle car with two compartments, the dividing partition being moveable so that the aggregate could be mixed to a certain extent while discharging into the mixer. The operation of this plant was satisfactory but progress was slow, not on account of the design of the plant, but on account of the condition of the rock. The total distance of 1,122 feet with 5,680 cubic yards of concrete was covered in a period of six months. The plant, however, was found to be so satisfactory that the construction of another one, with a half-yard mixer and similar loading features was decided upon.

This plant, which made the third put into operation, was installed at a point about eight hundred feet east of the first plant, which had been travelling east from the West Portal. It was in continuous operation from October, 1915, until the end of April, 1916, during which time 18,000 cubic yards of concrete were placed with a maximum of 4,170 cubic yards, or nearly double the average, during the month of March. Five forms were used, and the force consisted of seven men on the plant itself, three men on the forms, with two carpenters spending part of their time repairing forms. The greatest distance from the mixer to the form did not, as a rule, exceed six hundred feet, but in concreting the section to which the plant was to be moved, a distance as great as twelve hundred feet was covered, nearly one minute being required for the passage of a batch of concrete through this length of pipe.

As the work progressed two difficulties were encountered with this type of machine. The first was the enormous quantity of air required to shoot the concrete through the longer distances, with the consequent drop in pressure, and plugging of the line. The second was the excessive amount of wear on the pipe, requiring continual renewals. The former of these difficulties would naturally tend to increase as the plant receded further from the compressor plant, and the latter would naturally not improve without a radical change in conditions.

Portable Mixing Plant

A fourth plant was, therefore, designed to overcome both these obstacles, and eventually proved to be the most satisfactory type of all those that were used. It was in operation continuously from May to December, 1916, when the lining work was completed, placing 37,265 cubic yards of concrete, an average of 4,658 cubic yards per month, with a maximum of 5,811 cubic yards during October. With the object of overcoming the difficulties referred to above, the fourth plant was made portable so that the mixer could be kept within one hundred feet of the form to be filled. The plant had to be designed to run on the 3 feet gauge tunnel track, and also to pass through the openings in the form carriages, which were only 12 feet high by 12 feet wide. The general principle of the design adopted is shown in Figure 21. The tunnel cars were run over longitudinal hoppers, 31 feet long, stone cars dumping through the bottom, and sand cars dumping sidewise. A batch hopper, located between the longitudinal hoppers and the mixer was fed by means of two belt conveyors passing under the former, one carrying sand and the other stone. The mixer, in turn, was loaded by means of a shuttle car passing under the batch hopper. Cement was unloaded and stored on small

Considerable experimenting was carried out to determine the best material for the elbows, as the amount of wear was so great that they had to be continually replaced. Eventually, the type that was found to be the most satisfactory was made in two halves, and the outer half was lined with removable cast-iron blocks, the result being that instead of having to dismantle the whole elbow, with this system only the outer half was removed and new lining blocks put into place.

Table 4, in the appendix, gives the quantities of

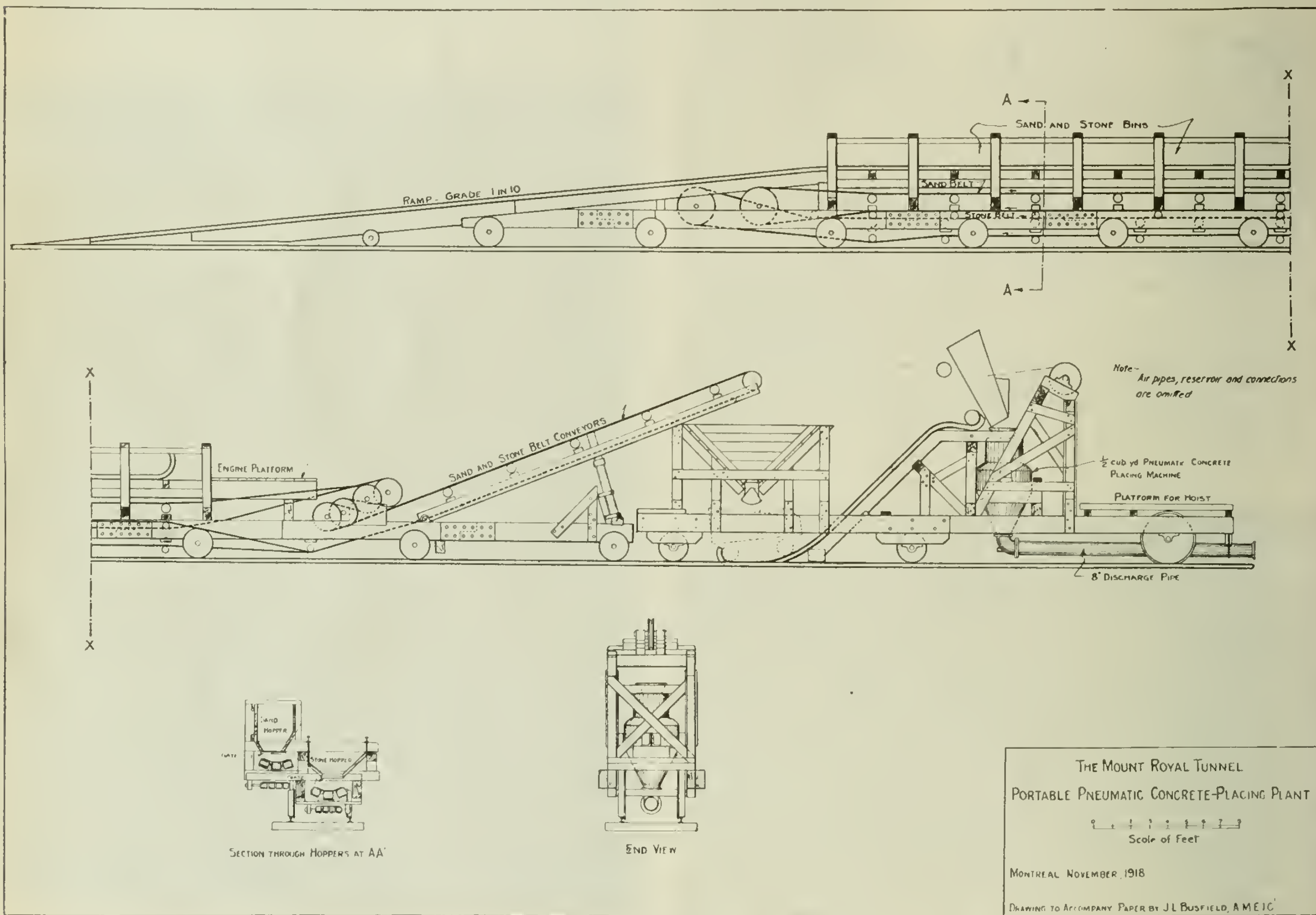


Fig. 21.

platforms and dumped into the shuttle car as required. The half-yard mixer was used and the discharge pipe was carried partly on the mixer car, and partly on special trucks built for the purpose. It was found necessary to have at least three 12 feet lengths of pipe between the mixer and the vertical elbow to obtain a proper mix. The force required for the operation of this portable plant consisted of a foreman, mixer operator, hoist runner, thirteen labourers, a pipe-fitter, and a handy man, in addition to those required for operating the trains. Two shifts worked each day, but carpenters only worked for one shift. Seven sets of forms were used.

concrete placed each month by each of the four different types of plant. A view of part of the finished concrete lining is shown in Figure 22.

UNDERGROUND TRANSPORTATION

The efficiency of the underground transportation system was of the greatest importance, as a breakdown of any branch of the system could cause serious disorganization of the excavation work. The importance of efficient service can be readily understood when it is borne in mind that over 422,000 cubic yards of solid rock, equivalent

Fig. 22. Concrete Lining in Place.

to considerably over 700,000 cubic yards of broken rock, were handled by the narrow gauge tunnel cars, and also all the material for over 64,000 cubic yards of concrete. In fact, during the Marion shovel excavation of the benches over a thousand cars of muck per day would frequently be hauled out of the tunnel.

Tracks were built to a three feet gauge throughout, using 45 pound rails, which, however, had to be replaced by 60 pound rails for the passage of the portable concrete mixing plant, the former rails being too light to carry the load. Stub, split and movable centre rail switches were used, and sidetracks were installed wherever necessary, their locations being changed from time to time to suit the varying conditions, it always being arranged that loading could take place on sidetracks so as to leave the main line clear for through haulage.

Fig. 23. Eight ton Construction Locomotive.

The motive power passed through various stages from horses to ten ton electric trolley locomotives. The former were used for a short period only during the commencement of the heading excavation west of the Dorchester Street shaft. A type of gasoline locomotive was tried, and as far as haulage was concerned it was satisfactory, but the exhaust gases vitiated the atmosphere to such an extent that notwithstanding the use of blowers the gangs were entirely incapacitated. The gasoline engines were removed from the frames of these locomotives and electric motors substituted, converting them into five ton electric locomotives. The electric current was obtained from

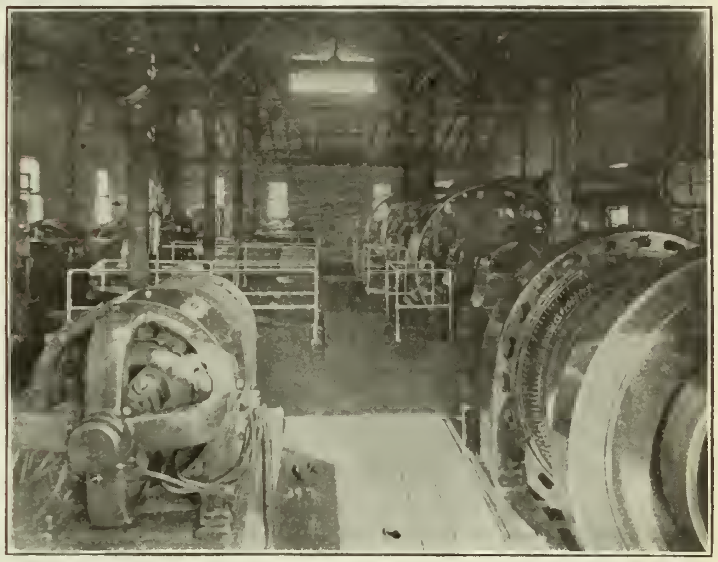


Fig. 24. Compressor Plant at West Portal.

storage batteries carried on a truck separate from the locomotive. Two sets of batteries were provided for each locomotive so that one set could be kept on the surface charging while the other was in use. There were two of this type used, both being made in the shops at the West Portal. In figure 23 is shown an 8-ton trolley locomotive also built at the Company's own shops, and equipped with two 20 horse power, 110 volt motors in series. As the transportation requirements became heavier 10-ton General Electric locomotives of the mining type were installed. The trolley locomotives obtained current from a trolley wire fed by a generator at 275 volts and fastened to the roof of the heading and to the breakup jumbo timbers. A certain amount of inconvenience was caused the workers by the trolley wire being so low, but there were no serious accidents from this cause.

The muck cars had to be something more than merely a means of carrying the muck. They were designed with a great deal of attention to the obtaining of a car which

Fig. 26. Panoramic View of West Portal from Crusher Plant.

should be reasonably low to facilitate loading by hand, and yet have as large a capacity as possible; which should be strong and able to withstand extremely hard usage, and also which should have a low frictional resistance. The car eventually designed had an overall height of 3 feet 4 inches, and inside dimensions of 3 feet 2 inches wide, by 20 inches deep and 6 feet 6 inches long. It was carried on 18 inch wheels with a spring on the axles and had a capacity of two tons. It was of the end dumping type lined with steel plate on the bottom and also at the dumping end. Between two and three hundred of these cars were built in the shops at the West Portal. They were dumped by automatic cages at the two shafts, and by a tipple at the crusher plant at the West Portal. At the latter point the cars were hauled up an inclined track by a hoisting engine.

For handling the material for the concrete mixer a number of the same cars were converted into bottom dump cars for the stone, and side dump for the sand.

PLANT

A very comprehensive plant and mechanical equipment was provided for the proper carrying on of the construction work. The principal features consisted of two compressor plants, shaft and other hoisting gear, general workshops, and a stone crushing plant.

Compressor Plants

Large quantities of compressed air had to be supplied at all times for the operation of the drills, of the Marion shovel, of the pneumatic concrete mixer, and of numerous

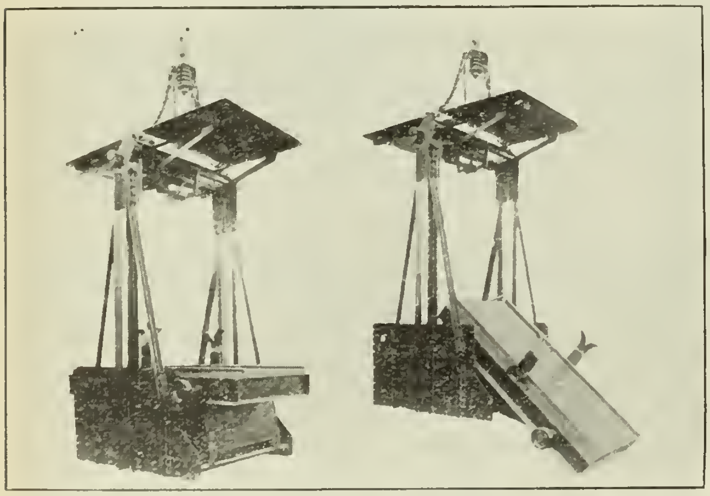


Fig. 25. Automatic Self-Dumping Cage.

Fig. 27. Rock-Crushing Plant at West Portal.

tools in the workshops. Two plants were originally built, one immediately north of Dorchester Street, the other at the West Portal. Each plant as originally installed had a capacity of 5,100 cubic feet of free air per minute, delivered at a pressure of 100 pounds per square inch. A Canadian General Electric 400 horse power synchronous motor was direct-connected to a Sullivan two-Stage compressor with a capacity of 1800 cubic feet per minute, while three Blaisdell cross compound compressors each with a capacity of 1100 cubic feet per minute were driven by 225 horse power, three-phase motors. All machines were fitted with unloading valves automatically cutting off the supply of air to the compressor when the pressure in the receiver reached a predetermined amount, thus compensating for the fluctuation in the quantity of air being used at any one time. It is of interest to note that these machines were frequently run continuously day and night for many days on end. A general view of a compressor plant is shown in Figure 24.

The air was delivered to the tunnel through 10-inch cast iron pipes which were passed down the Dorchester and Maplewood shafts and into the tunnel at the West Portal. Between the plant at the latter point and the Maplewood shaft a surface pipe was laid, following the company's private road, and passing under public streets. As the demand for air increased at the west end of the tunnel some of the machines were transferred from the city to the West Portal plant.

Shaft Gear

At both the shafts heavy timber headhouses were built suitable for the operation of automatic self-dumping cages. They provided not only for the running of cars off or on the cage at the ground level, but they were high enough to allow the cars to be hoisted up and automatically dumped into hoppers connected with the headhouse. The Lidgerwood hoists were operated by 50 horse power electric motors, with special braking attachments, the cages also being provided with self acting safety grips. A view of the cage in the hoisting and dumping positions is shown in Figure 25.

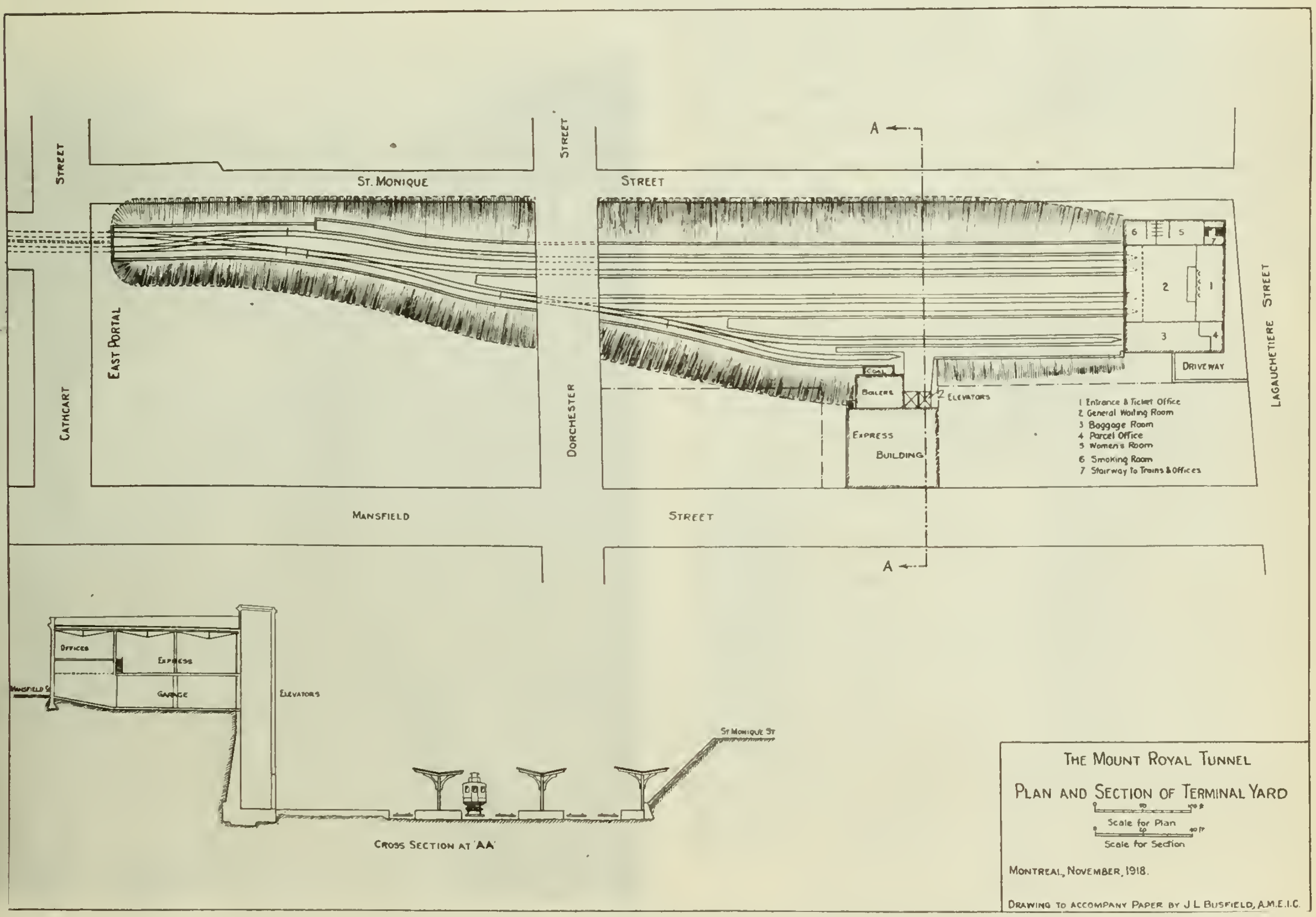


Fig. 28.

Fig. 29. "Tunnel Terminal" from Dorchester Street.

Workshops

At the city end of the tunnel a comparatively small plant was maintained, the principal feature being a blacksmith shop equipped with a Ward drill sharpener (a special machine of the steam hammer type), besides the usual hand equipment. A small machine shop equipped with lathe, drill, power hack saw and hand tools was able to undertake light repairs to machinery and equipment. A carpenters' shop equipped with a band and a circular saw handled lagging timbers, wedges, and other wood work used at the east end of the tunnel. A garage for the company's automobiles and trucks was also maintained near the Dorchester Street Office.

In order to make the company independent of local machine shops for repair work and also because it was found cheaper to build the tunnel cars rather than to buy them, a quite elaborate plant was installed at the West Portal, a general view of the buildings being shown in Figure 26. In the central background the roofs of the boarding houses for the men, and of the emergency hospital are seen, while immediately to the left of the open cut are the store and office building, machine shop, carpenters' shops, blacksmith shop, compressor house (white), and the dry house in the left foreground. The machine shop was provided with a complete equipment consisting of a 60-inch and 24-inch lathe; two 30-inch radial drills; combined shear and punch for plate work; two power drill presses; a power hack saw; pipe and bolt machine; a shaper; emery wheels, grindstones, and oxy-acetylene apparatus. The blacksmith shop was equipeed with a Ward drill sharpener, and a steam hammer operated with compressed air. The carpenters' shop had circular and band saws. In addition to the power tools a complete outfit of hand and small tools was provided for each shop. In fact the capacity of the whole plant is well illustrated by the construction of the muck-handling drill carriage.

At the Maplewood shaft a third blacksmith shop was located, equipped with a Ward drill sharpener.

Crusher Plant

A stone crushing plant was installed at the West Portal with a capacity of about 1,600 tons per day. The loaded tunnel cars were hoisted up inclines by a " dumby " to automatic tipples from which the rock was passed through two No. 7 Kennedy gyratory crushers. The broken stone was then elevated by Stevens-Adamson bucket elevators, passed through revolving and oscillating screens and was distributed by chutes into various bins. The greater portion, however, was conveyed to large stock piles by belt conveyors, different sizes of stone being kept in separate piles. After the tunnel cars had been dumped at the tipple they were automatically returned to the down track by a gravity switchback. A general view of the plant with the inclined track and stock piles is shown in Figure 27.

With the exception of what was required for the company's own purposes for concrete and ballast the crushed stone was sold to outside parties. From the bins it could be loaded direct into cars on tracks connected with the Canadian Pacific Railway, and from the stock piles a locomotive crane with clam shell bucket loaded either railway cars or motor trucks.

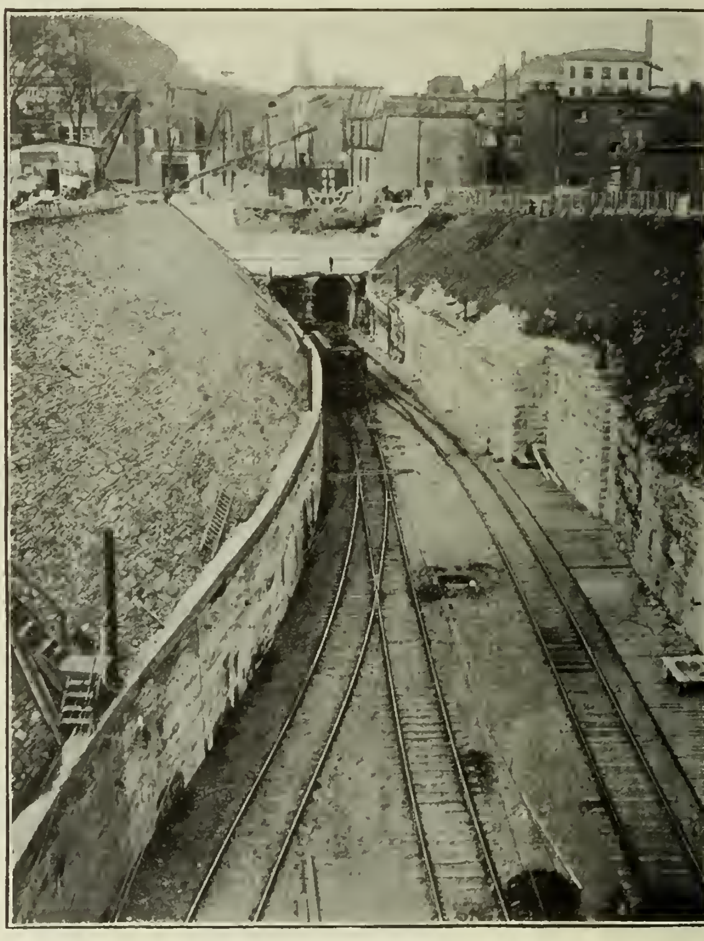


Fig. 30. East Portal of Tunnel from Dorchester Street.

MISCELLANEOUS STRUCTURES

Terminal Station and Yard

The facilities now provided at the " Tunnel Terminal" are only of a temporary nature and, therefore, will only be described briefly. A rear view of the station building is shown in Figure 29, while the general layout of the whole yard and buildings is shown in figure 28. The station itself is a reinforced concrete structure in which octagonal reinforcing bars were used and in addition to the public facilities indicated in Figure 28 contains offices on the second floor for the railway company's officials. The entrance of the building is located on Lagauchetiere Street. The east portal of the tunnel and the west end of the terminal yard is shown in Figure 30.

In the centre of the layout on the Mansfield Street side a building for the Canadian Northern Express has been built. This building is of brick construction on concrete foundations, with a cement finish to match the station. The basement is used as a garage for the company's trucks. Two elevators handle the express matter between track and street levels. A retaining wall of unique design has been built at the express building, detail plans of which are shown in Figures 31, 32 and 33. The wall was designed by Mr. J. C. Krumm in the office of Mr. C. C. Briggs, Superviser of Buildings, Canadian Northern Railway, and the writer is indebted to Mr. Briggs for the following information explaining the assumptions upon which the design was based.

> " These walls were primarily built as retaining walls, except walls C and E, which two walls also serve as foundations for the east wall of the express building and south wall of the elevator shaft respectively. Top of walls A and D are stopped to serve as foundations for brick walls for extensions which are being contemplated. Although for this height of wall counterfort types under ordinary conditions would be the cheapest local conditions such as expensive properties bordering on the work, etc., made it necessary to select the cantilever type with a reversed base. All walls are designed for stability against overturning without the extra load from the buildings, which load in every case tends to decrease

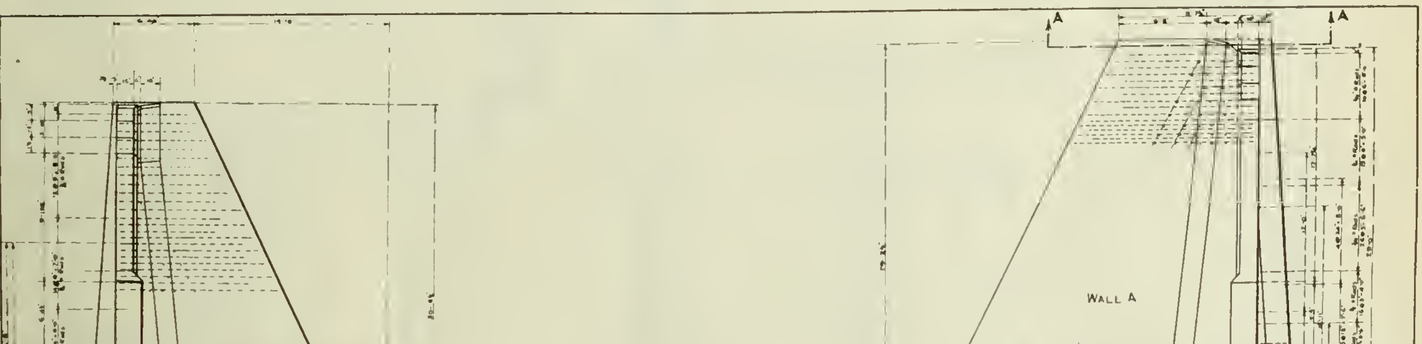


Fig. 31.

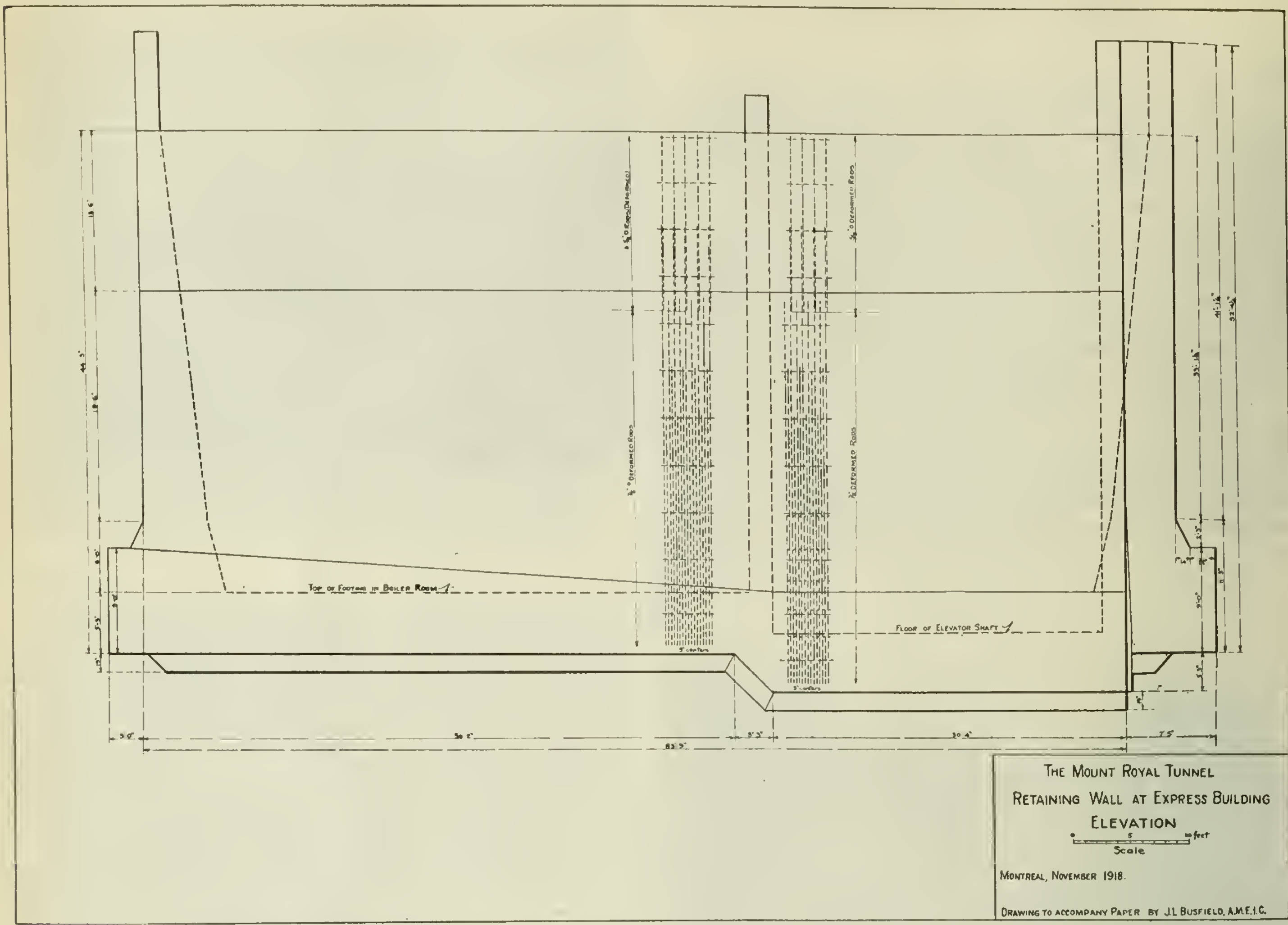


Fig. 32.

the toe pressures, and the reinforcement arranged to take care of cantilever action.

A surcharge of 200 pounds per square foot from the floor of the garage in the express building was assumed for wall C. Wall E makes an exception to this, however, and it is designed as a flat slab supported by wall C and the east wall of the elevator shaft.

While the ground is very hard and stands up nearly vertically, we assumed an angle of repose of 30 degrees, partly to guard against any slip caused by possible seams or pockets, and also any partial hydraulic pressure behind the wall, although in the design great care has been taken to provide sufficient drainage to eliminate this last mentioned danger.

The foundation is hard pan."

The walls contain a total of 2,256 cubic yards of concrete, and 143,330 pounds of reinforcing steel.

Dorchester Street Viaduct

Dorchester Street is carried over the open cut on a viaduct 163 feet long 60 feet wide. The details of the construction are shown in Figure 34. The floor system consists of monolithic concrete spanning I-beams carried, in turn, by plate girders resting on a steel tower in the centre, and two steel bents, and two timber bents. Provision had to be made on the north side for the two cast iron sewer pipes. The columns were founded on bed rock in every case.

Undercrossing of Canadian Pacific Railway

The details of the undercrossing of the Canadian Pacific Railway at the West Portal of the tunnel are shown in Figure 35. It will be noted that this bridge is of reinforced concrete and not only spans the Canadian Northern tracks but also the platforms of the Portal Heights station. The latter are shown at the car floor level which will be the standard height for platforms throughout the electric zone where multiple-unit cars will be operated. The roof of the crossing is built up of pre-cast reinforced concrete slabs which were put in place by means of a travelling locomotive crane. This method enabled the construction to be carried on with the minimum interference to the Canadian Pacific tracks.

ELECTRICAL EQUIPMENT

Substation

One of the essentials of a power supply for an electric railway is that it should be as free from the danger of a shut-down as is physically possible. With this object in view power is supplied to the Canadian Northern substation at the West Portal by the Montreal Light, Heat & Power Company over two distinct feeder systems. The first consists of feeder cables through the tunnel itself and connected to the Power Company's central station which, in turn, is fed by hydro-electric plants at Cedars Rapids, Soulanges, Lachine, Chambly, Shawinigan Falls and from a steam auxiliary station. The second system consists of an overhead line from a transformer station on Mentana Street, about two miles away. A shut-down due to lack of power, therefore, should be a most unusual occurrence.

Considerable study was made of alternative schemes of electrification, not only from the viewpoint of initial cost but also from the viewpoint of operating cost; in addition, local factors and the nature of the power supply available had to be taken into consideration. It was eventually decided to use a 2400-volt, direct current trolley system. Power is supplied by the Montreal Light, Heat & Power Company through the feeders referred to above at 11,000 volts, 3 phase, 60 cycles and is transformed to 2400-volt, direct current at the West Portal substation.

The building itself is 88 feet long by 70 feet wide, and, in addition to the main transformer room, has separate rooms for switches, lightning arresters and auxiliary apparatus. Two 1500 kilowatt synchronous motor-generator sets have been installed, and the foundation for a third set has been provided. Under present conditions one set is capable of handling the load while the second is used as a standby. A 2500-ton travelling crane spans the transformer room. Each motor generator is driven by an 11,000-volt synchronous motor direct connected to 750 kilowatt, compound wound, commutating pole, compensating generators operated at a speed of 600 revolutions per minute. The two generators in each set are permanently connected together in series in order to

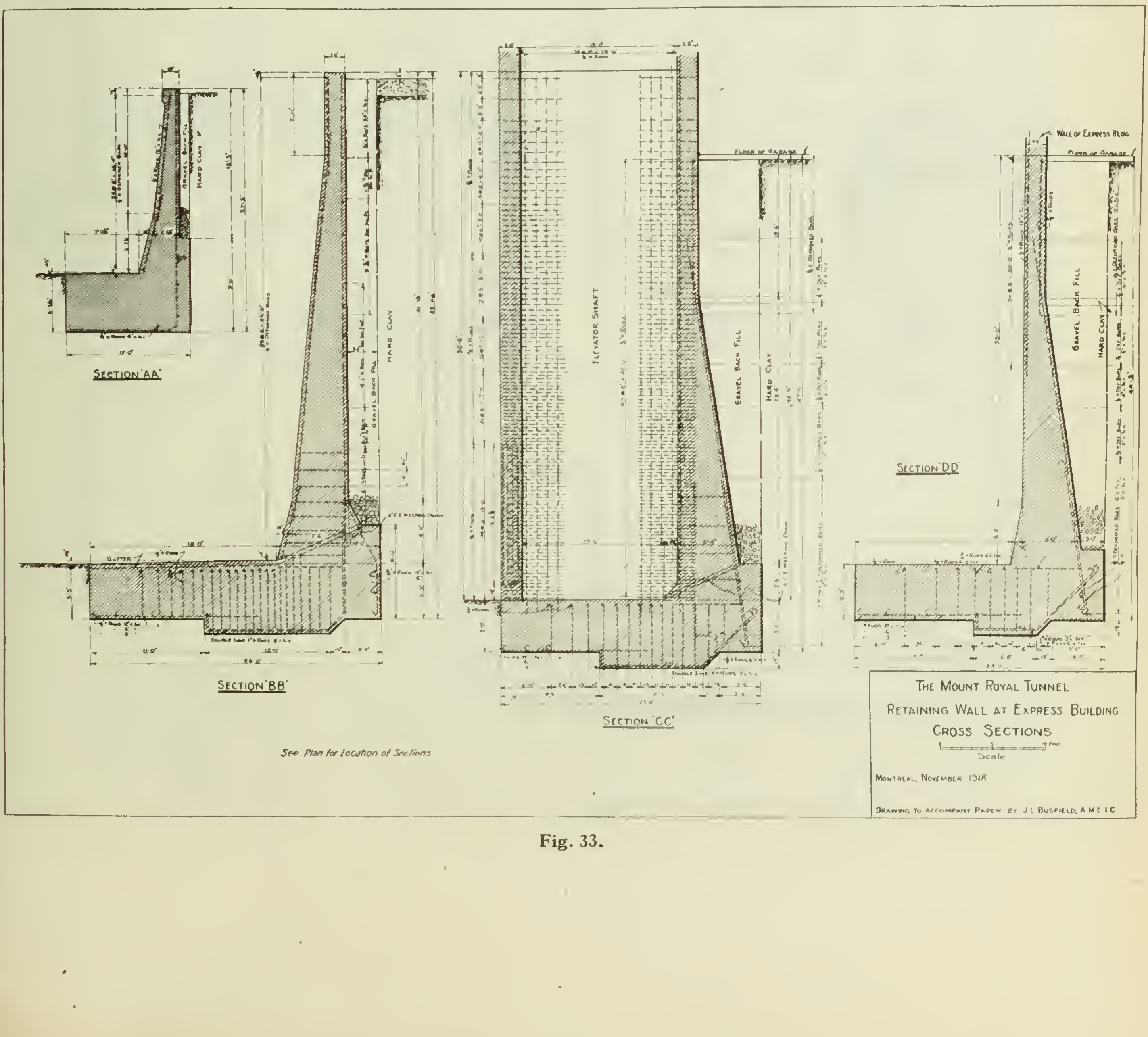


Fig. 33.

give a total of 2400 volts and are designed to withstand an overload of 200 per cent for five minutes.

Three motor-generator exciter sets have been installed, each consisting of an 125-volt generator of the commutating pole type driven by a 550-volt induction motor at 1200 revolutions per minute. One exciter furnishes current to the four generators, the second to the fields of the motors, while the third is retained as a spare. Two banks of three 100-kilowatt transformers step down the current from 11,000 to 550 volts the latter being used for the induction motors of the exciting sets, while other small transformers step down from 550 to 110 volts for the lighting circuits.

A 32-panel switchboard built of black slate is provided for the control of the various power circuits.

A general view of the exterior of the substation is shown in Figure 36, and of the interior in Figure. 37. In this latter view the switchboard can be seen on the left, the motor generators in the centre and the foundation for the third set in the lower right-hand corner.

Locomotives

Six locomotives of the type illustrated in Figure 38 have been put into service. Each locomotive was built by the General Electric Company and is equipped with four commutating pole motors permanently connected in series in pairs. The one hour rating of each motor is 350-horse power at 1200 volts, forced ventilation being provided by a blower. A small motor generator set provides current at 120 volts for lighting circuits and for operating the contactors. This set also drives the blower and through slip rings supplies alternating current for the headlight circuit. A 2400 volt motor-driven air

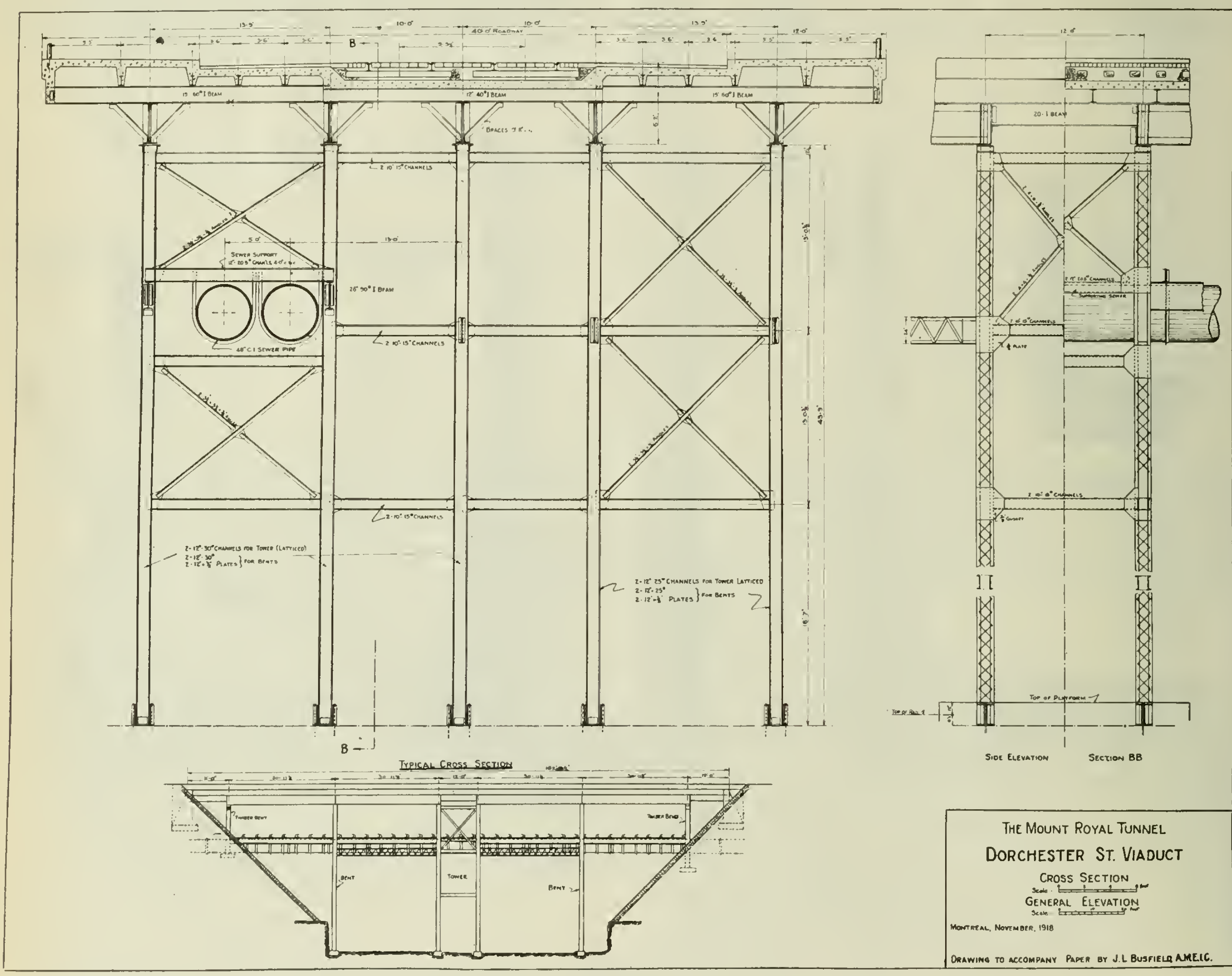


Fig. 34.

compressor with a capacity of 100 cubic feet of free air per minute is used for the air-brake equipment.

The cab is divided into three compartments, the two end compartments being identical in every way and supplied with all the controlling apparatus, including controller and switches, various meters, pantograph control, bell, whistle, and so forth, giving complete double end control. A view of the motorman's seat and the arrangement of the control apparatus is shown in Figure 39. Current is collected from the trolley line by means of a sliding pantograph, pneumatically operated and mounted on an insulated base, two being provided on each locomotive. The principal dimensions of these locomotives are given in Table 5 in the Appendix.

Overhead Construction

The catenary type of trolley construction is used throughout. In the tunnel a messenger cable which also acts as a feeder and is, therefore, made of phosphor-bronze, is supported by iron yokes located 90 feet apart, hung by special bolts from the concrete roof, a near view of the support being shown in Figure 40. It will be noted that the yokes are arranged so as to permit lateral adjustment so as to bring the trolley to correct alignment, and also that they are provided with two insulators in series between the live wire and ground. Two 4/0 "phono-electric" trolley wires are suspended from the messenger cable by loop hangers spaced 15 feet apart and staggered on each trolley. Two trolley wires were used so as to provide additional weight and thus reduce the amount of vertical movement from the pantograph, the limits naturally being very confined in the tunnel. The two wires also have the advantage of reducing wear and sparking.

Through the Model City the same general type of construction is adopted with the difference that the messenger is a seven-strand ½ inch steel cable and is supported by cross spans and wooden poles instead of the special yokes employed in the tunnel. The poles are placed 150 feet apart and the general appearance of this form of construction can be seen in Figure 38.

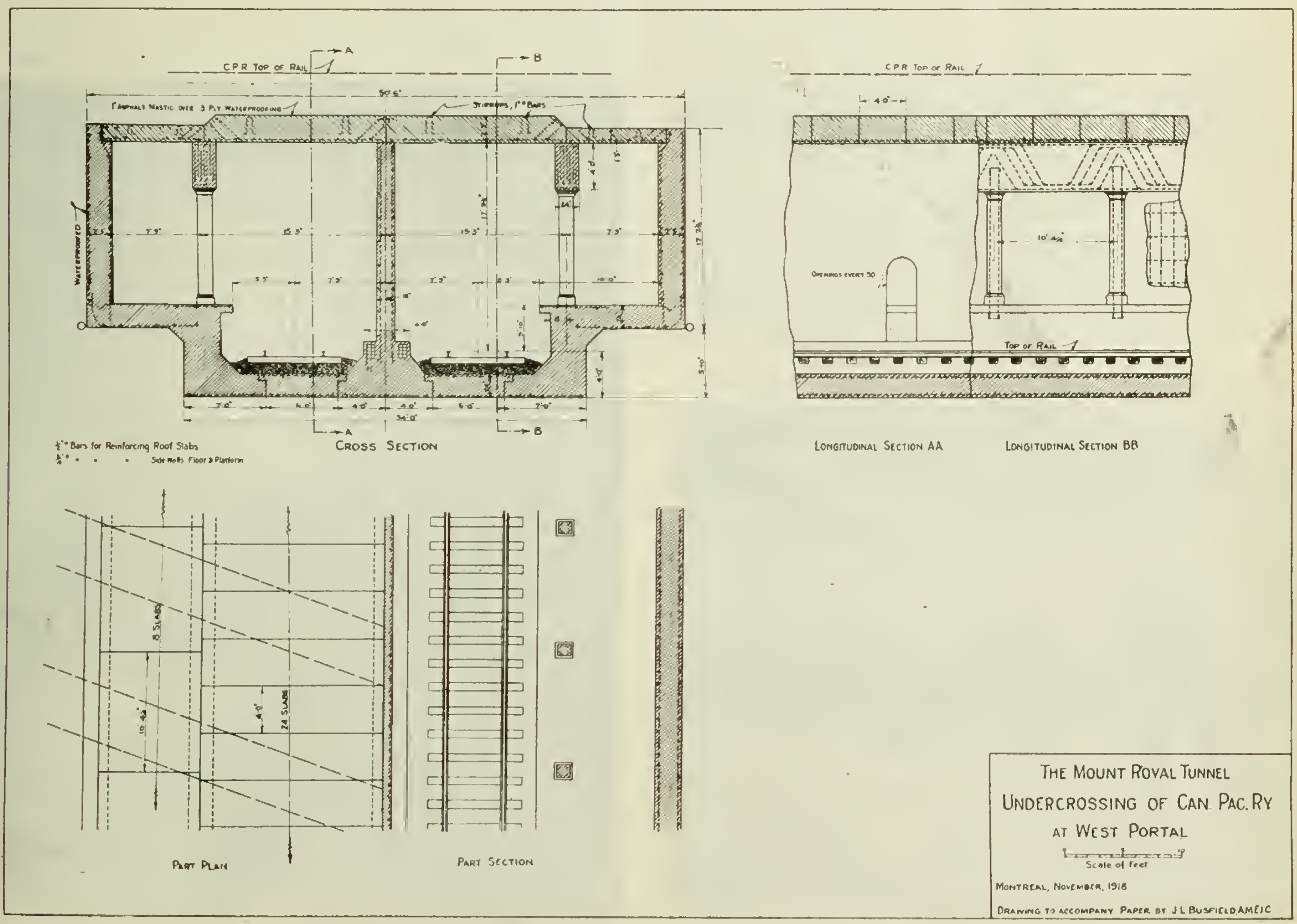


Fig. 35.

Fig. 36. Exterior of Transformer Station at West Portal.

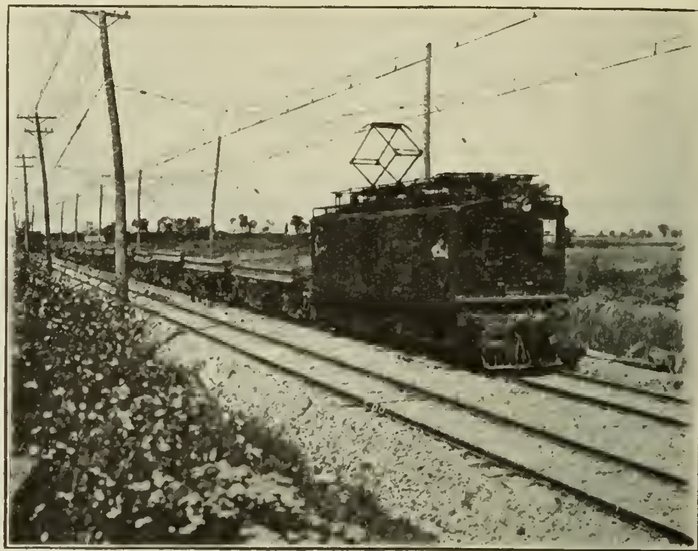


Fig. 38. Electric Locomotive and Overhead Construction.

CONCLUSION

Organization

The Mount Royal Tunnel was built by a special force under the control of Mackenzie, Mann and Company, Limited, for the Canadian Northern Montreal Tunnel and Terminal Company, Limited, the name of which, however, was changed to Mount Royal Tunnel and Terminal Company, Limited, of which, Sir William Mackenzie was President and Sir Donald Mann, Vice-President. The construction work of the tunnel was carried out entirely under the direction of Mr. S. P. Brown, B.Sc., M.E.I.C., as Managing Engineer for Mackenzie, Mann & Company, and Chief Engineer of the Mount Royal Tun-

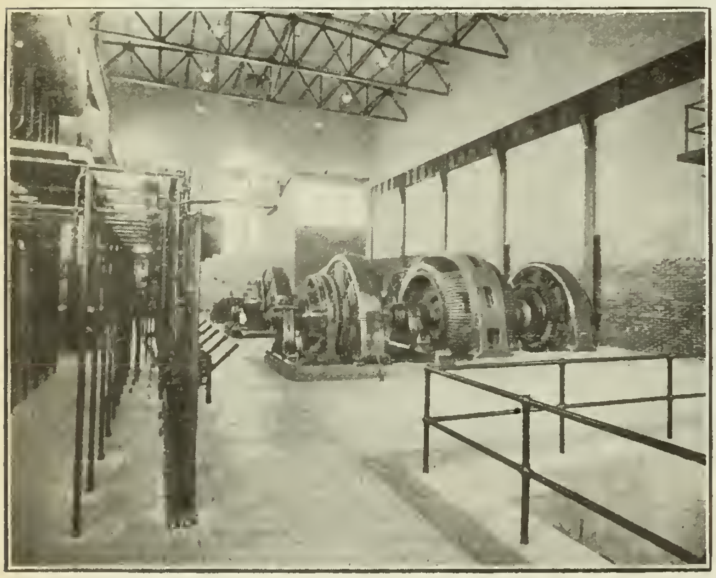


Fig. 37. Interior of Transformer Station at West Portal.

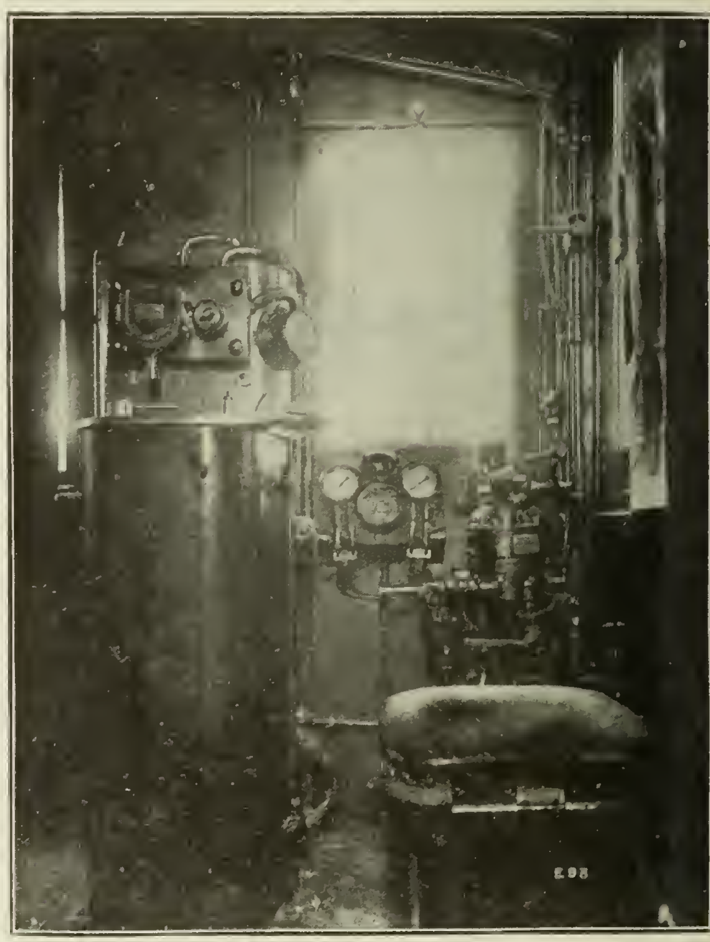


Fig. 39. Interior of Locomotive Cab.

Fig. 40. Catenary Trolley Suspension in Tunnel.

nel and Terminal Company. In the Department of Design, Mr. W. C. Lancaster, E.E., M.E., was in charge of all electrical and mechanical work, his office being taken over recently by Mr. C. P. Price, as Electrical Superintendent. The Structural Department was in charge of Mr. Holton D. Robinson, B.Sc., and more recently of Mr. W. E. Joyce, A.M.E.I.C., as Engineer of Design. The Department of Surveys and Alignment was in charge of Mr. Howell T. Fisher, M.E.I.C., his organization consisting of survey parties for the eastern and western divisions, and a staff of inspectors. Mr. J. C. K. Stuart, A.M.E.I.C., had charge of the Department of Construction, with Edward Duffy as General Superintendent on the Eastern Division and Richard Byers in a similar position on the Western Division. The Purchasing and Accounting Departments were in charge of Mr. C. C. Labree, Managing Accountant, with a staff of storekeepers, timekeepers, cashiers, and clerks. The inspection of buildings was under the direction of Mr. C. Gordon Mitchell, Inspecting Architect, while a medical department was operated under the supervision of Mackenzie and Mackenzie, Limited. Upon the resignation of Mr. S. P. Brown to take up important war work in the United States, the work was carried on with Mr. Angus Sinclair as General Manager, under the direction of Mr. A. F. Stewart, Chief Engineer of the Canadian Northern Railway.

Acknowledgments

The writer wishes to express his sincere appreciation of numerous courtesies extended to him in connection with the preparation of the foregoing description of the tunnel work, and particularly to Mr. A. F. Stewart and the Executive of the Canadian Northern Railway, under whose authority this paper has ben prepared. Mr. W. E. Joyce, Mr. C. P. Price and the whole of the tunnel staff have most willingly co-operated with the writer, giving every possible assistance. The writer's thanks are also due to Messrs. Walter J. Francis & Company, for giving him every facility for the preparation of the paper and accompanying drawings.

APPENDIX

Table I

SUMMARY OF QUANTITIES

Length of Tunnel—Cathcart Street to Portal Heights		16,315	feet
" " Arch Block Section		1,650	"
" " Double Track Concrete Arch		12,322	"
" " Twin Arch at West End		300	"
" " Unlined Portion		2,063	"
Excavation by heading	Rock	66,319	cu. yds.
" " breakups	Rock	177,890	"
" " benches	Rock	135,746	"
" " trimming and miscellaneous	Rock	42,403	"
" total in tunnel	Rock	422,358	"
" for station building	Earth	20,173	"
" " terminal yard	Rock	18,689	"
" " " "	Earth	263,073	"
" " Portal Station	Rock	4,928	"
" " " "	Earth	30,093	"
" miscellaneous	Rock	1,849	"
" " " "	Earth	12,920	"
Concrete lining, by pneumatic method		64,040	"
Concrete blocks (6,536)		5,355	"
Miscellaneous concrete		10,635	"
Steel columns and girders in arch block section		1,107,260	lbs.
" in side wall in arch block section		73,456	"
" arch ribs in arch block section		180,000	"
" splicing chambers and ducts		40,575	"

Table II

MONTHLY HEADING PROGRESS

WORKING	1—W		3—E		3—W		4—E	
MONTH	Adv'ce (feet)	Adv'ce per working day	Adv'ce (feet)	Adv'ce per working day	Adv'ce (feet)	Adv'ce per working day	Adv'ce (feet)	Adv'ce per working day
1912								
July	......	......	......	......	......	......	105	5.0
August	......	......	......	......	......	......	226	7.8
September	222	8.5	......	......	......	......	326	12.1
October	423	15.7	......	......	......	......	470	15.1
November	500	20.0	253	12.6	195	10.9	486	17.3
December	373	14.9	502	16.7	502	16.7	408	13.6
1913								
January	319	13.6	394	12.7	483	15.5	367	11.8
February	372	15.5	235	9.0	439	15.5	275	9.8
March	419	16.1	332	10.7	450	14.5	384	12.8
April	500	19.2	352	11.7	76	15.2	71	14.2
May	728	26.0	509	18.1	......	......	......	......
June	509	21.2	430	16.5	......	......	......	......
July	469	18.0	463	17.8	......	......	......	......
August	379	14.6	489	18.8	......	......	......	......
September	350	14.0	491	19.6	......	......	......	......
October	427	15.8	500	18.5	......	......	......	......
November	444	17.7	479	19.1	......	......	......	......
December	160	17.7	137	15.2	......	......	......	......

TABLE III

GENERAL PROGRESS STATEMENT

MONTH	EXCAVATION IN CUBIC YARDS					Cubic yards concrete lining
	Heading	Breakups	Bench	Total of all sources		
				Rock	Earth	
1912						
July	415	....	....	415	....	....
August	884	....	....	884	....	....
September	2,132	....	....	2,132	....	....
October	3,512	....	....	3,512	....	....
November	5,676	....	....	5,676	....	....
December	7,070	....	....	7,070	....	....
1913						
January	6,182	....	....	6,182	....	....
February	5,244	....	....	5,244	....	....
March	6,307	....	....	6,307	....	....
April	3,986	....	....	3,986	....	....
May	4,331	7,086	....	11,417	....	....
June	3,283	5,998	....	9,281	....	....
July	3,263	10,657	....	14,920	....	....
August	3,279	11,969	....	15,248	....	....
September	3,284	12,157	224	15,665	....	....
October	3,431	13,954	862	18,247	....	....
November	3,450	12,967	495	16,912	....	....
December	600	12,413	0	13,013	....	....
1914						
January	....	14,675	0	14,675	....	....
February	....	11,979	0	11,979	....	....
March	....	13,922	32	14,254	5,086	....
April	....	13,913	62	13,975	7,838	....
May	....	12,329	29	12,449	7,901	....
June	....	11,432	....	12,562	8,750	....
July	....	872	....	2,356	67	....
August	....	....	....	10,706	628	....
September	....	....	15,237	....	....	....
October	....	....	14,059	14,496	218	....
November	....	....	19,318	19,486	565	....
December	....	148	12,479	12,767	1,100	....
1915						
January	....	836	9,040	10,685	579	....
February	....	600	9,798	11,586	292	....
March	....	....	10,023	10,956	821	....
April	....	....	13,320	13,975	1,149	....
May	....	....	5,204	5,855	1,710	....
June	....	....	1,086	1,420	2,053	....
July	....	....	227	2,253	1,415	166
August	....	....	411	1,493	331	1,121
September	....	....	512	1,438	140	2,493
October	....	....	1,052	1,786	118	2,789
November	....	....	948	1,603	161	4,214
December	....	....	1,479	2,224	152	3,200
1916						
January	....	....	1,842	3,296	54	3,781
February	....	....	1,904	3,998	....	2,682
March	....	....	3,443	5,139	....	4,171
April	....	....	3,910	5,108	....	2,158
May	....	....	280	4,129	100	3,409
June	....	....	....	3,272	115	4,368
July	....	....	....	1,395	50	4,242

TABLE III—Continued

GENERAL PROGRESS STATEMENT

MONTH	EXCAVATION IN CUBIC YARDS					Cubic yards concrete lining
	Heading	Breakups	Bench	Total of all sources		
				Rock	Earth	
August	....	....	....	1,609	225	4,619
September	....	....	....	1,568	210	3,996
October	....	....	....	2,242	235	5,811
November	....	....	....	2,624	337	5,790
December	....	....	....	2,309	6	5,031

TABLE IV

QUANTITIES OF CONCRETE LINING PLACED PER MONTH

MONTH	First Plant		Second Plant		Third Plant		Fourth Plant	
	Lin. ft.	Cu. yds.	Lin. ft.	Cu. yds.	Lin. ft.	Cu. yds.	Lin. ft.	Cu. yds.
1915								
July	27	166	......	......	......	......	......	......
August	258	1,121	......	......	......	......	......	......
September	383	1,704	180	789	......	......	......	......
October	......	......	193	1,018	455	1,771	......	......
November	......	......	265	1,436	628	2,778	......	......
December	......	......	131	681	600	2,519	......	......
1916								
January	......	......	234	1,203	515	2,578	......	......
February	......	......	118	553	425	2,129	......	......
March	......	......	......	......	765	4,171	......	......
April	......	......	......	......	372	2,158	......	......
May	......	......	......	......	......	......	700	3,409
June	......	......	......	......	......	......	877	4,369
July	......	......	......	......	......	......	849	4,242
August	......	......	......	......	......	......	930	4,619
September	......	......	......	......	......	......	611	3,996
October	......	......	......	......	......	......	1,017	5,811
November	......	......	......	......	......	......	956	5,790
December	......	......	......	......	......	......	833	5,031

TABLE V

CHARACTERISTICS OF ELECTRIC LOCOMOTIVE

Total weight of locomotive	171,740 pounds
Weight per axle	42,935 "
Weight of spring borne parts	127,330 "
Weight of motors	37,020 "
Weight of all mechanical equipment	106,942 "
Tractive effort continuous	14,500 "
Tractive effort at one hour rating	20,300 "
Tractive effort at 30% co-efficient	51,000 "
Length inside knuckles	37 feet 4 inches
Length over cab	31 " 0 "
Overall height	15 " 6 "
Height over cab	12 " 10 "
Overall width	10 " 0 "
Rigid wheel base	8 " 8 "
Total wheel base	26 " 0 "

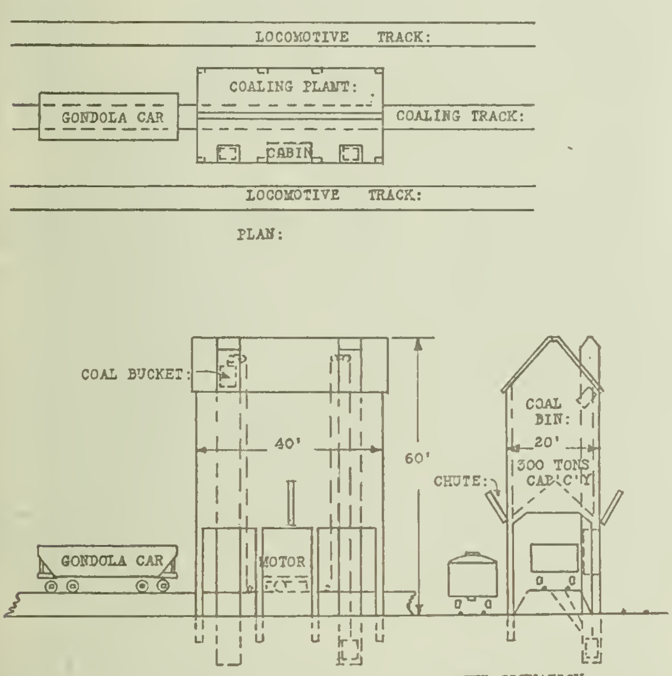
Locomotive Coaling Plants

*By J. A. Burnett, A.M.E.I.C.**

The subject of coal handling for locomotives is one of considerable importance and as improvements have been introduced within the last few years, it is thought that the subject may be of interest to the members of *The Engineering Institute of Canada*.

Formerly the ramp or gravity system was in use. This comprised a long ramp or incline of about 5% grade, then a series of bins or pockets. These bins were furnished with side chutes to allow the coal to be dumped into the locomotive tenders. However, the Holman type of coaling

LOCOMOTIVE COALING PLANTS:



plant was introduced, using the balanced bucket system and with a storage bin overhead. The advantages were many, among them being, saving in land area, less fire risk, and inasmuch as it frequently happened that a locomotive ran out over the end of the coal shed it was a safer arrangement. It was also found that only light weight engines were able to climb the ramp and these often had to be brought on from a distance, adding to the expense. It would be safe to say, therefore, that no more gravity coaling plants will be installed on our railways.

The balanced bucket type has been found easier to maintain than any hoist using the continuous bucket or conveyor system, and where electric power is available the electric driven hoist is preferred, and in most cases the cost for electric power does not come very high. The attached plate shows plan, and side elevations of the structure.

In general it is found that the hoisting is done during the day time and about three hours are needed to dump the gondola cars and hoist the coal to the bin overhead. The maximum load on the motor is about 10 to 12 H.P., the speed of hoisting being 70′ per minute. The buckets are designed to hoist 2000 lbs. per lift, but at times the weight runs to 3000 lbs.

The motor, if electric, is of the wound rotor type, and controlled by reversing drum controller, and solenoid brake. A powerful hand brake is also provided operated by a lever in the cabin and applying by a band to the end of the cable drum. This is seldom used, and is merely a precautionary measure. The cabin should be quite small, about 5′ x 9′ to save heating in winter time and should be well boarded in with well fitted door and windows. The roof of this cabin should be well waterproofed as water drips in quantity from the coal bin above.

The buckets are prevented from over-running by means of a limit switch installed at the top of each bucket shaft and are actuated by means of a steel ear rivetted to the bucket. The motor is at once cut off and the solenoid brake holds the mechanism at a stop, meanwhile the coal is dumped and fills the bin overhead.

The night attendant has only to keep guard, there being no hoisting of coal at night. At times in severe winter weather the night attendant will be obliged to trim the coal in the bin to premit it to flow into the chutes, and thence into the locomotive tender.

The bucket pits should be waterproofed below the ground line, and all pitches for the flow of coal should be steep enough so that the coal shall flow freely. Sixty degrees from the horizontal is recommended.

Where fleeting sheaves are used, they should be of C. I. bronze bushed and equipped with grease cups.

Where sheaves are running idle they should be securely keyed to the shaft, and the shaft should turn in its bearings in preference to the sheave turning on the shaft as is sometimes done.

The electrical control should comprise an ammeter of rugged design and a main switch, mounted with fuses on a panel about 18″ x 24″. As the prevailing voltage throughout Canada is 550 for 3-phase service, the slate used must be carefully selected otherwise metallic veins will result in burning and damage to parts.

In connecting the limit switches the wire used should not be smaller than No. 10 B. & S. Guage, as there is considerable vibration to the structure and a lighter wire will break.

The roof of the coaling plant should be covered with asbestos shingle so as to fireproof the structure.

Costs relative to 300-ton coaling plant, operating at 80% capacity or 240 tons daily.

First cost	$15,000.00
Interest per annum, $15,000 @ 6%	900.00
Electric Power 10 H.P. @ $30.00 per H.P.	300.00
1 day attendant, partly skilled, @ 75	900.00
2 day helpers, @ 60	1,440.00
1 night attendant, unskilled, @ 60	720.00
Maintenance, 5% on $15,000.00	750.00
Insurance, 2% on $15,000.00	300.00
Engine service in spotting 5 cars coal per diem, $5.00 per day (nominal)	1,825.00
Total cost per annum	$7,135.00

Coal handled per day .... 240 Tons.
" " " annum .... 87,600 "
Cost per ton for storing and handling, $.082 (8.2 cents) per ton of 2,000 lbs.

In general this type of coaling plant has been found to be safe, economical and of pleasing appearance, and it can be operated by electric, steam or gasoline power.

*Read before the Montreal Branch of the E.I.C., Jan. 23rd, 1919.

Notes on the Test of a Girderless Floor

By Peter Gillespie, M.E.I.C., & T. D. Mylrea, A.M.W.S.E.

Introductory

Until the advent of the reinforced concrete ship, the flat slab type of floor was very properly regarded as the most recent development in reinforced concrete, and for buildings which can be divided into rectangular bays nearly square, it is by far the most popular. The principal reasons for this popularity: (1) ease in construction of form; (2) economy in steel and concrete; (3) ease in placing steel; (4) saving in story heights; (5) absence of deep shadows on ceiling; and (6) adaptability to automatic sprinkler lay-out—owing to the absence of beams and girders—are too well known to need more than passing mention. Some conception of this popularity may be had from a study of the records of the Building Departments of some of the larger American cities. In 1916, for example, the total value of buildings of the flat slab type erected in the city of Cleveland was about $1,300,000; in the city of Pittsburg approximately $1,200,000; while in the city of Philadelphia it was over $6,300,000. Information furnished by Building Commissioners shows that it representes about 7% of the total, and from 40% to 90% of the concrete building operations carried on in recent years in the larger cities of the United States.

The chief difficulty in the design of the flat slab, and the one which delayed its more rapid adoption, is that the stresses therein are not readily subject to analysis. From the year 1905, when it was first proposed by the man who later became its most enthusiastic sponsor, until about 1909 it was bitterly opposed by nearly all engineers because of this difficulty. But, by this time, it had established itself commercially and as a type of construction whose strength had been proven by many load tests. From 1910 on, many articles, based on theoretical considerations, appeared in the technical press suggesting methods of analysis. Many of these, however, have since been modified to accord with principles deduced from extensometer tests.

Coincident with the publication of methods of analysis came a flood of so-called "systems" developed in the effort to avoid patent infringements. These "systems" fall into three general classes, viz.:—(1) the 4-way system, in which bands of rods run directly and diagonally between columns, the steel being all or partially raised to the upper part of the slab in the region of the column heads; (2) the 2-way system, in which diagonal bands are omitted, extra steel being placed parallel to the direct bands to compensate therefor; and (3) combinations of the two preceeding.

The City of Chicago was the first whose building department was seriously confronted with the issuing of permits for this type of building, and solved the difficulty by appointing commissions of consulting engineers to report on all proposed systems. Approval by a commission was necessary before building permits could be obtained. Subsequently the city authorities required extensometer tests to be conducted until data, judged to be sufficient for the compilation of a city ordinance governing flat slab floors, had been accumulated. Such an ordinance—the first of its kind— was compiled and published in 1914, and remains, with but slight modification, in force to-day.

The testing of flat slab buildings under load by means of the extensometer was carried on in the United States through the combined efforts of several universities, construction companies and consulting engineers. Much of the test data was kept as private information by the construction companies concerned. Some of it appeared later in the form of University Bulletins.

Early in 1916, the Building Department of the City of Toronto was asked for a permit to erect a large warehouse of the flat slab type. As Toronto had no building by-law of its own governing flat slabs, an examination was made of those in force in the principal American cities, but it was discovered that there was a marked lack of agreement among them. The City Architect's Department thereupon decided to grant permits for buildings designed according to the Chicago building ordinance previously mentioned, on condition that the buildings when completed be subjected to extensometer tests. Accordingly five buildings, designed for different live loads, and having various panel lengths and schemes of reinforcement, were subjected to such tests by the City Architect's Department working in conjunction with the Department of Applied Mechanics, University of Toronto.

Of these the T. Eaton factory, the last one tested, has been chosen as the subject of this paper, because in the conduct of the test, there was available the experience and skill in observation acquired from its predecessors.

The form of the paper is somewhat out of the ordinary, in that all observed data are presented. Great difficulty was encountered by the writers when attempts were made to check the published results of others who had conducted similar building tests. In some cases full data as to the structure and a mere summary of the results of the tests were given. In others, rather more complete results of the tests were given, but with an entire omission of the details of reinforcing and other constructional features. In consequence it was impossible to check the conclusions reported from the data available. For this reason it was deemed advisable to give full information as to the structure as well as all the observed data, even though the results have been worked out for one live load only. It is the purpose of the writers to compare the bending moments which were found to exist in the actual slab under test, with those prescribed in the better known regulations governing flat slab construction, namely, the "Report of the Joint Committee." "The Recommendations of the American Concrete Institute," and "The Ordinances of the City of Chicago."

Fig. 1

The Building

The building, see Fig. 1, is twelve stories high and has a frontage of about 228 feet on Alice Street and 166 feet on Downey's Lane. It was designed by the William Steele Coy. of Philadelphia, and erected under their supervision by the Raymond Construction Co., of Toronto. To both of these companies, as well as to the T. Eaton Co., and the City Architect's Department, acknowledgment is made for permission to put the results of the test into print.

With certain exceptions the floor slabs were similar and were designed for a live load of 125 pounds per square foot. The reinforcement differed from that in any of the other buildings tested, in that the rods resisting positive moment were independent of those resisting negative moment. In the bottom of the slab, short rods, less than one panel in length, were used as a 4-way reinforcement, while over each column cap a mat composed of rods running in two directions only, parallel to the panel sides resisted the negative moments. Another feature was the use of structural steel columns, enclosed in a concrete envelope. These steel cores, in the case of the wall columns, extended to the 8th floor, and in the case of the interior columns, to the 10th floor. By this means the size of column in the lower stories was much reduced. Fig. 2 shows clearly the scheme of the slab and column construction, while details are shown on Plates I and II.

The reinforcing steel was of the grade known as Munition steel and Table 1 gives a summary of tests showing its physical and chemical properties. The structural steel used in the columns was of a much softer quality, as may be seen by comparison with Table 2. The concrete used throughout was a 1-2-4 mix, with a limestone coarse aggregate of ¾″ size. At the time the tested floor was poured, control cylinders were taken and these were tested at the age of 60 days at the University of Toronto. These cylinders showed an average compressive strength of 2950 pounds per square inch, and an average modulus of elasticity of 2,350,000 lbs. per square inch which latter value was used in converting concrete deformations into stresses.

The Test

The test was made on four panels on the 8th floor. Observations were also made on one wall column and one interior column in the story below, since it was desired to determine the stresses in the structural steel column cores as well as in the floor slabs. The test load was applied by means of cement in bags, and Fig. 3 shows the masimum load in place.

By means of a Berry strain gauge, deformation readings were taken on the concrete and reinforcing steel on 243 gauge lines, 89 of which were upon the upper surface of the slab, 121 on the lower surface, 13 on the wall column and 20 on the interior column. The dial of the strain gauge was graduated to read in thousandths of an inch, and with an arm ratio of five to one a change in reading of one division on the dial represented an actual deformation of one five-thousandth of an inch. In the tabulated deformations on Plate III one unit represents one division on the dial of the strain gauge, or a deformation of one five-thousandth of an inch in an eight-inch gauge length. In order that the reinforcing steel might be readily located at the points where gauge holes were to be drilled, small tapered wooden plugs were attached to the reinforcement of these points previous to pouring the concrete, and were readily removed after it had set. Where readings were to be taken on the concrete, small metal plugs were attached to the forms. Removal of the forms exposed the metal surface for the drilling of gauge holes. Figs. 4 and 5 show some of these blocks and plugs in place ready for the pouring of the concrete. The general appearance of these gauge lines when ready for the test may be seen in Figs. 6, 7 and 8, and Plates I and II give their exact location.

There were no construction joints in the floor panels under test, but in the interior column such a joint occurred just below the flared head, and one in the wall column immediately below the bracket, as shown on Plate II.

On the 8th floor one series of gauge lines Nos. 201 to 207, was located on the negative reinforcing rod nearest the lintel at column 27. Two other gauge lines, Nos. 208 and 209, were located on the outside rod of this band; No. 208 being across the centre line between columns 26 and 27, and No. 209 directly opposite the edge of the dropped head. At column 21 another series of gauge lines Nos. 215 to 221, and 229 and 240 are similarly located, and at right angles to this series were gauge lines Nos. 222 to 228 and 236 to 239 upon the outer and centre rods respectively of the mat. Two rows of gauge lines, Nos. 243 to 249 and 261 to 267, were located symmetrically with the centre line of column 20 upon the middle rod of the mat for this column, and gauge lines, Nos. 254, 255 and 256, were upon the outside rod of this mat. At column 19 upon the middle and outer rods of the mat were located gauge lines, Nos. 270 to 276 and 278 to 284, respectively. Gauge lines, Nos. 207, 215, 228, 229, 239, 243, 267 and 270, were less than 8 inches from the ends of rods.

For investigation of positive moments at the intersection of diagonal lines in the wall panel and interior panel, two other series of gauge lines Nos. 211 to 214 and 285 to 288 were located, and midway between the columns over the direct bands were located gauge lines Nos. 241 and 268, and 242 and 269 for positive and negative deformations in the concrete. Gauge line No. 210 was located as near the lintel as possible, so that the bending moment in that member might be investigated.

Since there were no diagonal bands to resist negative moment, it was necessary to insert steel plugs in the floor surface in order to investigate the deformation along diagonal lines. Such deformations were measured over the edges of the column capitals and in the neighborhood of the drop head corners at both wall and interior columns.

The gauge lines on the ceiling were so arranged that as nearly as possible they would pair with corresponding gauge lines on the floor above. In general the ceiling gauge lines were on the steel reinforcement, but on the drop heads, and at No. 20 on the lintel, as well as at several other places where check deformations were measured, they were located on the surface of the concrete. It was hoped that the line of inflection surrounding the column heads might be determined, and gauge lines on both floor and ceiling were located with a view to determing its position.

TABLE 1

Munition Steel

Size of rod.	PHYSICAL PROPERTIES				CHEMICAL PROPERTIES			
	Elastic limit lbs. per sq. in.	Ult. Strength lbs. per sq. in.	Elong. in 8 ins. %	Reduc'n in area %	C. %	Mn. %	P. %	S. %
1″	60610	82420	25.	55.	.30	.56	.015	.042
	49060	83610	30.	44.	.45	.56	.02	.044
	43940	83590	29.	55.	.41	.64	.02	.037
	45020	72400	29.	38.	.31	.51	.02	.045
	47320	74800	25.	41.	.31	.53	.02	.04
	44990	72210	25.	38.	.33	.42	.02	.041

TABLE 2

Structural Steel Column Cores

PHYSICAL PROPERTIES				CHEMICAL PROPERTIES			
Elastic limit lbs. per sq. in.	Ultimate strength lbs. per sq. in.	Elongation in 8 ins. %	Reduction in area %	C. %	Mn. %	P. %	S. %
38640	58780	30.	56.	.20	.64	.018	.039
34740	60380	34.	49.	.20	.56	.014	.028
41670	62040	31.	53.	.22	.47	.017	.029
37470	57420	26.	49.	.20	.52	.024	.044
39520	63640	30.	50.	.21	.47	.024	.048

Fig. 2. View Showing Slab Reinforcement and Steel Cores of Columns, The T. Eaton Company's New Factory, Toronto.

The gauge lines on the columns formed an upper and a lower series; the upper one on both wall and interior columns being across the construction joint. On the wall column two gauge lines were located one above the other on each of the four corner reinforcing rods. Two were on the concrete face, and three on the face of the bracket. On the interior column two gauge lines were located one above the other on each corner of the structural steel core and on each of the reinforcing rods. Check readings were taken on the concrete on opposite faces, gauge lines C 14 and C 15 being on the side nearest the windows.

Before applying any load, all gauge lines were read and then a load of 125 lbs. per square foot was put on all 4 panels, leaving uncovered only enough room for the observer. To compensate for this sufficient additional material was piled around the edges of the unloaded spaces. When a new set of readings had been taken, an additional 125 lbs. per square foot was added to all 4 panels. This gave a live load of 250 lbs. per square foot or twice that for which the floor was designed. Another set of readings was then taken, and after three days without any alteration in the test load, a further set was taken to note any change in deformations due to the lapse of time. After this the two interior panels were completely unloaded, leaving 250 lbs. per square foot on the two wall panels. The deformations were again observed and the two wall panels unloaded. After the complete removal of the load, a final set of readings was taken to observe the extent of the permanent set.

Plate III gives the observed deformations under the various conditions of loading, and on Plates I and II these deformations have been converted into stresses in the usual way, assuming the modulus of elasticity for concrete to be the same in tension as in compression.

Deflections

In this test no attempt was made to determine deflection. In some of the previous tests attempts had been made but the difficulties encountered far outweighed the information obtained. In the earlier tests where deflections were measured a substantial scaffold was erected to within a few inches of the ceiling and an Ames dial mounted on a suitable base was used as a deflectometer. Another scaffold, in no way connected to the first one, was erected as an observer's platform. It was often found that the workmen drove spikes into the framing upon which to hand coats with the result that reliable readings were almost impossible to obtain. Fences or barricades merely served to attract attention.

Plate IV gives deflection contours of the slab surface of the Robert Simpson Building under the design load, the vertical interval being .01 of an inch. This diagram is presented for the reason that the recorded deflections for this test were considered the most reliable. From such a diagram it might be possible to check computed moments by means of the slope deflection method. No attempt has been made to make such a check however since this deflection diagram pertains to another building.

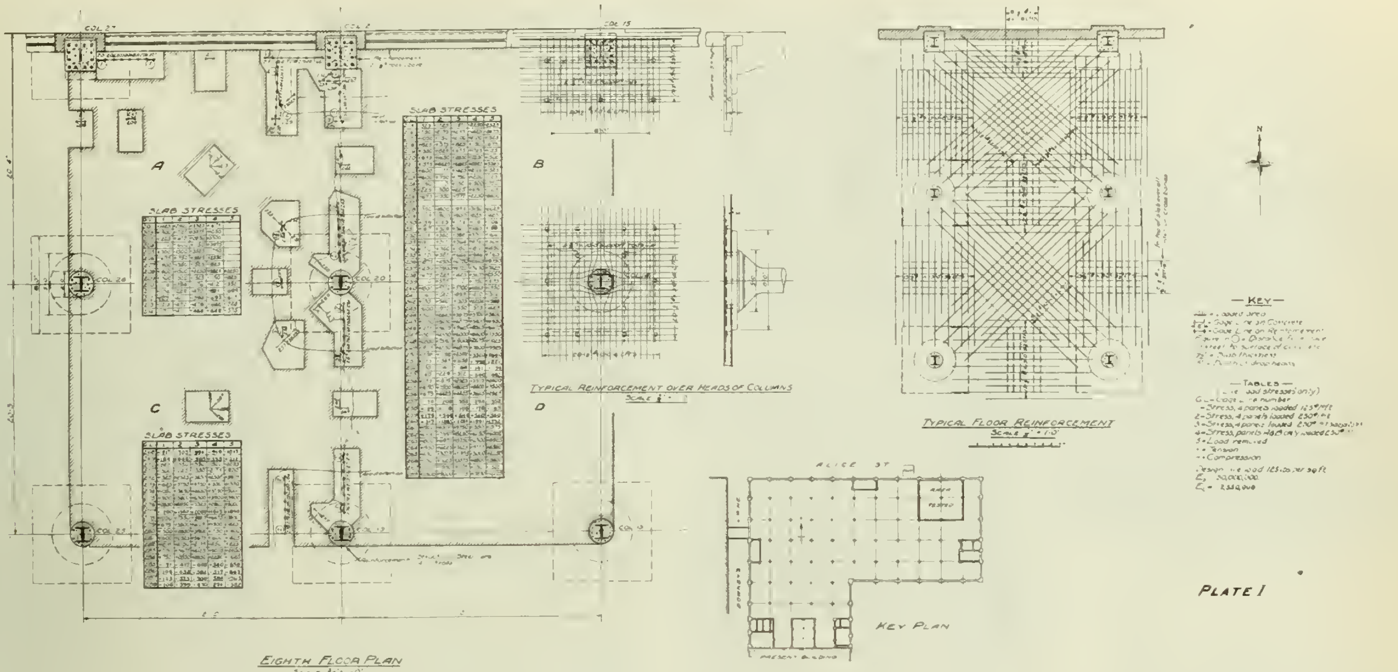
One peculiarity of the diagram seems to merit attention. It will be noticed that across a line joining wall column No. 10 with the interior columns Nos. 23 and 36, the curvature appears to be more abrupt than that across a line parallel to the wall joining interior columns. This would seem to be the opposite of what would be expected for, with a comparatively rigid lintel along one edge, one could readily conceive of the wall panels troughing parallel to the wall. A striking confimation of this peculiarity was afforded by the excessive sagging of the floor slabs in the concrete warehouse of the Quaker Oats Co., Peterborough, Ont., which was destroyed by fire Dec. 11th, 1916. Before the building was razed deflection readings were taken on one typical sagging wall panel, the results of which are plotted on Plate V. The vertical interval in this case is one inch instead of .01 inch.

Fig. 3

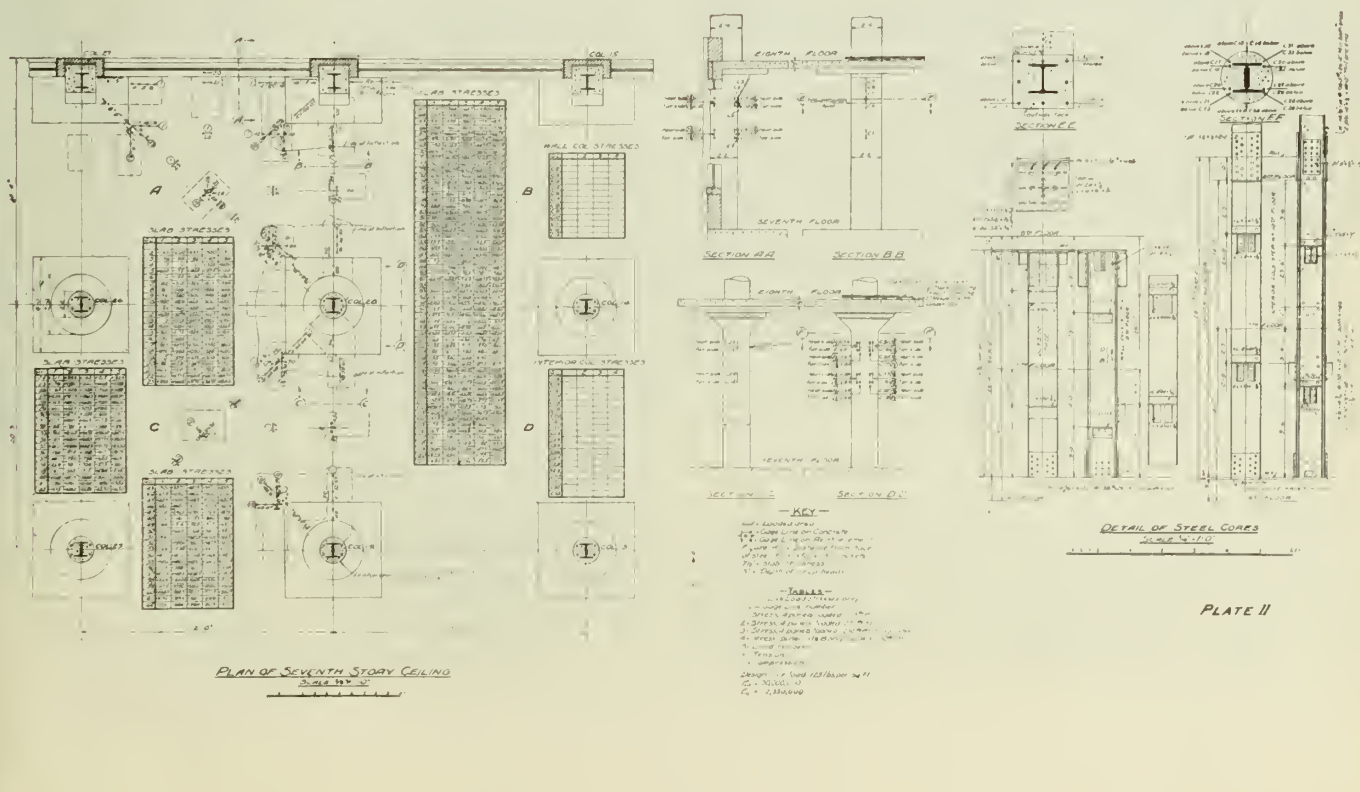
Cracks

Under a live load of 125 lbs. per square foot no cracks were visible, but with the increase to 250 lbs. per square foot they became apparent. Those which were visible to the naked eye both on the upper surface of the slab and on the ceiling have been carefully mapped on Plates I and II. The phenomenon of troughing perpendicular to the wall is again indicated by the formation of a very clearly defined crack in the upper surface of the slab, extending from column No. 19 to column No. 21 in an almost unbroken line. Fig. 9 is a photograph tracing the course of this crack between two columns and Fig. 10 is a view of it at close range. It will be noted that the crack extends into the slab to the reinforcement, thus indicating the necessity of providing reinforcing metal across the direct bands.

In the tensile stresses tabulated on Plates I and II this cracking of the concrete must be taken into account particularly where the gauge line is on the concrete rather than on the reinforcement. An illustration will make this clear. Take as an example, gauge line No. 250, on the upper surface of the slab near the column No. 20, where no diagonal reinforcement existed.



It will be noticed that a crack in the concrete occurred directly between the two gauge points under a 250 lb. load, and that the indicated tensile stress therein is 1789 lbs. per sq. inch, increasing to 2580 lbs. per sq. in. after the load had been in place 3 days, and further increasing to 3320 lbs. per sq. in. when the load was removed from the two interior panels. These stresses are clearly impossible, for a live load of 125 lbs. per sq. ft. produced a tension of only 258 lbs. per sq. inch in the concrete, which was probably very nearly its ultimate value at this place. When the crack occurred the tension for some little distance on both sides of it was relieved resulting in the drawing back of the edges and the indication of excessive deformations. Had a gauge line on diagonal reinforcement been possible, the indications would doubtless have been different.



SLAB STRESSES

G.L.	1	2	3	4	5
201	+1425	+2925	+5325	+ 675	
202	+ 900	+1725	+3375	+1050	
203	+ 225	+ 675	+2850	+3300	
204	0	- 600	+ 150	+3975	
205	+300	-1500	-3525	- 750	
206	-675	+ 750	+3825	+2550	
207	-900	-1350	- 525	-825	
208	+900	+1500	+2250	+3825	+2250
209	+ 300	-300	+ 525	-150	-825
210	- 6	-194	-176	-412	-352
211	-106	-229	-470	-881	-699
212	-123	-411	-394	-693	-617
213	-129	-470	-476	-646	-528
214	-171	-411	-464	-646	-575

SLAB STRESSES

G.L.	1.	2	3	4	5
268	- 217	-705	-994	- 916	-1017
269	+164	+446	+ 505	+335	+ 211
270	-825	-1350	-1350	-1500	-2025
271	-300	- 225	-1350	-2175	-900
272	+525	+2325	+3450	+4350	+3975
273	+1625	+3750	+3750	+1350	+1350
274	+1050	+3450	+4650	+3750	+3000
275	+900	+5400	+6300	+3900	+3900
276	+2850	+4950	+5325	+2925	+3000
277	+ 200	+1362	+2000	+1615	+1690
278	+1050	+7350	+9825	+6675	+7800
279	+675	+3300	+4125	+1500	+1425
280	+ 300	+2850	+3900	+ 750	+ 900
281	+600	+2925	+3675	+ 600	+1425
282	+1275	+2100	+2175	-450	+225
283	+750	+3675	+4125	+3075	+2400
284	+750	+2850	+2850	+2250	+1625
285	- 71	- 417	- 605	-540	- 658
286	-106	-458	-582	-517	-643
287	-123	-523	-700	-588	-705
288	-106	-399	-470	-294	-382

SLAB STRESSES

G.L.	1	2	3	4	5
215	-525	-1725	-150	-2250	-2325
216	-750	-2175	-1275	-1425	-2475
217	+1050	+ 150	+2100	+2100	+ 525
218	+825	+375	+825	+150	-675
219	+1350	+825	+975	+1725	+1125
220	+975	+1650	+2850	+2250	+1500
221	+1575	+4425	+6825	+8325	+5325
222	+600	- 75	+1425	+2100	+ 525
223	+600	+750	+ 750	+1200	-225
224	-150	0	+150	+1500	-750
225	-225	-300	+225	+450	-1125
226	-675	-1350	-1575	-2250	-2400
227					
228	-750	-1800	-975	-3150	-2625
229	-225	-900	-900	-825	-1425
230	+ 59	+123	+ 76	+ 18	- 106
231	+147	+329	+340	+463	+ 88
232	+135	+352	+388	+370	+164
233	+141	+317	+364	+476	+324
234	+170	+740	+1180	+1810	+1430
235	+170	+523	+646	+946	+763
236	+1875	+4950	+6750	+4625	+9750
237	+1250	+3900	+4725	+7650	+7425
238	-675	+225	+1425	+3675	+2550
239	0	+525	0	+ 750	-675
240	+1800	+5700	+5700	+15825	+11550
241	- 141	-582	-899	-1410	-1310
242	+135	+540	+1303	+2204	+1948
243	-600	-975	-1350	-375	-1425
244	+300	+2625	+3975	+5700	+5400
245	+1050	+3450	+4275	+5400	+4950
246	+1275	+3675	+5925	+8325	+6675
247	+1500	+4350	+6000	+8400	+7350
248	+2850	+7350	+9000	+12675	+11025
249	+1875	+4350	+4875	+7800	+5925
250	+258	+1798	+2582	+3320	+2640
251	+123	+547	+658	+ 998	+822
252	- 35	- 41	-164	- 141	- 94
253	-65	-229	-512	- 540	-482
254	+375	+1875	+2325	+3375	+2400
255	+1650	+7500	+8025	+8400	+7500
256	+675	+4425	+4425	+5625	+2925
257	- 70	- 200	- 352	-294	- 352
258	+ 29	+ 6	-106	- 176	- 47
259	+176	+546	+646	+540	+540
260	+317	+1885	+2281	+1591	+1532
261	+1500	+4500	+3750	+1350	+1575
262	+2100	+7350	+8250	+6150	+6000
263	+1800	+6975	+8750	+6300	+5925
264	+1950	+6225	+7425	+5725	+4500
265	+450	+3075	+3975	+3000	+2250
266	+150	+1625	+3375	+4800	+5400
267	-1200	-1950	-2175	+150	- 525
289	+3300	+9000	+11775	+17850	+12225

Part of Plate I (enlarged)

The Line of Inflection

The position of the line of inflection was readily determined by following radially from the column several series of consecutive gauge lines and noting where the tabulated stresses changed from negative to positive or *vice versa*. On the floor it was found to be at an average distance of about 5′ 6″ from the central column while on the ceiling it varied from 6′ 0″ in the interior panel to

SLAB STRESSES

G.L.	1	2	3	4	5
1					
2	-141	-200	-235	-300	-171
3	- 76	- 88	- 82	- 47	- 94
4	0	0	0	-1500	-2250
5	+600	- 75	+1425	+975	+150
6	0	-150	+150	-600	-2925
7	-182	-505	-522	-817	-599
8	-182	-528	-570	-852	-646
9	-176	-540	-600	-880	-687
10	-1950	-4875	-4200	-5250	-4200
11	- 153	-446	-458	-663	-563
12	-1650	-3075	-2550	-3225	-3000
13	0	-1725	-2475	-2700	-2700
14	-1200	-2250	-2100	-2325	-2325
15	- 900	-2175	-825	-225	-525
16	-150	- 600	-150	+150	- 70
17	- 825	-2475	-2700	-3750	-3825
18	-975	-1950	-1050	-525	-1050
19	0	-375	+675	+300	-300
20	+82	+129	+247	+293	+ 70
21	+600	-150	-150	-750	-1500
22	+1200	+4725	+6375	+6675	+4275
23	+900	+3600	+5175	+5475	+3150

SLAB STRESSES

GL.	1	2	3	4	5
24	+ 211	+ 993	+1162	+1215	+ 952
25	+ 176	+1580	+1240	+1468	+1058
26	+ 65	+ 458	+ 528	+ 764	+458
27	+1200	+7275	+8625	+9600	+5250
28	+525	+4950	+6450	+7050	+4200
29	+600	+2625	+3075	+3750	+1125
30	+300	+1875	+2250	- 600	-750
31	+217	+1280	+1469	+1139	+1116
32	+ 88	+782	+917	+588	+59
33	+ 900	+8025	+9075	+5400	+5475
34	+1125	+6300	+8025	+5775	+5850
35	+1425	+3900	+4425	+2175	+2250
36	-294	-875	-1068	-817	-875
37	-241	- 593	- 793	-605	-628
38	-229	-581	-700	-575	-582
39	-141	-545	-717	-498	-534
40	-2025	-2475	-3450	-3000	-3000
41	- 750	-1500	-2100	-1950	-1350
42	-1575	-2025	-2250	-2250	-1650

SLAB STRESSES

GL.	1	2	3	4	5
43	-900	-3375	-4275	-3975	-4350
44	-675	-1200	-1800	-1800	-2100
45	-1425	-1500	-1425	-2100	-6525
46	-600	-3600	-5175	-3075	-3675
47	-1125	-2925	-2700	-1725	-1875
48	-170	- 141	- 153	-940	- 94
49	-164	-516	-705	-517	-635
50	-205	-665	-764	-547	-552
51	-1950	-5550	-6225	-4500	-3225
52	-1650	-2850	-3825	-3675	-5250
53	-225	-1050	-2025	-3375	-4725
54	+417	+1410	+1568	+1069	+981
55	+3450	+11400	+12225	+ 6450	+5175
56	- 123	-528	- 612	- 352	- 358
57	+2775	+11550	+12525	+11775	+7875
58	+225	- 2400	-3000	-4350	-5100
59	-1275	-3750	-3300	-4350	-3300
60	-2625	-7425	-7275	-5775	-5325
61	-470	-993	-981	-699	- 570
62	-300	-882	-964	-805	-852

SLAB STRESSES

G.L.	1	2	3	4	5
63	- 540	-1362	-1627	-1350	-1385
64	- 247	- 728	- 893	- 740	-776
65	- 252	- 775	- 940	- 775	-870
66	-258	-740	-823	-723	-776
67	-2925	-6600	-6675	-6000	-6675
68	-1950	-3150	-3000	-3225	-3600
69	- 750	-2025	-1725	-2475	-3075
70	-1950	-5925	-7275	-5850	-5850
71	-1575	-4050	-3825	-3225	-3150
72	-300	-1275	-900	-1275	-1575
73	-1800	-6075	-6525	-6525	-7275
74	-1650	-3000	-3000	-3450	-3900
75	+150	- 975	- 525	-1650	-2100
76	-270	- 975	-1132	-1503	-1268
77	-270	-840	- 917	-1175	-1062
78	-393	-752	-858	-1087	-928
79	-288	-646	-700	-787	-640
80	-2625	-6300	-7350	-8475	-7125
81	-1500	-2850	-2325	-3000	-3000
82	-900	-2175	-1875	-1650	-2250
83	-1350	-4125	-4050	-4425	-5025
84	-675	-2400	-2700	-2700	-3450
85	-525	-1050	-1200	-525	-2400
86	-975	-4725	-4125	-4500	-3750
87	-1200	-4200	-4125	-4350	-3900
88	+ 75	-1200	- 825	-1275	-1575
89	-241	- 746	-917	-1092	-987
90	-217	-676	-723	-781	-782
91	-2475	-6825	-7125	-6975	-7050
92	-300	-3375	-3150	-3825	-5325
93	-300	-2475	-2475	-2325	-3975
94	+141	+678	+828	+1098	+ 770
95	+2100	+7500	+8550	+11850	+7800
96	- 135	-1180	-1444	-1882	-1890
97	+975	+7350	+8700	+11100	+6975
98	+ 75	-450	0	+1200	- 375
99	-675	-2100	-1275	-525	-600
100	-2550	-4575	-4125	-4652	-4200
101	-165	-411	-434	-476	-452
102	-135	-652	-717	-970	-840
103	- 82	-611	- 782	- 980	-887
104	-135	-540	-658	-870	-717
105	-170	-546	-652	-875	-817
106	-1050	-3600	-4050	-4650	-4950
107	- 71	- 305	- 317	-405	- 358
108	-300	-2325	-2175	-1425	-2025
109	+600	- 825	-825	- 600	-2850
110	- 525	-1950	-2250	-2625	-2625
111	- 525	-750	-1875	-1275	-2175
112	+2925	-675	-1125	+ 75	-1500
113	- 600	-2775	-3300	-3675	-4500
114	- 375	-2625	-2625	-2025	-3225
115	- 75	-1050	-1500	- 900	-2100
116	-65	-358	-423	-323	-582
117	-47	-247	-223	-341	-335
118	-41	-100	-129	- 188	-293
119	-300	-1350	-1050	-1275	-2625
120	+825	-450	0	+75	-1200
121	-450	-375	-150	-225	-1275

Part of Plate II (enlarged)

6′ 6″ in the wall panel. A general average would be about .28L which is larger than the .2L commonly assumed. The reason for this probably lies in the fact that the drop panels were larger than usual, being about .38L as against .33L found in common practice. It will be noted that in the wall panel the center-to-center distance between columns is smaller than elsewhere. The effect of the large drop panels is thus increased, causing the line of inflection to move toward the center of the span.

On the ceiling the distance from column center to line of inflection appears to be greater than on the floor. A horizontal thrust of some magnitude due to arch action existed in the slab, and was probably the cause of the difference. Assume for example, that at a certain section of a slab, a negative bending moment exists producing tension on the upper surface and compression on the lower surface. Any central thrust acting toward the support would decrease the tension in the upper surface of the slab thus bringing the line of inflection closer to the support. At the same time it would increase the compression at the lower surface, which would have the effect of moving the line of inflection there, farther from the support. It will be seen later that the line of action of the thrust was practically central in the region of contraflexure.

Tension in Concrete

The assumption that in a reinforced concrete beam the concrete takes no tension, is known to be erroneous. The same holds true for the flat slab. Under moderate loads a very large amount of the tensile resistance is undoubtedly furnished by the concrete. As the loading increases and the tensile deformations become greater than the extensibility of the concrete, rupture occurs at the surface. With the continued addition of load the rupture approaches nearer and nearer to the neutral surface, and owing to its shortened lever arm, the resultant of the tensile stress in the unbroken concrete supplies a resisting moment of diminishing magnitude. For this reason it is justifiable in design to neglect the part that the tensile resistance of the concrete may play. A casual inspection of the tabulated deformations on Plate III and stresses on Plates I and II, will make this point clear, for it will be noted that the deformations and stresses as recorded in column No. 2 are out of proportion to those appearing in column No. 1. The sudden increase with the change of load is probably due to the fact that rupture of the concrete occurred, throwing upon the reinforcement a larger proportion of the tension.

DEFORMATIONS IN 8″ GAUGE LENGTH

1 Unit = 1/5000″ $n = 12.76$
1 Unit = 750 #/□″ • Stress in Steel — E_s = 30,000,000
1 Unit = 58.75 #/□″ • Stress in Concrete — E_c = 2,350,000

G.L.	1	2	3	4	5
1	abandoned ½ pipe line				
2	-2.4	-3.4	-4.0	-5.1	-3.0
3	-1.3	-1.5	-1.4	-0.8	-1.6
4	0.0	0.0	0.0	2.0	-3.0
5	+0.8	-0.1	+1.9	+1.3	+0.2
6	0.0	-0.2	+0.2	-0.8	-3.9
7	-3.1	-8.6	-8.9	-13.9	-10.2
8	-3.1	-9.0	-9.7	-14.5	-11.0
9	-3.0	-9.2	-10.2	-15.0	-11.7
10	-2.6	-6.5	-5.6	-7.0	-5.6
11	-2.6	-7.6	-1.8	-11.3	-9.6
12	-2.2	-4.1	-3.4	-4.3	-4.0
13	0.0	-2.3	-3.3	-3.6	-3.6
14	-1.6	-3.4		-3.1	-3.1
15	-1.2	-2.9		-0.3	-0.7
16	-0.2	-0.8	-0.2	+0.2	-1.2
17	-1.1	-3.3	-3.6	-5.0	-5.1
18	-1.3	-2.6	-1.4	-0.7	-1.4
19	0.0	-0.5	+0.9	+0.4	-0.4
20	+1.4	+2.2	+4.2	+5.0	+1.2
21	+0.8	-0.2	-0.2	-1.0	-2.0
22	+1.6	+6.3	+8.5	+8.9	+5.7
23	+1.2	+4.8	+6.9	+7.3	+4.2
24	+3.6	+16.9	+19.8	+20.7	+16.2
25	+3.0	+18.0	+21.1	+25.0	+18.0
26	+1.1	+7.8	+9.0	+13.0	+7.8
27	+1.6	+9.7	+11.5	+12.3	+7.0
28	+0.7	+6.6	+8.6	+9.4	+5.6
29	+0.8	+3.5	+4.1	+5.0	+1.5
30	+0.4	+2.5	+3.0	-0.8	-1.0
31	+3.7	+21.8	+25.0	+19.4	+19.0
32	+1.5	+13.3	+15.6	+10.0	+10.0
33	+1.2	+10.7	+12.1	+7.2	+7.3
34	+1.5	+8.4	+10.7	+7.7	+7.8
35	+1.9	+5.2	+5.9	+2.9	+3.0
36	-5.0	-14.9	-18.2	-13.9	-14.9
37	-4.1	-10.1	-13.5	-10.3	-10.7
38	-3.9	-9.9	-11.9	-9.8	-9.9
39	-2.4	-9.3	-12.2	-8.5	-9.1
40	-2.7	-3.3	-4.6	-4.0	-4.0
41	-1.0	-2.0	-2.8	-2.6	-1.8
42	-2.1	-2.7	-3.0	-3.0	-2.2
43	-1.2	-4.3	-5.7	-5.3	-5.8
44	-0.9	-1.6	-2.4	-2.4	-2.8
45	-1.9	-2.0	-1.9	-2.8	-8.7
46	-0.8	-4.8	-6.9	-4.1	-4.9
47	-1.5	-3.9	-3.6	-2.3	-2.5
48	-2.9	-2.4	-2.6	-1.6	-1.6
49	-2.8	-8.8	-12.0	-8.8	-10.8
50	-3.5	-11.3	-13.0	-9.3	-9.4
51	-2.6	-7.4	-8.3	-6.0	-4.3
52	-2.2	-3.8	-5.1	-4.9	-7.0
53	-0.3	-1.4	-2.7	-4.5	-6.3
54	+7.1	+24.0	+26.7	+18.2	+16.7
55	+4.6	+15.2	+16.3	+8.6	+6.9
56	-2.1	-9.0	-10.4	-6.0	-6.1
57	+3.7	+15.4	+16.7	+15.7	+10.5
58	+0.3	-3.2	-4.0	-5.8	-6.8
59	-1.7	-5.0	-4.4	-5.8	-4.4
60	-3.5	-9.9	-9.7	-7.8	-7.1
61	-8.0	-16.9	-16.7	-11.9	-9.7

G.L.	1	2	3	4	5
62	-5.1	-15.0	-16.4	-13.7	-14.5
63	-9.2	-23.2	-27.7	-23.0	-23.6
64	-4.2	-12.4	-15.0	-12.6	-13.2
65	-4.3	-13.2	-16.0	-13.2	-14.8
66	-4.4	-12.6	-14.0	-12.3	-13.2
67	-3.9	-8.8	-8.9	-8.0	-8.9
68	-2.6	-4.2	-4.0	-4.3	-4.8
69	-1.0	-2.7	-2.3	-3.3	-4.1
70	-2.6	-7.9	-9.7	-7.8	-7.8
71	-2.1	-5.4	-5.1	-4.3	-4.2
72	-0.4	-1.7	-1.2	-1.7	-2.1
73	-2.4	-8.1	-8.7	-8.7	-9.7
74	-2.2	-4.0	-4.0	-4.6	-5.2
75	+0.2	-1.3	-0.7	-2.2	-2.8
76	-4.6	-16.6	-19.3	-25.8	-21.6
77	-4.6	-14.3	-15.6	-20.0	-18.1
78	-6.7	-12.8	-14.6	-18.5	-15.8
79	-4.9	-11.0	-11.9	-13.4	-10.9
80	-3.5	-8.4	-9.8	-11.3	-9.5
81	-2.0	-3.8	-3.1	-4.0	-4.0
82	-1.2	-2.9	-2.5	-2.2	-3.0
83	-1.8	-5.5	-5.4	-5.9	-6.7
84	-0.9	-3.2	-3.6	-3.6	-4.6
85	-0.7	-1.4	-1.6	-0.7	-3.2
86	-1.3	-6.3	-5.5	-6.0	-5.0
87	-1.6	-5.6	-5.5	-5.8	-5.2
88	+0.1	-1.6	-1.1	-1.7	-2.1
89	-4.1	-12.7	-15.6	-18.6	-16.8
90	-3.7	-11.5	-12.3	-13.3	-13.3
91	-3.3	-9.1	-9.7	-9.3	-9.4
92	-0.4	-4.5		-5.1	-7.1
93	-0.4	-3.3	-3.3	-3.1	-5.3
94	+2.4	+11.7	+14.1	+10.7	+13.1
95	+2.8	+10.0	+11.4	+15.8	+10.4
96	-2.3	-20.1	-24.6	-22.1	-32.2
97	+1.3	+9.8	+11.6	+14.8	+9.3
98	+0.1	-0.6	0.0	+1.6	-0.5
99	-0.9	-2.8	-1.7	-0.7	-0.8
100	-3.4	-6.1	-5.5	-6.2	-5.6
101	-2.8	-7.0	-7.4	-8.1	-7.7
102	-2.3	-11.1	-12.2	-16.5	-14.3
103	-1.4	-10.4	-13.3	-16.7	-15.1
104	-2.3	-9.2	-11.2	-14.8	-12.2
105	-2.9	-9.3	-11.1	-14.9	-13.9
106	-1.4	-4.8	-5.4	-6.2	-6.6
107	-1.2	-5.2	-5.4	-6.9	-6.1
108	-0.4	-3.1	-2.9	-1.9	-2.7
109	+0.8	-1.1	-1.1	-0.8	-3.8
110	-0.7	-2.6	-3.0	-3.5	-3.5
111	-0.7	-1.0	-2.5	-1.7	-2.9
112	+3.9	-0.9	-1.5	+0.1	-2.0
113	-0.8	-3.7	-4.4	-4.9	-6.0
114	-0.5	-3.5	-3.5	-2.7	-4.3
115	-0.1	-1.4	-2.0	-1.2	-2.8
116	-1.1	-6.1	-7.2	-8.9	-9.9
117	-0.8	-4.2	-3.8	-5.8	-5.7
118	-0.7	-1.7	-2.2	-3.2	-5.0
119	-0.4	-1.8	-1.4	-1.7	-3.5
120	+1.1	-0.6	0.0	+0.1	-1.6
121	-0.6	-0.5	-0.2	-0.3	-1.7

G.L.	1	2	3	4	5
201	+1.9	+3.9	+7.1	+0.9	
202	+1.2	+2.3	+4.5	+1.4	
203	+0.3	+0.9	+3.8	+4.4	
204	0.0	-0.8	+0.2	+5.3	
205	+0.4	-2.0	-4.7	-1.0	
206	-0.9	+1.0	+5.1	+3.4	
207	-1.2	-1.8	-0.7	-1.1	
208	+1.2	+2.0	+3.0	+5.1	+3.0
209	+0.4	-0.4	+0.7	-0.2	-1.1
210	-0.1	-3.3	-3.0	-7.0	-6.0
211	-1.8	-3.9	-8.0	-15.0	-11.9
212	-2.1	-7.0	-6.7	-11.8	-10.5
213	-2.2	-8.0	-8.1	-11.0	-9.0
214	-3.0	-7.0	-7.9	-11.0	-9.8
215	-0.7	-2.3	-0.2	-3.0	-3.1
216	-1.0	-2.9	-1.7	-1.9	-3.3
217	+1.4	+0.2	+2.8	+2.8	+0.7
218	+1.1	+0.5	+1.1	+0.2	-0.9
219	+1.8	+1.1	+1.3	+2.3	+1.5
220	+1.3	+2.2	+3.8	+3.0	+2.0
221	+2.1	+5.9	+9.1	+11.1	+7.1
222	+0.8	-0.1	+1.9	+2.8	+0.7
223	+0.8	+1.0	+1.0	+1.6	-0.3
224	-0.2	-0.0	+0.2	+2.0	-1.0
225	-0.3	-0.4	+0.3	+0.6	-1.5
226	-0.9	-1.8	-2.1	-3.0	-3.2
227	0.0	-2.1	-1.9	-2.9	-3.5
228	-1.0	-2.4	-1.3	-4.2	-3.6
229	-0.3	-1.2	-1.2	-1.1	
230	+1.0	+2.1	+1.3	+0.3	-1.8
231	+2.5	+5.6	+5.8	+7.9	+1.5
232	+2.3	+6.0	+6.6	+6.3	+2.8
233	+2.4	+5.4	+6.2	+8.1	+5.5
234	+2.9	+12.6	+20.1	+30.9	+23.9
235	+2.9	+8.9	+11.0	+16.1	+13.0
236	+2.5	+6.6	+9.0	+15.5	+12.9
237	+1.6	+5.2	+6.3	+10.2	+9.9
238	-0.3	+0.3	+1.9	+4.9	+3.4
239	0.0	+0.7	+0.0	+1.0	-0.9
240	+2.4	+7.6	+7.6	+21.1	+15.4
241	-2.4	-9.9	-15.3	-24.0	-27.3
242	+2.3	+9.2	+22.2	+37.6	+33.0
243	-0.8	-1.3	-1.8	-0.5	-1.9
244	+0.4	+3.5	+5.3	+7.6	+7.2

G.L.	1	2	3	4	5
245	4	+4.6	+5.7	+7.2	+6.6
246	+1.7	+4.9	+7.9	+11.1	+0.9
247	+2.0	+5.8	+8.0	+11.2	+9.8
248	+3.8	+9.8	+12.0	+16.9	+14.7
249	+2.5	+5.8	+6.5	+10.4	+7.9
250	+4.4	+30.6	+44.0	+56.5	+45.0
251	+2.1	+9.3	+11.2	+17.0	+14.0
252	-0.6	-0.7	-2.8	-2.4	-1.6
253	-1.1	-3.9	-8.7	-9.2	-8.2
254	+0.5	+2.5	+3.1	+4.5	+3.2
255	+2.2	+10.0	+10.7	+11.2	+10.0
256	+0.9	+5.9	+5.9	+7.5	+3.9
257	-1.2	-3.4	-6.0	-5.0	-6.0
258	+0.5	+0.1	-1.8	-3.0	-0.8
259	+3.0	+9.3	+11.0	+9.2	+9.2
260	+5.4	+32.1	+30.9	+27.1	+26.1
261	+2.0	+6.0	+5.0	+1.8	+2.1
262	+2.8	+9.8	+11.0	+8.2	+8.0
263	+2.4	+9.3	+11.6	+8.4	+7.0
264	+2.6	+8.3	+9.9	+7.7	+6.0
265	+0.6	+4.1	+5.3	+4.0	+3.0
266	+0.2	+2.2	+4.5	+6.4	+7.2
267	-1.6	-2.6	-2.9	+0.2	-0.7
268	-3.7	-12.0	-16.9	-15.6	-17.3
269	+2.8	+7.6	+8.6	+5.7	+3.6
270	-1.1	-1.8	-1.8	-2.0	-2.7
271	-0.4	-0.3	-1.8	-2.9	-1.2
272	+0.7	+3.1	+4.6	+5.8	+5.3
273	+2.2	+5.0	+5.0	+1.8	+1.8
274	+1.4	+4.6	+6.2	+5.0	+4.0
275	+1.2	+7.2	+8.4	+5.2	+5.2
276	+3.8	+6.6	+7.1	+3.9	+4.0
277	+3.4	+23.2	+34.1	+27.5	+28.8
278	+1.4	+9.8	+13.1	+8.9	+10.4
279	+0.9	+4.4	+5.5	+2.0	+1.9
280	+0.4	+3.8	+5.2	+1.0	+1.2
281	+0.8	+3.9	+4.9	+0.8	+1.9
282	+1.7	+2.8	+2.9	-0.6	+0.3
283	+1.0	+4.9	+5.5	+4.1	+3.2
284	+1.0	+3.8	+3.8	+3.0	+2.2
285	-1.2	-7.1	-10.3	-9.2	-11.2
286	-1.8	-7.8	-9.9	-8.8	-10.9
287	-2.1	-8.9	-11.9	-10.0	-12.0
288	-1.8	-6.8		-5.0	-6.5
289	+4.4	+12.0	+15.7	+23.8	+16.3

G.L.	1	2	3	4	5
C14	-1.9	-4.2		-5.1	-4.1
C15	-1.0	-3.1		-9.9	-0.1
C16	-1.0	-3.3		-5.8	-3.8
C17	-3.0	-6.2		-5.0	-5.2
C18	-2.8	-8.0		-3.2	-2.2
C19	-3.0	-5.2		-5.9	-3.6
C20	-2.7	-7.1		+1.5	-1.7
C21	-2.0	-7.9		+0.9	-5.1
C22	-2.4	-3.6		-0.3	-1.8
C23	-3.0	-4.0		0.0	
C24	-2.8	-4.6		+0.1	-1.1
C25	-3.0	-7.7		+17.8	+12.5
C26	-1.9	-4.4		+0.6	-1.5
C27	-1.7	-5.8		+8.2	-2.8
C28	-2.9	-5.5		-4.3	-4.0
C29					
C30	-2.1	-4.8		-7.2	-4.2
C31	+2.2	-5.0		-8.2	-6.0
C32	-2.7	-6.5		-7.9	-4.9
C33	-2.2	-6.2		-9.4	-5.2

PLATE III

The stress at which concrete ruptures is a variable quantity even in the same slab. In order to take account of it in the computations it was necessary to fix upon some arbitrary value. After an examination of the results of computations based on various assumed values of strength and a consideration of the tests on the control cylinders, this was finally placed at 200 pounds per square inch. It was assumed that unobserved stresses due to dead load are proportional to those produced by live load. If, for example, the dead load is 94 lbs. per sq. ft., the live load 125 lbs. per sq. ft. and the observed stress due to the latter in a specific instance is 115 lbs. per sq. in., the assumed unobserved stress due to dead load only is $\frac{94}{125}$ x 115 or 85 lbs. per sq. in. The total existing stress is therefore the sum of these or 200 lbs. per sq. in., the ultimate tensile value assumed as above. This condition would be produced by an actual tensile deformation of 3.4 divisions on the dial or by an indicated tensile deformation of 1.93 divisions.

Plates VI and VII have been prepared showing to scale the deformations at 17 pairs of gauge lines on the upper and lower surfaces of the slab between columns Nos. 19 and 21. The thickness of the slab, the amount of reinforcement present and its position are shown, as is also the loading which produced these deformations. A line joining the ordinates representing the respective deformations on the upper and lower surfaces, intersects the vertical plane of the section at the neutral axis in accordance with usual assumptions. On these diagrams interesting conditions are revealed. In any vertical series for example, the shifting of the neutral axis at the section due to changing load is shown. Again under constant load, the movement of the neutral axis and the variation in stress from section to section can be observed by following any horizontal series.

In many places particularly under the heavy loads, it will be noticed that the compressive deformations indicated appear to be excessive. This is observed at

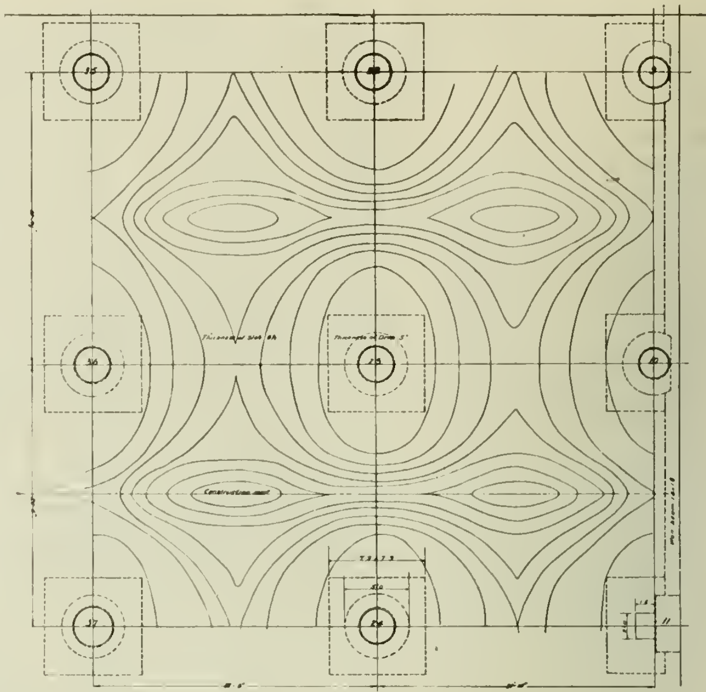


PLATE IV

pair No. 9 after the full load had been left in place for 3 days and indicates that the linear law had probably been exceeded. This assumption seems to be verified by pair No. 2 where under a live load of 250 lbs. per sq. ft. the indicated deformation in the concrete is 11.3 divisions while the computed deformation as figured from the corresponding steel deformation is but 9.7. In the reduction of the data however this has been ignored and the linear law assumed to be in operation. An analogous condition obtains at pair No. 5. These facts should be kept in mind in considering the question of thrusts along lines connecting columns.

As indicated above, at any point on the tensile side of a neutral surface where the scaled deformation exceeds 1.93 divisions concrete is assumed to have ruptured.

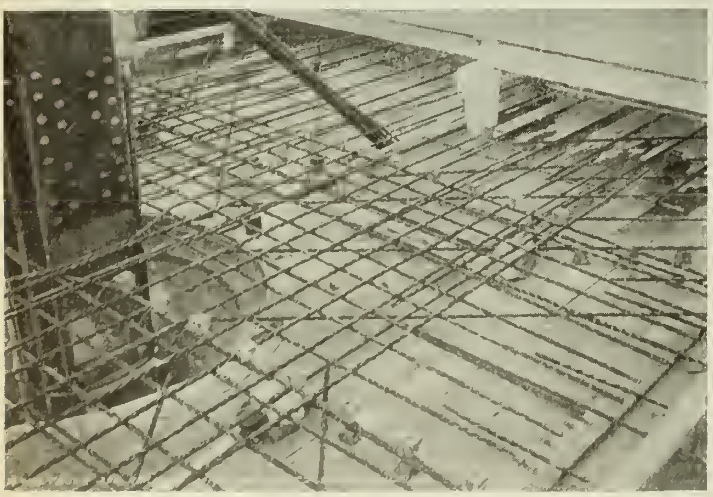


Fig. 4

Combined Bending Moments and Thrusts

Preliminary to a further examination of Plates VI, VII and IX a brief consideration will be given to the phenomena of thrust combined with bending. Assume a beam of solid section and of homogeneous material of cross-section 6″ x 6″ subjected to such an external action that stresses on two opposite faces of 300 lbs. per sq. in. in compression and 100 lbs. per sq. in. in tension exist, these stresses having been presumably observed with the aid of an extensometer. In accordance with usual assumptions, the average stress existing at the cross-section (and the actual stress at the Center of Gravity) is a compression of 100 lbs. per sq. in. and the consequent resultant thrust is 3600 pounds. Now the observed phenomena of stress in this instance may be due to:

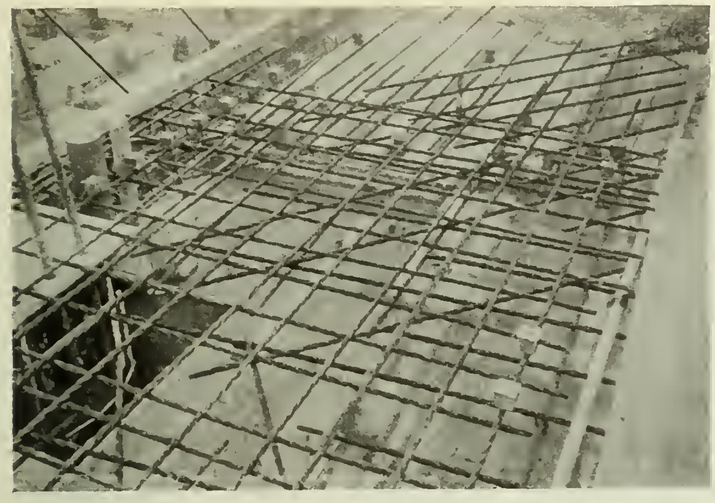


Fig. 5

(1) a central thrust of 3600 lbs., plus an external bending moment of 7200 in-lbs.; or (2) a thrust of 3600 lbs. acting with an eccentricity of 2 ins. toward the face which is known to be in compression.

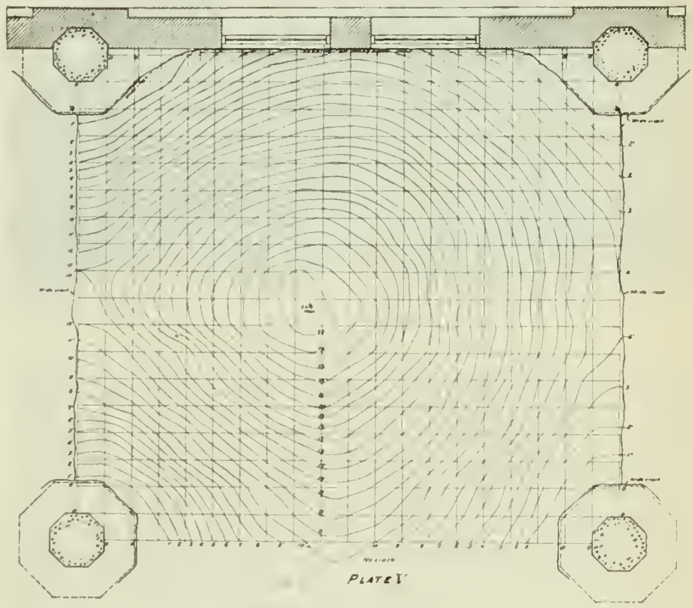
A little reflection will show that the external bending moment is a maximum when the eccentricity is zero, and is zero when the eccentricity is at its maximum of 2 inches, the thrust being constant. Indeed the two conditions above indicated are but the limits in an infinite series, the inch-pounds following being some of the intermediate steps:—(3) a thrust of 3600 lbs. whose eccentricity is 1 inch combined with a true external bending moment of 3600 inch-pounds; and (4) a thrust 3600 lbs. whose eccentricity is ½ inch combined with a true external bending moment of 5400 inch-pounds. The member, it will be seen, may act as a true column with eccentric oad or one of many combinations of true column and true beam; which of these the observer has perhaps no means of knowing. Of one thing, however, he may be sure and that is the magnitude of the thrust.

Fig. 6

Thrusts

In this test, much evidence as to the presence of thrust has been found, as an examination of Plates VI, VII and IX will show. In all instances where tension exists in the concrete at a section it is impossible to be certain as to the amount of the thrust. In such cases the values given are to be regarded as indications of what probably occurs. Where observation showed compression to exist in both faces of the slab, there is little doubt as to the extent of the thrust, except such as is due to the inevitable inaccuracies of the instrument which was employed.

The deformations indicated on Plates VI, VII and IX were converted into stresses in the usual way and the total tension and total compression for one foot width of slab found for each pair of gauge lines under the 125 lb.



load. In determing the amount of tension taken by concrete it was considered advisable to ignore all concrete nearer to the surface of the slab than the outer fibre of the tensile reinforcement because this concrete in all cases had been much cut up by gauge holes, and as before mentioned, only that concrete between the neutral axis and the point where its extension would indicate a stress of 200 lbs. per square inch due to dead and live load was considered. When the total tension at any one section was compared with the total compression at the same section, it was found that in every case the total compression exceeded the total tension, and the amount of this excess, for the 125 lb. load has been designated by the letter " H " on these diagrams.

With the span as an axis for ordinates, these thrusts have been plotted vertically in Plate VIII and the thrust curve drawn. The features of the curve are that the thrust apparently increases toward the column and diminishes toward midspan, and that the thrusts are generally less in the wall panel than in the interior one.

Fig. 7

thrust existing at each section was divided by the transformed area of the section, neglecting, as in the previous case, all concrete on the tension side of the slab more remote from the neutral surface than the outer fibre of the tensile reinforcement. This gave the average stress due to thrust from which was determined the corresponding deformation. Since the thrust was assumed as being applied at the center of gravity, the deformation would be uniform over all portions of the cross section.

On each section another deformation line was drawn, parallel to the original and at a distance from it equal to the deformation corresponding to the average stress due to thrust. Thus for each section a new neutral surface was located depending solely on the beam action existing. Values of k and j were then readily computed, and from the formula $M = \frac{e_c}{2} \times bd^2 \times k \times j \times 58.7$, the resisting moments in inch-pounds for a strip one foot in width were found for all sections, e_c being the maximum compressive deformation at the section in dial divisions. The constant 58.7 is the stress in the concrete corresponding to a reading of one division on the dial. Since, as may be seen from an inspection of Plates I and II, the stress at the edge of a band of reinforcement is practically the same as that at the centre of the band, the resisting moments for the one-foot strip above mentioned were multiplied by the half

This latter phenomenon is really not difficult to understand since the capacity of wall columns to resist thrust is obviously less than that of interior columns. Why the thrust should augment toward the column is, however, not so clear. Had the slab consisted of a series of radiating spoke-like elements, each independent of its neighbor except at the common hub-like drop panel, the increased radial compression toward the centre would be perhaps capable of explanation. But the independence of radiating elements in the slab cannot, by any reasonable effort of the imagination, be said to exist.

On the same drawing is shown an approximate line of thrust for the slab considered as an arch. It was constructed on the assumption that the slab behaved entirely as a continuous column without the existence of beam action as such. This is equivalent to assuming the existence of maximum eccentricity and that all bending is due thereto. With the thrust at each section known, its point of application was determined. These points were plotted in position on the cross-section of the slab and connected as shown.

Moments

For the derivation of bending moment coefficients it is better to consider that all the bending is due to beam action. This is equivalent to saying that the thrusts act at the centers of gravity of the various sections. Plates VI, VII and IX, were again made use of in the following manner to determine these coefficients. The

Fig. 8

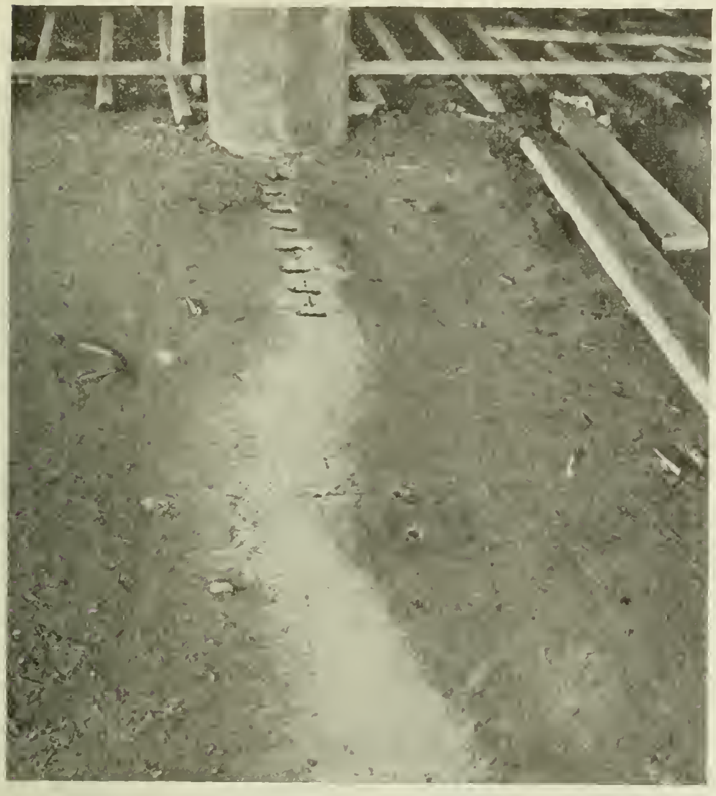


Fig. 9

panel width, to give the moments for the respective "strips" or "sections" of the various ordinances with which comparison was made.

Bending moments at the various sections are expressed in the Chicago ordinance as M = C W L, in which C is a constant depending upon the location of the section under consideration, W is the total panel load, and L the panel length. Given the values of M, W. & L, the coefficient C may be determined from the formula $C = \frac{M}{WL}$ For the interior panel under consideration WL = 125 (20.25 x 21) 20.66 x 12 = 13,170,000 in-lbs. For the wall panel WL = 125 (21.0 x 18.7) 19.9 x 12 = 11,720,000 in-lbs. or 125 (18.7 x 18.7) 18.7 x 12 = 9,820,000 in lbs. depending multiplication on whether the diagonal or the direct bend is under examination. The coefficients may, therefore, be found at any point by dividing the moment of a half panel strip by the proper value of WL. Plate X gives in compact form the computations for selected gauge lines, and also a comparison of the constants at the critical points with those prescribed in the various ordinances.

In the case of the rulings of the Joint Committee and the American Concrete Institute a more ready comparison was made by computing the moment for a strip one foot wide as determined by these rulings. The relation of the computed moments to the actual "M" for strips one foot wide given in Plate X may be seen at once. Where the Joint Committee ruling specifies that the sum of the moments in certain "sections" shall be not less than a certain quantity, such an addition has been made both for the required moment and the actual moment. The American Concrete Institute specifies a total moment for four "sections" and subdivides it into four parts, giving a minimum requirement for each of the four. The aggregate of these four comprises but 90% of the total specified moment, it being assumed that the remaining 10% will be distributed according to the judgment of the designer. Consequently the computed moments have been added and multiplied by $\frac{100}{90}$ for comparison with the sum of the actual moments. Without such an augmentation the American Concrete Institute moments appear small.

On the whole, the coefficients derived correspond very closely with those prescribed by the Chicago Building Ordinance and by the American Concrete Institute. At sections No. 1 and No. 17 the former being adjacent to an unloaded panel and the latter to the wall, the coefficients are almost identical and slightly lower than those prescribed by the Chicago ordinance. At sections No. 9 and 10, the coefficients are again almost identical, but in this case somewhat larger than those prescribed by the Chicago ordinance. Had the load extended indefinitely in all directions, the coefficients for sections No. 1 and 17 would probably have been larger, and those for sections 9 and 10 smaller. At midlength of the direct band in the interior panel, section No. 5, the coefficient is again somewhat larger than that prescribed by the Chicago ordinance, which is again due no doubt to the unloaded conditions of the adjoining panel. The influence of the large drop head on the short panel lengths between columns 20 and 21 may be seen in the fact that at section No. 14 the coefficient is considerably smaller than that required by the Chicago ordinance. In general the bending moment coefficients as determined from this test approximated very closely those prescribed by the City of Chicago.

As a practical suggestion for the consideration of thrust in design, it might be feasible to so modify the working stresses in concrete and steel by lowering the former and raising the latter so that these when corrected by the effect of the thrust would approach those values in reinforced concrete design which present practice favours.

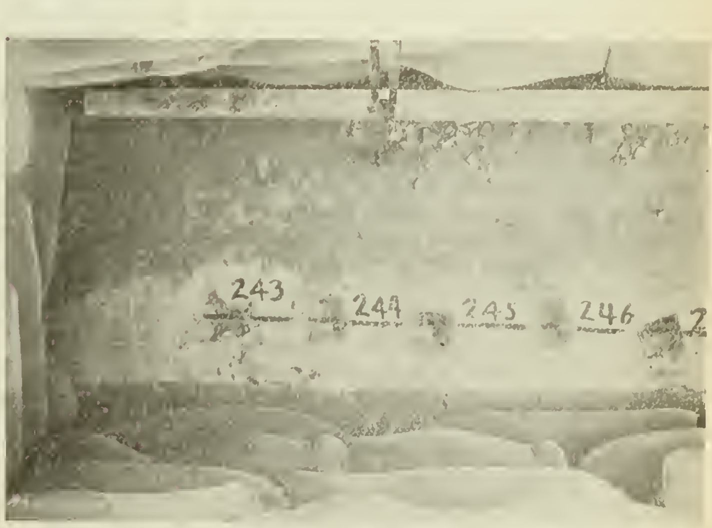


Fig. 10

To illustrate, consider a slab in which sufficient steel is imbedded to take care of tension in bending. Suppose a thrust of 7200 lbs. per square foot, acting centrally, is anticipated in the constructed slab. This will mean 50 lbs. per square inch compression in the concrete and 750 lbs. per square inch compression in the steel, over and above that which beam action would create. If then instead of stresses of say 750 lbs. per square inch in the concrete and 17,000 lbs. per sq. inch in the steel, which present practice seem to favour, values of 700 lbs. per sq. inch and 17,750 lbs. per sq. inch be adopted for flat slab design, the stresses resulting from the combination of bending and thrust in the finished structure in service would approximate more nearly those which the designer anticipated.

Bending Moments in Columns Under Eccentric Loadings

On Plate III will be found in addition to the deformations obtained on the gauge lines on the slab, those located on the wall and interior columns. It will be observed that for the interior column under an applied live load of 125 lbs. per sq. ft. the average deformations are 2.63 and 2.06 divisions for the lower and upper groups respectively. Similarly for an applied live load of 250 lbs. per sq. ft. these deformations become 4.98 and 5.53 divisions respectively. This column has an external diameter of 26 inches and contains a steel core consisting of a 14-inch, 138 lbs. per ft. Bethlehem H section with two 10″ x ½″ and two 10″ x ⅜″ steel web plates. In addition there are four 1″ diameter round steel rods.

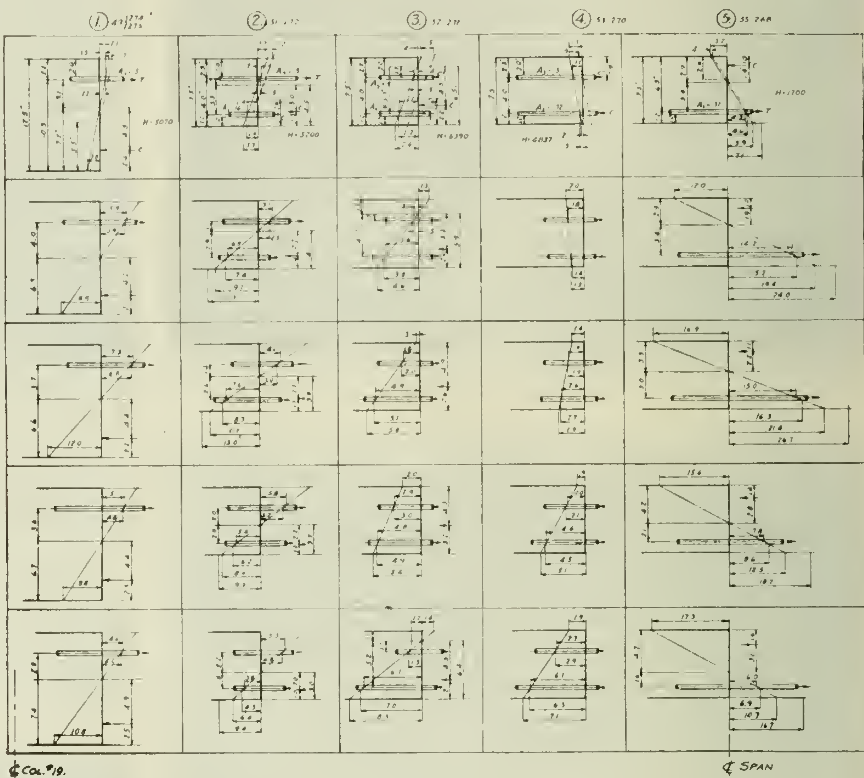


PLATE VI

In general the thrust would not affect the thickness of the slab at sections remote from the column, since at these points the percentage of steel is so low that the concrete stresses are quite small, as is verified by the tabulated values. Around the column capital and near the periphery of the drop head on the under surface of the slab, the compression due to beam action will be considerably augmented. That this is not a mere assumption, but an actual fact, is shown by the comparatively high stresses recorded under the heavier loadings. There has been a tendency on the part of some to lower unduly the bending moments and increase the allowable stresses in flat slab design. While this may be satisfactory on sections remote from the columns, great care should be exercised in formulating regulations governing the depth and width of drop panels in order that compressive stresses due to negative moment and thrust may not run too high.

The total area of steel is, therefore, 61.2 square inches, giving a net area of concrete of 469.7 square inches. Assuming an elastic modulus for concrete of 2,350,000 lbs. per sq. in. the load producing a dial reading of one division is 469.7 x 58.7 or 27,500 lbs. for the concrete; and 61.2 x 750 or 45,700 lbs. for the steel core, making a total of 73,200 lbs. in accordance with the usually accepted theory for the longitudinally reinforced concrete column. The roof slab having been poured during the interval which elapsed between the taking of the initial readings and observing the deformation after the application of the 125 lb. load, its weight must properly be added to the latter. This gives an aggregate load of 200 lbs. per sq. ft. or 82,000 lbs. per panel. The dial reading corresponding to this panel load computed as above should be $\frac{82,000}{73,200} \times 1$ or 1.12 divisions. But the actual deformation corresponding to this load was, as stated above, 2.63 divisions in one case and 2.06 in the other, values approximately twice as great as those computed on a theoretical basis. When, however, the 250 lbs. per sq. ft. was removed from two of the four panels (equivalent to removing 125 lbs. per sq. ft. from four panels) the average recovery on the lower series of gauge lines was .875 divisions as against the .70 divisions arrived at from computation. This is the only instance in the behaviour of this column in which approximate agreement between the observed and the figured deformations occurs. A study of the recorded behaviour for wall column No. 21 shows a similar discrepancy between computed and observed deformations to exist.

Let it be assumed that the uniformly distributed load on any interior panel is lifted. The tangent to the beam axis over either support adjacent to the unloaded panel is no longer horizontal, but the angle of movement is less than it would be were there neither continuity of beam nor rigidity of column to influence the performance. (In that case the bending moment at either support would be zero). Actually this moment is greater than zero, but less than 1/12 WL and the restraint supplied by the column plus that afforded by the beam sustaining its dead load only is obviously its equivalent. So it follows that at a panel point for the conditions laid down, the sum of the restraining moments in beam and support will not exceed 1/12 WL and may be much less than this value.

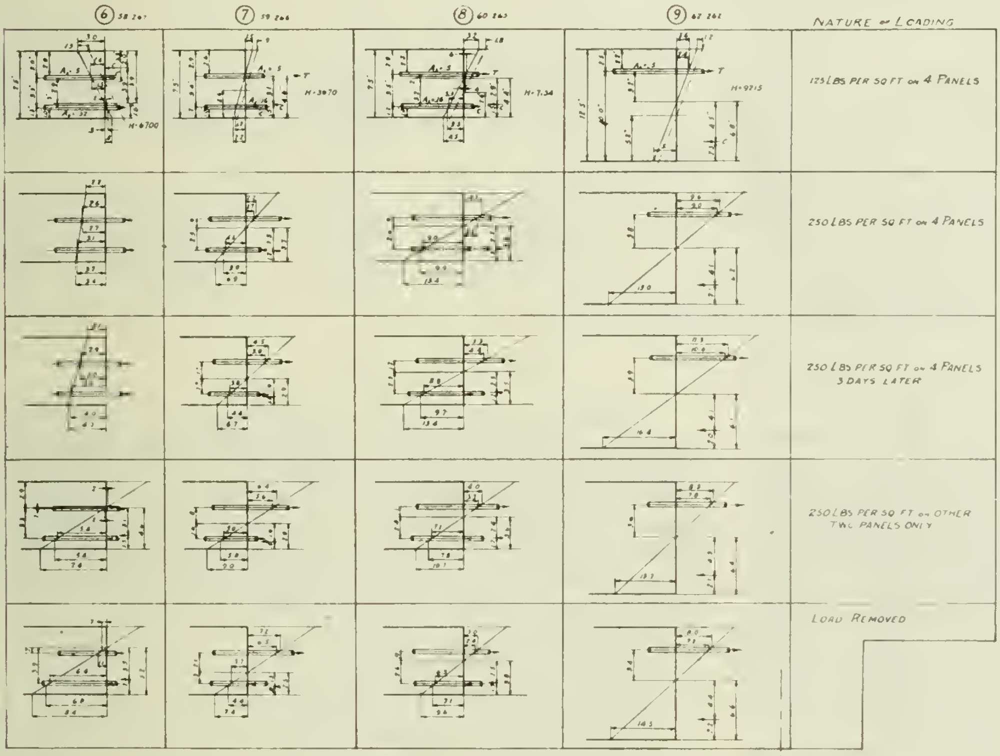


PLATE VI

Consider an indefinitely large series of equal and continuous beams, spans all equally and uniformly loaded and similarly constructed. The moments over supports and at midspans approach as limits, 1/12 WL and 1/24 WL respectively, giving a sum of negative and positive elements of 1/8 WL as its limit. This state of affairs would result if all supports were knife edges or the equivalent thereof. It will also be clear that by special or supplementary additions to the loading assumed, the coefficient 1/24 may be increased by diminishing 1/12 to a smaller value and may be decreased by raising 1/12 to a greater value. If in place of rockerlike supports, columns more or less rigid be substituted, the same statement will hold and moments will remain unchanged, because all tangents to the floor axis are horizontal over supports.

This hypothetical condition is doubtless almost never realized, since there is rarely either equality in rigidities or equality between story height and beam span. Moreover, in the flat slab type of construction the comparison is further affected by the fact that the beam is supplanted by a slab whose width is equal to the distance between column centres. It can be shown that the moment at the support in a cantilever of uniform section sustaining an end load varies directly as $\frac{E\,I\,\triangle}{L^2}$, where $\triangle$ is the end deflection. Since $\triangle$ is proportional to the product L $\ominus$, $\ominus$ being the angle of elastic deformation at the junction of column and beam, it follows that the moment of resistance is proportional to $\frac{1}{L}$ where E and $\ominus$ are constants for the three elements previously considered.

A computation, made with this principle in mind, shows that for a flat slab of the proportions of the one tested, the column even if unreinforced could not exceed 20″ in diameter without having a greater value of $\frac{1}{L}$ than the slab; and a 20″ column is the minimum allowable under good practice for the given panel dimensions. This would indicate that column No. 20, owing to its size and high percentage of reinforcement, was restraining the larger portion of the bending moment created by the unsymmetrical load, possibly 12/13 of the whole, half of it above and half of it below the floor line. The lower group of gauge lines on column No. 20 was located above the theoretical line of column contra-flexure, a distance equal to one third the distance of the latter from the ceiling and should, therefore, indicate about one third the bending moment in the column at the ceiling line.

Consider now a column of any constant section fixed at the end as in Fig. 11. If a couple M whose plane is vertical, be applied at mid-height, the axis of the column will assume a sinuous form with three points of contra-flexure, one of which is located 1/6 of the column height below the top, the second of which is 1/6 of the column height above the bottom, and the third at the point where the couple is applied. Further consideration will show that the bending moments in the column immediately below and immediately above the point of application of the couple are $\frac{M}{2}$ and $\frac{M}{2}$. Similarly the bending moments at top and bottom are $\frac{M}{4}$ and $-\frac{M}{4}$ respectively. Let now another restraining element, a beam for example be framed at the point of application of the couple and in the plane thereof. This element will be supposed to have a length equal to half the column length. Its rigidity for purposes of discussion will be considered equal to that of the half column and its remote end will be considered fixed. It will be clear that since there are now three restraining elements to oppose the couple M, each will contribute something to the resistance and from the conditions assumed, the contributions of all will be equal.

If instead of the combination described above, there is a series of columns rigidly connected by beams on any floor of a building, the analogy between the hypothetical and the real will be apparent. Let it be imagined that one beam only in the supposed series is loaded. Its ends are obviously restrained more or less where they join the columns and the moment existing at either end will be resisted by three elements, viz.: the column above the floor in question, the column below and the beam in the adjacent panel. If all of these possess equal rigidities, using the word in its broad sense, the restraining moments in all three will be equal. If, for example, the bending moment at one extremity of the loaded beam were $\frac{1}{20}$ WL the restraining moment in the column above the floor at the floor line, the restraining moment in the column below the floor at the ceiling line, and the restraining moment in the unloaded beam at its junction with the column might without great error, be taken as $\frac{WL}{60}$.

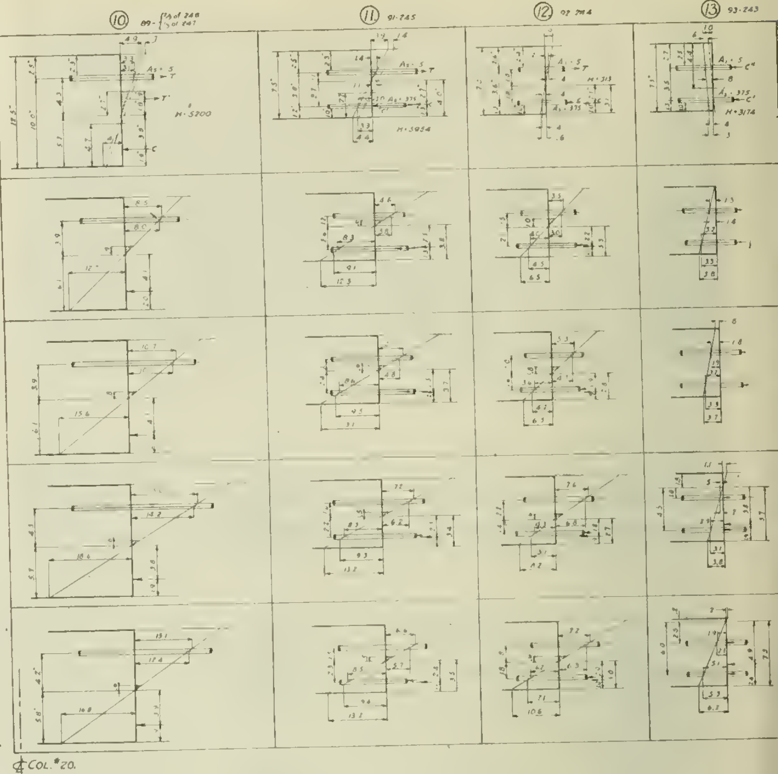


PLATE VII

When an attempt was made to check the behaviour of column No. 20 somewhat according to the foregoing, serious difficulties presented themselves as will be presently indicated. Assuming that the concrete had remained intact, it seemed proper to consider its behaviour in flexure by first computing the moment of inertia of its cross-section. This was done by the usual method for heterogeneous sections with the following results.

Moment of inertia of steel area........23,200 ins.^{4}
Moment of inertia of concrete area....18,700 ins.^{4}
Moment of intertia of entire area......41,900 ins.^{4}

On Fig. 12 will be seen a curve purporting to show how the bending strains appear to have varied across a right section of this column on the removal of a load of 250 lbs. per sq. ft. from two of the four contributing panels. This change of loading it will be remembered is the one that produced an average deformation approaching somewhat the computed value. The maximum flexural deformation shown on this graph is 4 divisions, the equivalent of a stress of 232 lbs. per sq. in. in the concrete. The average deformation due to the indicated change in loading, as distinct from bending, is .875 divisions. The bending moment computed from the formula M = S f, is 757,000 inch-pounds of which 337,000 inch-pounds is resisted by the concrete and 420,000 by the metal. Moreover since the position of the gauge lines on the column is one-third of the distance between the theoretical point of contra-flexure and the plane of the floor slab above, the computed maximum bending moment for the column would be three times the value given or 2,271,000 inch pounds and this takes no account of the nearly equivalent resistance offered by the column above the floor. The Chicago

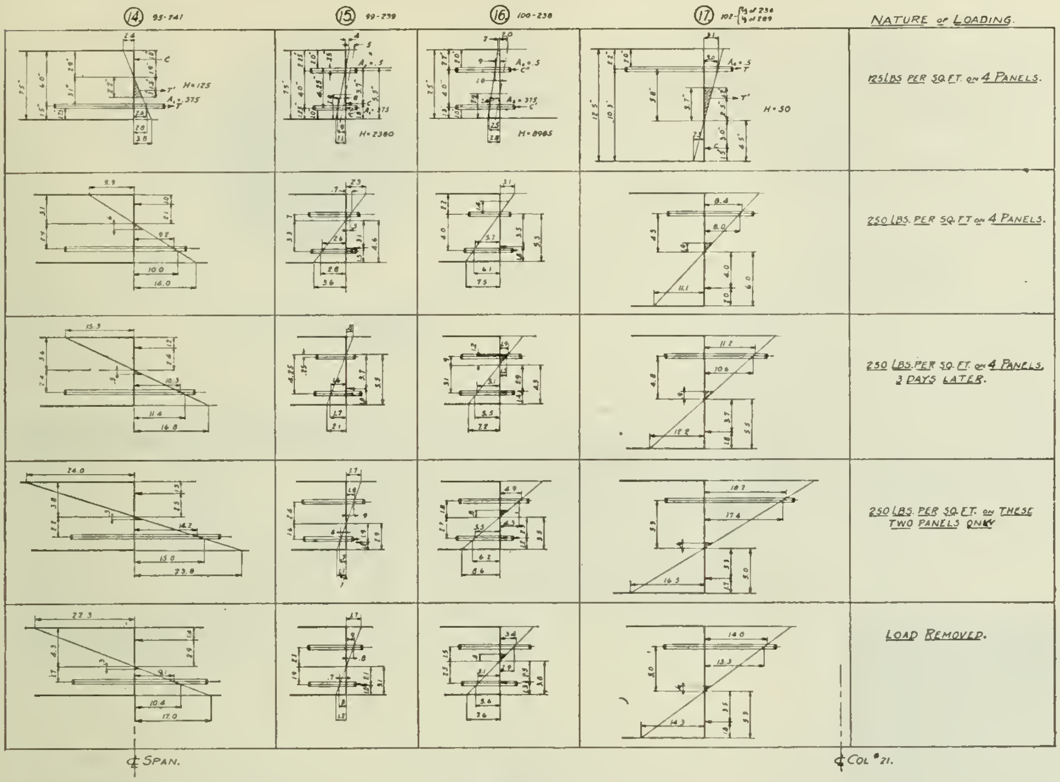


PLATE VII

flat slab code suggests $\frac{WL}{30}$ as a bending moment to be provided for in column design. For the case in hand this would be equal to 438,000 inch-pounds. Apparently then the steel core itself has provided a resistance to bending much greater than is called for by this regulation and the whole column is supplying one many times in excess of the same requirement and much greater than what seems to be indicated by theory. At the upper series of gauge lines on the same column, a similar state exists. In addition it should be borne in mind that the gauge lines in this series bridged a construction joint and that little if any tension in the concrete could exist there.

The features then of the column tests is the lack of agreement between the evidence of the extensometer and the facts as they are known. This applies to both the direct stress and the bending phenomena. As possible explanations the shrinkage of the concrete, the existence of unrecorded loads and the inaccuracy of the instrument have suggested themselves.

F. R. McMillan, in a discussion on the phenomenon of "flow" in concrete under load in Transactions of the American Concrete Institute, 1917, exhibited a graph showing the behaviour of concrete columns under load, in which the relative deformation or "flow" at 60 days following construction, varied from 1 in 10,000 to 2 in 10,000. Moreover this deformation seemed to be more or less proportional to the age of the member up to a six months' limit. Mr. Considere asserts that the shrinkage of mortars in air will vary from 3 in 10,000 to 5 in 10,000, although no time interval is given. So far as the evidence of the extensometer is concerned, it would seem that "flow" and shrinkage would be similar.

If shrinkage be restrained by the presence of a metal core (the non-shrinking element) the envelop of concrete will be in tension and the core in compression. This, of course, assumes that a perfect bond between the two materials exists. In addition to this the core will have to sustain the major portion of the applied load. If the restraint be equal to 1 in 20,000, it would account for a tension in the concrete envelope of nearly 120 lbs. per sq. in. and the resulting and, in the aggregate, equal compression thrown into the steel would be sufficient to account for some of the excessive deformation previously referred to. On the removal of the 250 lbs. per sq. ft. load from two

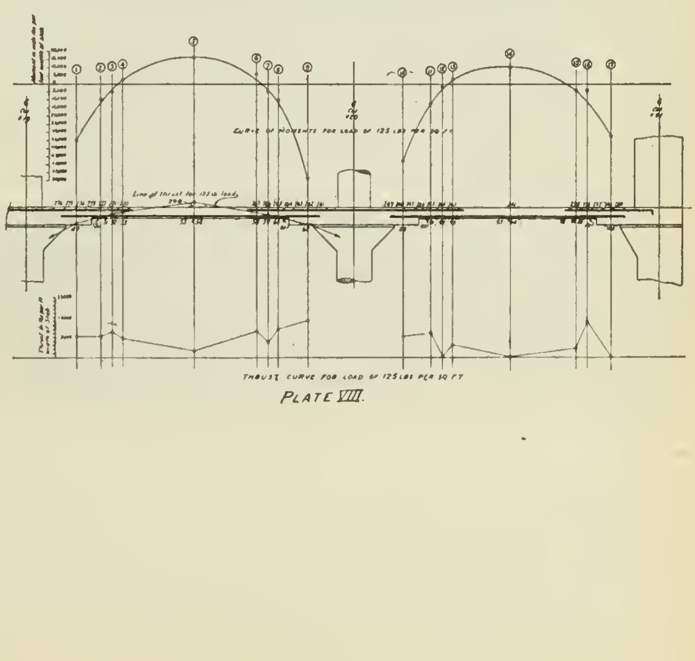


PLATE VIII.

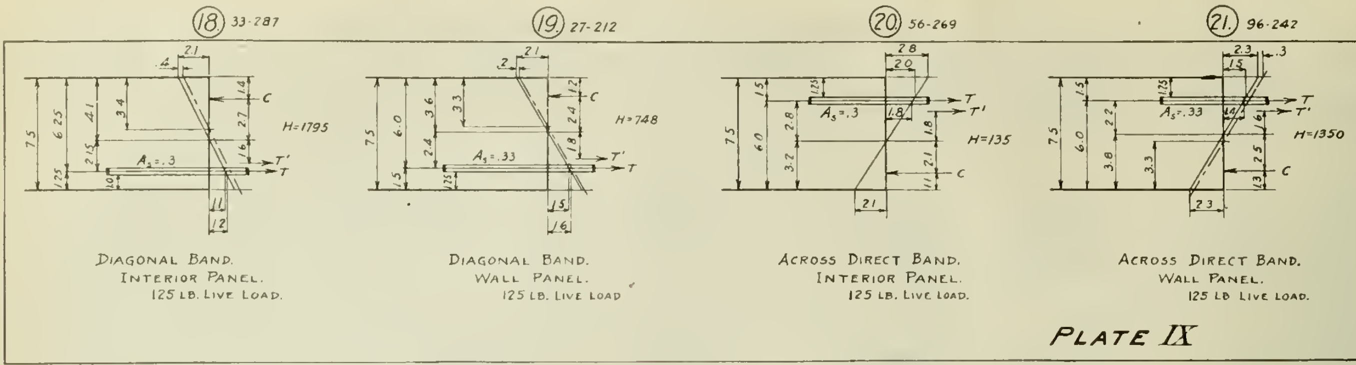


PLATE IX

Section No	H	Area	Unit H	Corresp. Deform. in divisions	Slope of Sect. per inch	Change in position of Neut. Axis	k	j	Deformation ϵ_c	$\frac{\epsilon_c}{I}$	b	d	d²	M, inch lbs per ft width	Width of strip	M, inch lbs per strip	WL	$C=\frac{M}{WL}$	c Chicago	C. Joint Committee: M, in lbs per ft	Joint Committee: Total must exceed	Joint Committee: Total is	C. American Concrete Institute: M, in lbs per ft	ACI: Total must exceed	ACI: [illegible]
1	3070	[illegible]	[illegible]	.66	36	[illegible] lower	[illegible] .33	.87	[illegible]	1.07	12	10.25	105.0	-34,600	10'3½	357,000	13,170,000	1/37	1/30	47,800			40,400		
5	1700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] higher	[illegible] .42	.86	[illegible]	1.67	12	6.25	39.0	-16,600	10'3½	171,200	do	1/77	1/80	21,500 min 26,900 max			14,550		
9	9215	[illegible]	[illegible]	[illegible]	75	[illegible] lower	[illegible] .52	.83	[illegible]	1.95	12	10.0	100.0	-58,000	10'3½	598,000	do	1/22	1/30	47,800			† 40,400		
10	3200	[illegible]	[illegible]	.69	72	.56 lower	[illegible]	.84	[illegible]	1.71	12	10.0	100.0	-47,500	10'6	498,000	9,810,000	[illegible]	1/24	45,600			40,100		
14	125	[illegible]	[illegible]	.03	83	.03 higher	[illegible]	.84	[illegible]	[illegible]	12	6.0	36.0	+10,740	10'6	112,800	do	[illegible]	[illegible]	30,500 min 73,600 max	(14)+(19) > 34150	21840	14,400		
17	50	[illegible]	[illegible]	.01	[illegible]	.01 lower	[illegible]	.80	[illegible]	1.15	12	10.25	105.0	-31,900	10'6	335,000	do	[illegible]	1/24	* 19,000 min			40,100		
18	1795	[illegible]	27.0	.38	[illegible]	[illegible] higher	[illegible]	.83	[illegible]	0.86	12	6.75	39.0	+10,460	10'3½	104,000	13,170,000	1/122	1/120	8960 min 14,320 max	(18)+(5) > 35,860	27,060	9700		
19	748	[illegible]	9.5	[illegible]	59	.27 higher	[illegible] .53	.82	[illegible]	.97	12	6.0	36.0	+11,100	9'11"	114,500	11,770,000	1/102	1/96	8550 min 13,680 max			9,500		
20	135	[illegible]	[illegible]	.03	62	.05 lower	[illegible] .58	.83	[illegible]	1.04	12	6.0	36.0	-11,800	10'3½	121,800	13,170,000	1/108	1/120	11,950	(20)+([illegible]) > 39750	58,100	8080		
21	1350	[illegible]	[illegible]	.29	[illegible]	.21 lower	[illegible] .55	.82	[illegible]	1.01	12	6.0	36.0	-11,500	9'11"	114,500	11,720,000	1/102	1/96	11,400	(21)+([illegible]) 43700	51,200	7,200		
																					Σ = 1, 5, 18 and 20		= 72,730	[illegible] = 80,810	85,160
																						Σ = 10, 14,	19, and 21 = 71,200 [illegible]		[illegible]

$M = \frac{1}{2} \cdot bd^2 \cdot j \cdot k \cdot \epsilon E$

ϵ being compressive deformation due to bending

* depends on relative rigidity of slab and wall col.

† Taken but once [illegible]

PLATE X

of the four panels, it might with some show of reason be assumed that because of the greater age of the concrete and the diminished loading the tendency to shrink would partially disappear. This assumption receives color from the fact that the mean changes in deformation observed agree roughly with the computed value as stated previously, the former being .875 and 1.1. divisions for the lower and upper series respectively and the latter .70.

Another circumstance which would operate to produce a discrepancy between the observed and the computed readings, was the fact that during the test the material required for the brick curtain walls was being elevated to the floors where it was to be used. The practice was to pile it on the floor adjacent to the hoist until such time as the workmen would require it. As the hoist was located in the panel immediately to the West of those under test, it is conceivable that some of the material which had been hoisted was placed on floor area above and tributary to column 20, and that its presence there was evidenced in the large readings obtained. This circumstance is one, the influence of which cannot be estimated in any quantitative way. Even though this additional loading on the upper floors were present, it will be conceded that it would operate almost entirely as a centric load on the column and that all manifestations of eccentricity in the column and of bending therein could not properly be attributed thereto.

Finally it might be suggested that the element of error in observation is much greater here than elsewhere because of the cramped position of the observer and because the axis of the instrument must be held vertically.

The writers do not believe that shrinkage of concrete about the steel core would create therein such compressive

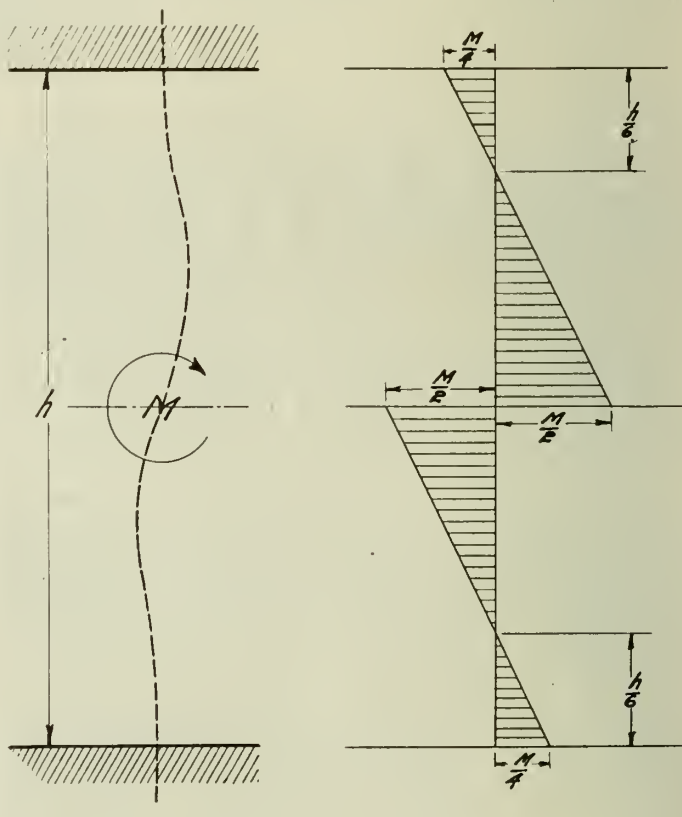
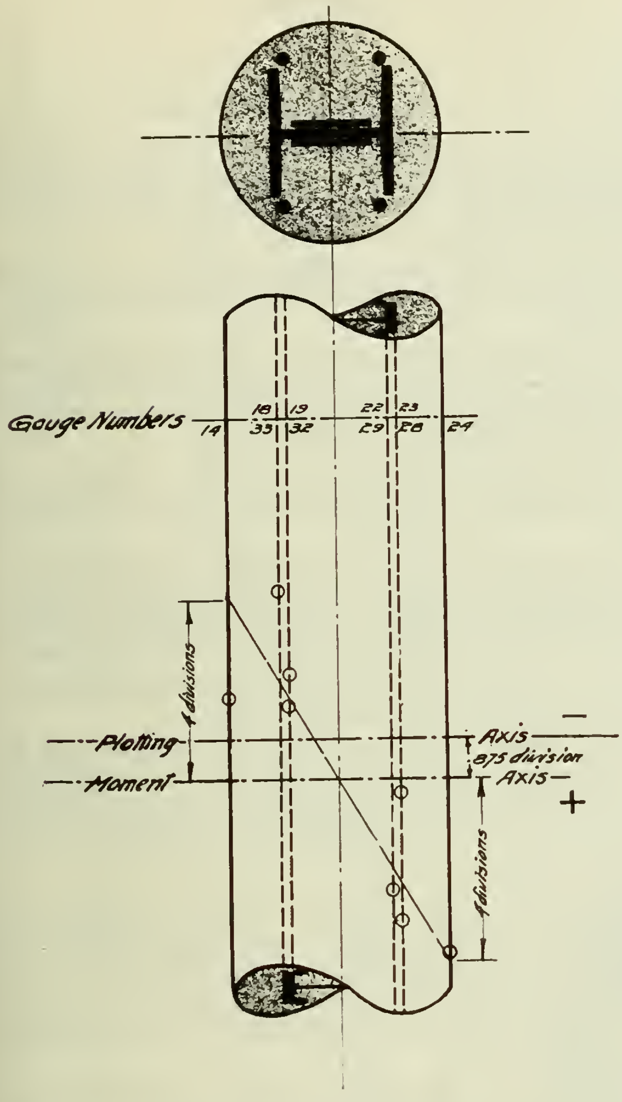


Fig. 11.



COLUMN 20, LOWER SERIES

Fig. 12.

stresses as the data sheets call for. Certainly this could not occur at a construction joint. The possibility of loads of material on upper floors could affect average deformations only and not the bending stresses, since the loads resulting therefrom would of necessity be centric. The irregular character of these results is possibly largely due to inaccuracies consequent on using a high clearance instrument in a vertical position and by an observer working in a cramped situation. The consistency in results elsewhere shows that when the instrument is used in the horizontal position flexibility due to high clearance may be overcome by skillful handling.

Community Halls and Athletic Fields

The Ontario Government proposes giving financial aid to the townships for establishing community halls and athletic fields in order to develop community spirit in the province.

* * *

"Trautwine" The Engineer's Pocketbook

Advance sheets have been received covering practically all the new material added in preparing the forthcoming twentieth edition of "Trautwine." The most radical and important change is an improvement in the arrangement of the several articles included, and the modernization and extension of the various articles on certain railroad subjects. In addition, the rules relating to the ellipse have been modernized, extended and re-written, a new isogonic chart is shown and the table of zimuths of polaris has been revised to cover present dates.

* * *

B. F. C. HAANEL, M.E.I.C., Ottawa,
Winner of the Gzowski Medal for 1918

* * *

The Provincial Government of British Columbia propose introducing a bill to provide for the borrowing of three and a half million dollars for the important public undertakings in the province during 1919. Part of this amount will be devoted to an emergency fund of one and a half million dollars, for the purpose of providing work for returned soldiers. Practically the whole of this amount will be for capital expenditure on public work in the province, chiefly trunk roads.

Suggested Harbour Improvements for Greater Montreal *

By E. S. M. Lovelace, M.E.I.C.

In what follows the writer does not propose to touch upon any special development in the way of new wharfage accommodation, or on any improvements along the lines of better transportation facilities, or, in fact, to concern himself with any of the matters usually associated with harbour works properly so called.

These can all well be left to the constituted authorities to inaugurate in due course, as the need for such arises, *as it surely will arise*, in the not distant future.

It seemed to the writer, however, that now, when the whole world so to speak, is being re-arranged, is the time to go into, and, with the greater experience that meanwhile has been gained, consider afresh the problems confronting us on every hand.

Montreal, from its geographical position alone, in the future, even more than in the past, must inevitably become the principal gateway from the ocean to the whole continent. That being so, no minor consideration as to cost, should be allowed to stand in the way of improvements from which all Canada would ultimately benefit.

In a broad sense, our harbour as it at present stands, suffers from three great natural drawbacks, and, in proportion to the extent that the effects of such drawbacks may be mitigated or entirely done away with, lies the measure of success attending efforts in the direction of the requirements of a harbour for Greater Montreal.

These three natural drawbacks as they appear to the writer, in order, are:—

1. *Excessively* strong current over the whole of the water front from the canal basin to the foot of the Island opposite Varennes.

2. The amount of dredging necessary to provide sufficient depth at low water for the larger ocean going vessels.

3. The ever present danger of floods occurring each Spring and Fall, with all the consequent inconvenience to, as well as the marked lowering in value of the *lands* in the districts affected on both sides of the St. Lawrence.

These three drawbacks are so well known, that it seems almost superfluous to mention them. They have occupied the attention of the harbour authorities, and, of *commissions*, both civic and federal, and yet, heretofore, no adequate method of dealing with all three, has as yet been brought forward.

Under these circumstances, an idea which occurred some time ago to the writer (an idea the *feasibility* of which such further study as he has been able to devote to the matter has tended to confirm) is now put forward, in the hope, that discussion before the Montreal Branch of *The Engineering Institute of Canada*, may bring out, if such exist, any inherent flaws in the proposal.

Should the criticism of the members prove favorable as a whole, then, the proposal could be brought to the notice of the *Authorities* competent to take action in so large and important an undertaking.

*Read before the Montreal Branch of *The Institute* on March 6th, 1919.

Briefly, *the proposed scheme*, is as follows:—

As indicated on drawings Nos. (1) and (2), and more in detail, on drawing No. (3), a *submerged dam* would be placed across the river opposite Varennes to the foot of the Island of Montreal at Bout de l'Ile.

This dam would be of sufficient height, to raise the level of the river say ten feet above ordinary low water at these points.

The immediate effect of this, would be to back up and drown out the *St. Mary Current* and convert the whole of the river from the foot of Nuns Island to a few hundred feet above the submerged dam into a lake.

This lake would then become the Harbour of Greater Montreal, and under the control of the Harbour Board.

At the same time, the *channel* proper, and, in fact, the whole river between the above mentioned points, would be correspondingly deepened, so that further *dredging operations* in the ocean channel would be quite unnecessary.

Thus, at one stroke, the two first drawbacks would, at a very moderate cost, be done away with.

With regard to the third drawback, there is room for some difference of opinion, as to the effect this damming of the river might have on the flooding of the banks during the taking of the ice each winter, and its breaking up the following spring.

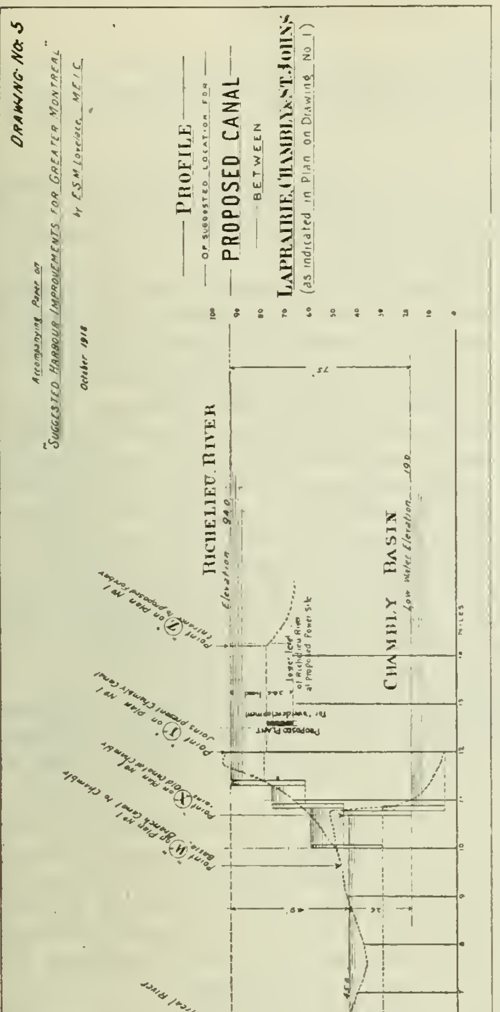
After giving the subject close consideration, and having before him the facts very carefully collected and presented in a report, made many years ago by the "Montreal Flood Commission," the writer is of the opinion that the damming would result in doing away largely, if not entirely, with the menace of these periodical floods.

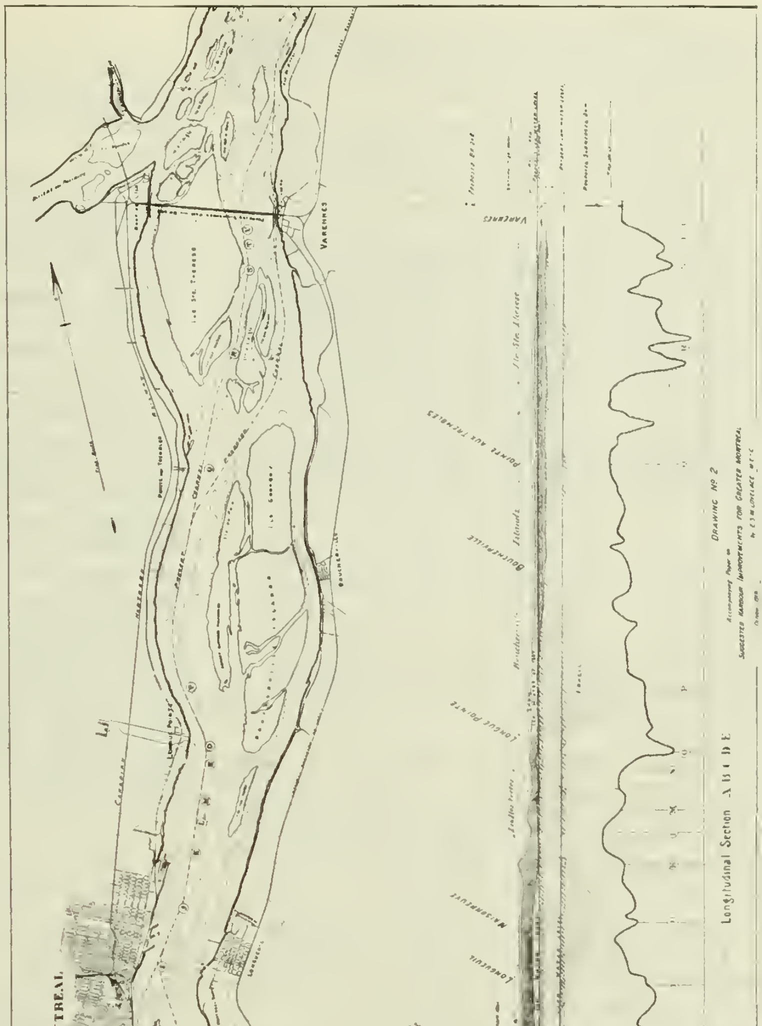
This aspect of the case is, however, presented more fully further on in the paper, and, it is hoped, that the opinions and experience of other Members (more fully qualified to speak possibly than is the writer) will become available on this point.

Before going into this, however, the paramount importance of the *effect* which the damming back of the river would have upon ocean navigation cannot fail to force itself upon ones consideration, for, upon this point chiefly, if not altogether, must depend the general acceptance of so radical a scheme.

If it can be shown to curtail, in any marked degree, the free passage of vessels into the Harbour, then, in spite of other obvious advantages, it could not possibly be entered upon. If, on the other hand, there is ground for the belief, that in this respect, there would be a marked improvement in the speed and ease with which water so dammed could be traversed by all vessels, ocean going or river steamers, then, at least, the proposal will be worth the closest study and attention.

Looking at the plan on drawing No. 2, it will be noted, that the existing *channel* for both ocean and river going


DRAWING No. 5
Accompanying Paper on
"Suggested Harbour Improvements for Greater Montreal"
by E.S.M. Lovelace, M.E.I.C.
October 1918
PROFILE
of suggested location for
PROPOSED CANAL
BETWEEN
LAPRAIRIE, CHAMBLY & ST. JOHNS
(as indicated in Plan on Drawing No. 1)
RICHELIEU RIVER
CHAMBLY BASIN
Low Water Elevation 190
Proposed Plant for Power Development
Montreal River
Surface of water
ST. LAWRENCE RIVER
Low Water Elevation 340
Miles


CITY OF MONTREAL
VARENNES
Longitudinal Section A B C D E
DRAWING No 2
SAINT LAWRENCE RIVER
SUBMERGED DAM AND BRIDGE

vessels passes to the *east* of Isle Ste. Therese, that is, on the Varennes side of the river, and this, in connection with other reasons, would seem to indicate that this would be a suitable place for the submerged dam.

As shown on the plan, it is proposed to place two large twin locks, each one thousand feet long (1000) by one hundred feet wide (100), at Varennes, with a depth of, at least, five feet on the sill.

Generally speaking one of these locks would be used for incoming, and the other for outgoing vessels, thus expediting their passage and at the same time doing away with the danger of collision. If one lock, however, should be temporarily out of order, or when repairs are being made, then, for the time being, there would always be one lock available for both up and down stream vessels.

Any slight delay in passing through the lock, would be more than compensated for by the ease with which, having no current to contend with, the vessel would reach its berth further up.

The existing ship channel would, of course,as indicated on the plan, be modified locally, to suit the position of the locks.

On the Montreal side of Ste. Therese Island, at Bout de l'Ile, a small lock, as shown, could be placed for the convenience of pleasure craft desiring to get below the dam or into the Ottawa River.

Wharves could be placed at any desired point, either on the Island of Montreal right down to Bout de l'Ile, or on the South Shore opposite, and, with the increased depth of water all over, due to the placing of the submerged dams, little or no dredging would be required.

On account of the small difference in elevation on the up and down stream side of the lock gates (ten feet or thereabouts) it will be possible to design gates of the type outlined on drawing No. 4 which, in place of opening in the usual way, would be elevated bascule style.

Such gates would have large circular counterbalanced drums, to which water could be introduced from the upper level, or let out at the lower (in the manner indicated on the drawing) so that the raising and lowering would be affected without any power being required other than that provided by the available head of ten feet.

The operator, by simply drawing a lever in one direction, or pushing it in the other, could start, stop, raise or lower a gate with ease and dispatch. There would be no machinery of any kind, and virtually nothing to get out of order.

On the approach of a vessel going say upstream, a gate would be raised into a vertical position, and as the vessel passed into the lock, this gate would close behind it. Immediately this was done, the gate at the upper end of the lock could be made slowly to raise, water from the higher level passing under the gate, at first slowly, and then, more and more quickly, raising the water surface in the lock to the higher level.

So soon as the upper gate was vertical, the vessel would pass out of the lock and continue on its journey.

The actual type of lock gate to adopt, however, is, of course, a mere matter of design with no specific bearing on the scheme as a whole.

Bridge at Varennes

As a detail of the scheme, it is also proposed to have a highway bridge (with provision for the tracks of electric and other railways) connecting Varennes with Bout de l'Ile.

This bridge would be carried on piers built up through the submerged dam, the sloping faces of the piers on the upstream side, serving to protect the dam from the action of ice jams, should such occur.

In crosing the canal locks, bascule bridges, similar in type to the lock gates (but at a higher level and of different design) would be placed, and operated of course in the same manner and in connection with these gates.

Across Ste. Therese Island, the railway tracks would be carried on the viaduct as shown, but the highway and electric railway, could very well, as indicated on drawing No. 3 reach the ground surface by properly designed ramps, thereby effecting a considerable saving in the cost of the bridge proper, and also resulting in a convenience to any inhabitants of the Island. The more especially would this be the case, so far as the latter point is concerned, should the Island (as it well might be now that the shores of Lake St. Louis are nearly filled up) ever come to be considered a desirable summer resort.

The proposed bridge would be of the greatest possible value to the inhabitants of Varennes and vicinity, as they would thus be brought within easy and direct access of Montreal Island.

The line of The Canadian Northern Railway from Quebec (now part of The Canadian Government System) reaches Montreal Island at Bout de l'Ile. Under existing conditions, freight and passenger traffic intended for the South Shore, is obliged to work its way slowly through the Montreal City terminals, eventually reaching its destination by way of the Victoria Bridge.

By having a branch line from Bout de l'Ile crossing over this proposed bridge and connecting in the manner shown with The Quebec, Montreal and Southern Railway at Varennes, all such traffic could be diverted directly to the South Shore.

General

The slack water (produced by the damming back of the river would be ideal for boating, sailing, canoeing, etc., so that all the water front from Montreal right down to Bout de l'Ile, on both shores of the river, would be suitable for summer residences, which now, generally speaking, are necessarily compelled to go to Lake St. Louis above.

So far, however, as the actual details of the proposal are concerned, it must of course be understood that the writer has not gone very fully into these. On further and fuller examination, it might for instance, be found preferable to use lock gates of the ordinary type, and the exact position and size of the submerged dam would require an exhaustive survey and much thought to determine.

The idea, is therefore, only presented in a general and very rough form.

Effect on Flooding

And now with regard to the effect the building of the dams would have on the prevention of flooding each Spring and Fall.

As clearly pointed out in the " report " previously mentioned of the Montreal Flood Commission for 1886-87.

" The St. Lawrence River is not subject to floods in the ordinary sense in which this term is applied to other rivers such as the Ohio and Mississippi. The floods with which we have to deal are not due to excessive quantity of water but of ice, and are entirely local, being confined to a comparatively insignificant extent of the river.

The St. Lawrence is a river of such width and depth that notwithstanding the great volume of water which it carries (its low water discharge above Lake St. Peter being three hundred and fifteen thousand cubic feet per second, (315,000) its extreme range between highest and lowest water marks is only about six feet, or one-tenth that of the Ohio at Cincinnati. Wherever this range is exceeded, as at Cornwall, Beauharnois and Montreal, it is only in winter, and is due to the packing of the ice. High water in the St. Lawrence and Ottawa occurs long after the departure of the ice, and seldom reaches within ten feet of the ice flood level. The river is so large and its banks of such height that when relieved of *ice* the greatest known height of water cannot flood Montreal. Even when covered with ice, it is only when the covering conceals a much larger body of other *submerged* ice that flooding is caused by it."

Plan and Longitudinal Section

(Drawing No. 2)

Drawing No. 2, based on one given in the above mentioned report of the Montreal Flood Commission, gives a plan and longitudinal section of the St. Lawrence river between the foot of the rapids and Varennes. The longitudinal section, taken along the dotted line A, B, C, D, E, ..., indicates the surface and submerged ice present in the river during the winter of 1886-87. This was the winter following the disastrous flood in the Spring of 1886.

The striking and surprisingly large quantity of submerged or frazil ice shown on this longitudinal section as compared with the comparatively small quantity of surface ice is at once apparent, and its consequent effect in the production of floods can easily be imagined. In fact, quoting again from the " report."

" These collections of frazil ice are the most important factor of the flood question, and, indeed, it may safely be asserted that they are the sole cause of them. In other words, if there were only field or bordage ice to deal with, no matter how often *they* were broken up, or broken off by wind or thaw, there would be no floods, because it is inconceivable that in a river over a mile in width, with a channel half a mile wide and thirty feet deep, enough of this ice could be sunk to raise the water to such an extent as to produce a flood. The tendency of field or bordage ice is to float, and it *resists* submersion with great force, while the tendency of frazil and anchor ice is to sink upon the slightest provocation, and follow submerged channels, taking all the windings of the currents until grounded in shallow water or arrested against the underside of the fixed ice, to which it freezes and forms a nucleus for further accessions of the same material, until this spongy downward growth reaches many times the thickness of the surface ice to which it is attached."

And further, " There is no formation (of either frazil or anchor ice) *when and where* the surface is covered with ice, and whereas large formations of both take place in the beginning of winter over the vast surface below the Lachine Rapids, the *further* formation of this ice ceases as soon as and wherever the ice bridge is formed."

It might be urged, even supposing the ice bridge was formed in a natural way (as is now the case in Lake St. Louis above) through the freezing of the slack water due to the proposed dam (which would form the water above Varennes into a virtual lake) that the frazil ice coming down throughout the winter from the rapids above would still, passing underneath the ice, adhere to its under surface and block the channel.

This view, however, in the opinion of the writer, is distinctly not borne out by the actual facts as ascertained by the Flood Commission and illustrated on the longitudinal section of Drawing No. 2.

There it will be seen that these formations of frazil are not continuous, as might naturally be expected, but occur in isolated masses, such masses varying greatly in depth.

There must be some reason for this, and the writer contends that whether or no such accretions of frazil occur underneath the ice surface is entirely a question of the speed of the current at any particular point.

As serving to establish this contention, it might be pointed out that in Lake St. Louis, no frazil was found underneath the ice over the whole extent of its surface with the exception of the one point at the head of the lake near Beauharnois where a swift current enters from the river above. Very little frazil was found in the South Shore channel, opposite the Boucherville Islands, where it has always been popularly supposed that the ice grounded. Below Varennes, where the river begins to widen and deepen, and where in consequence the velocity of the current does not exceed about two and a quarter miles per hour ($2\frac{1}{4}$), scarcely any frazil was found, and below, in Lake St. Peter (as in the case of Lake St. Louis above) none whatsoever.

In the Laprairie Basin on the other hand, which is very shallow and traversed with *strong currents*, large quantities of frazil accumulated. It might be here pointed out that, as stated in the report:

> " The condition under which the ice takes in Lake St. Louis are very different from those which obtain in the Laprairie Basin. Lake St. Louis closes entirely with severe weather, without the aid of drift ice, while the Basin does not close until it is filled up with *running ice*."

The greatest mass of frazil was, however, found in the St. Mary Current between Hochelaga and Longue Pointe, and the strong presumption is that this mass would not form if the current were done away with through the building of the dam.

Just why the frazil should accumulate only at points where the current is strong is hard to say. It may be, however, that the frazil formed all winter, as it undoubtedly is in the rapids above, once it comes into contact with the quiet, undisturbed and possibly slightly warmer water found in slack water underneath a coating of ice becomes disintegrated and returns to its natural state *as* water, whereas, in running and disturbed water, the temperature remaining at the critical point favours its adherence to the surface ice above.

It is possible that experiments might be carried out to determine the point definitely, and such experiments would be well worth while, for if it could be established that these accumulations of frazil will not occur in slack water, then the building of the proposed dam besides producing the advantages already drawn attention to, would remove for all time, from Montreal and vicinity, the necessity for guarding against the occurrence of floods.

Proposed Low Water Level in Harbour

The summer fall in the river from Victoria Bridge to the foot of the St. Mary Current is nine feet in three miles and the velocity of current four to eight miles per hour.

The rise of water which accompanied the closing of the river in December, 1886, as noted by the Montreal Food Commission at the respective points was as follows:

Sorel.........	4	feet	2	inches	above	low	water.
Vercheres.....	10	"	2	"	"	"	"
Varennes.....	11	"	2	"	"	"	"
Longue Pointe.	11	"	5	"	"	"	"
Hochelaga....	15	"	9	"	"	"	"
Lock Sill.....	16	"	11	"	"	"	"
Laprairie.....	9	"	9	"	"	"	"

There are no rapids between Hochelaga and Sorel, but there is a nearly uniform rate of fall and velocity of surface current between these points. The effect of the ice pack is seen in the fact that it raised the river at Hochelaga over three and a half times as much as at Sorel.

A section plotted from data collected by the Montreal Flood Commission showing the highest and lowest levels reached by flood waters in Montreal Harbour (at Lock No. 1, Lachine Canal) over a period of thirty-five years (that is from 1852 to 1887, inclusive) is shown inserted on the longitudinal section of drawing No. 2.

The levels are plotted with reference to the *top* of the revetment wall on Commissioners Street which stands at a height of 21 feet 6 inches above ordinary low water.

Here it will be seen that the lowest level noted in this period of thirty-five years at the taking of the ice was a point 11 feet 1 inch below the top of the revetment wall that is a point 10 feet 5 inches *above* low water, and the lowest level at the breaking up of the ice a point 9 feet 0 inches below the wall or 12 feet 6 inches above low water.

The corresponding points for the *highest* levels reached are 1 foot 0 inches above the top of the revetment wall or 22 feet 6 inches above low water at the taking of the ice, and 5 feet 10 inches above the wall or 27 feet 4 inches above low water at its breaking up.

With the proposed submerged dams in place, the low water level would, as shown, only be raised about six feet (6′ 0″) above *present* low water at lock No. 1.

It is clear, therefore, that in the period referred to there was never a season during which, at one time or another the river was not at least 6 feet 6 inches (12′ 6″—6′ 0″) higher than the proposed level for low water in the harbour and that, consequently, such damming would not necessarily entail any alterations in the heights of the various wharves, etc.

As already stated (and as shown on the longitudinal section) the water in December, 1886, reached a point 16 feet 11 inches above low water at lock No. 1, corresponding to about what might be called *Mean Flood Level.* This level would be 10 feet 11 inches (16′ 11″—6′ 0″) above the proposed low water level.

At Varennes the highest flood level noted by the Commissioners was 20 feet 0 inches above low water, and the lowest, assuming that the drop in the surface of the river retains the same ratio as that shown on the longitudinal section would be about ten feet (10′ 0″) above low water.

Proposed Low Water Level at Varennes

It is, therefore, apparent that, by placing the *submerged dam* where proposed and raising the surface of the river ten feet above low water at Varennes, the level would still be 1 foot 2 inches (11′ 2″—10′ 0″) lower at that point (and at all other points upstream correspondingly lower) than it was in the winter of 1886-87, a non-flood year.

As indicated on the section the St. Mary current would be wiped out completely.

Design of Dam.

A suggested type of dam is shown in section on drawing No. 3 in connection with an elevation of one of the proposed bridge piers, but the design is merely illustrative of the proposal and is not to be regarded as being in any sense final. In this, as in all other respects, suggestions would be welcomed by the writer.

The *upstream* side of the dam would, of course, have to be designed with an easy curve so that the ice in passing out to sea would not encounter an obstruction and lodge there.

Type of Lock Gate

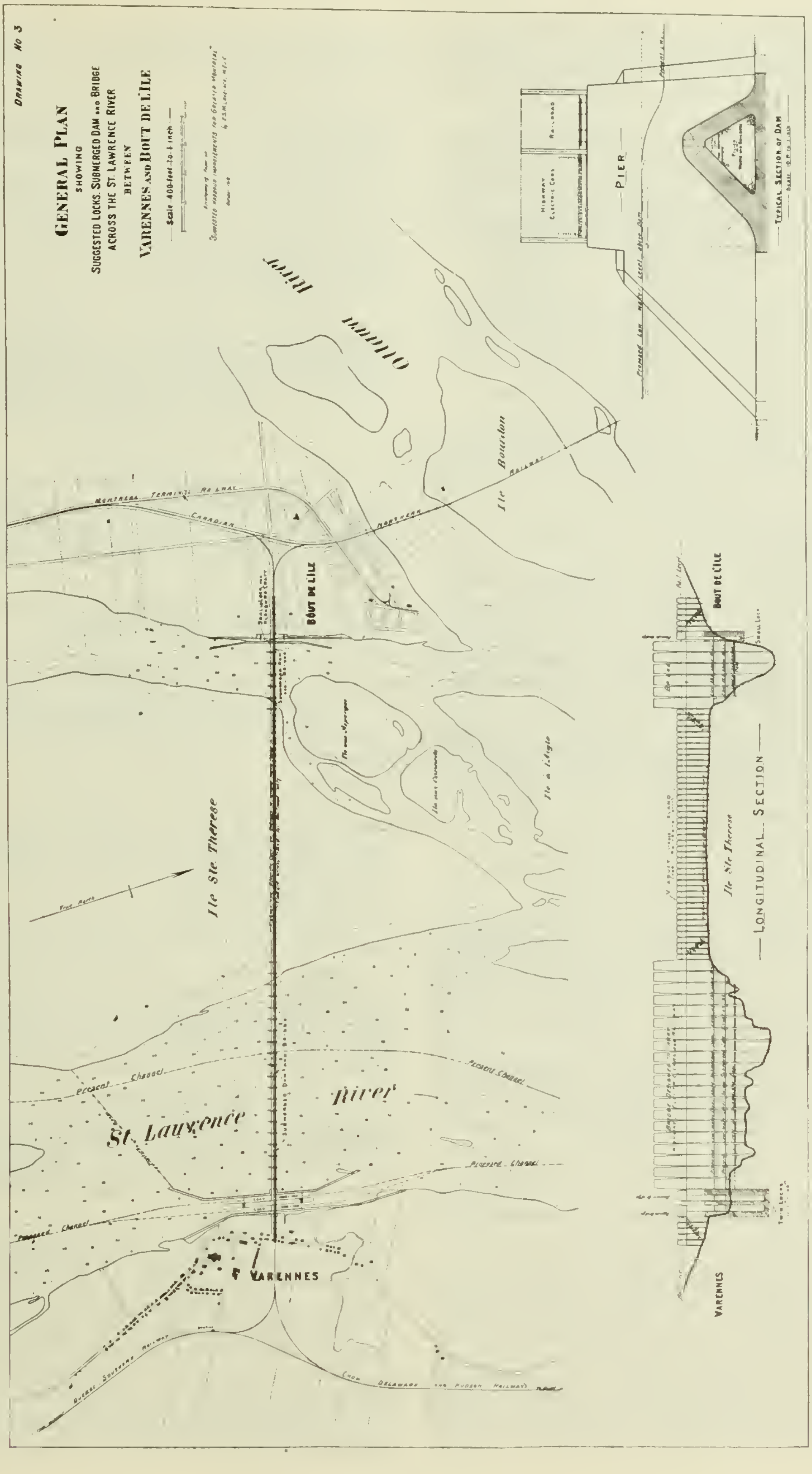
The type of lock gate which the writer has in mind is indicated somewhat in detail on drawing No. 4.

Here it will be seen that the gate would operate much on the principal of a large mill wheel. By introducing into a compartment on the periphery water from the upper level the wheel would commence to turn, lifting at the same time the attached gate.

The rear end of the wheel or drum would be counterbalanced so that only enough water would have to be admitted to overcome friction.

The water would be introduced to the bucket or compartment by way of the axis of the wheel which would be hollow.

In lowering the gate, water would be allowed to escape through this axis which is connected by a pipe with the


Drawing No 3
General Plan
showing
Suggested Locks, Submerged Dam and Bridge
across the St. Lawrence River
between
Varennes and Bout de L'Ile
Pier
Typical Section of Dam
Ottawa River
Ile Bourdon
Bout de L'Ile
Ile Ste Therese
St. Lawrence River
Present Channel
Proposed Channel
Varennes
Longitudinal Section

lower level below the dam. The weight of the gate would then slowly cause the wheel to revolve in the reverse direction and as the wheel revolves, the gate would slowly fall into sockets along the bottom and sides of the lock entirely closing the opening.

The operator, with a lever, would thus have complete control of the gate, and could cause it to raise, or lower, or remain in any position that he might consider desirable.

As has already been pointed out, however, such gates are only a small detail of the scheme as a whole, and, on further examination it might be found preferable to use the older type opening in two leaves.

The same might be said with regard to the proposed bridge, for a *swing* bridge across both locks could be used in place of bridges opening bascule style as described above.

To Open a Channel Each Spring

The Montreal Flood Commission reported ni favour of attempting to open up a channel from Varennes to the city in advance of the general break up of the ice each Spring, thus providing a channel for the ice coming down from the lakes above, which at times produces a jam with consequent flooding.

With a covering of *natural* ice such as would form once the proposed submerged dams were in position, it would be comparatively easy for a vessel of the modern ice-breaking type to do this, whereas, under existing conditions, with the channel blocked with pack ice and frazil, it would prove a very difficult undertaking.

Such a vessel might also be used each Fall in *keeping* open the channel between the above mentioned points so that an additional two or three weeks would be added to the period of navigation, and, if found to be successful, the practice might ultimately be extended in the direction of making Montreal an all-winter open port.

Canal to Chambly and St. Johns

As shown on Drawing No. 1, it is also proposed at the *upper* end to have on the South Shore a canal connecting Montreal Harbour with St. John via Chambly and the Richelieu River, and then, with New York, by way of Lake Champlain and the American system of canals on the Hudson.

The entrance to the canal would be between St. Lamberts and Laprairie at the point marked " V " on the plan, where there would be a single lock with about an eleven foot lift.

From " V," the canal (based on barometer readings taken by the writer in October, 1918) would follow approximately the line indicated to the Richelieu River at " Z."

In the stretch of about ten miles between " V " and " W," the surface of the canal would be level (no locks being required at all). At " W " there would be a large basin, and from this basin, a branch, still at this same level, would connect the main canal with the Town of Chambly. The branch about a mile long, would join the present canal at the point " X " and from " X " the Chambly Basin could be reached by the three existing locks.

Between the basin at " W " and the point " Y " where the canal would join the present Chambly Canal, there would be a lift of about forty-nine feet (49) requiring, say three locks.

From " Y " to the point " Z " where the canal joins the Richelieu River, the existing canal would be widened and deepened.

Below the entrance to the canal at " Z " a dam would be built across the Richelieu River, raising the water to the level of Lake Champlain, so that from " Z " navigation would follow the Richelieu River itself, and not, as now, the canal to St. Johns.

It may be pointed out in this connection that, in a *report* sent to the Deputy Minister of Public Works in June, 1912, dealing with the *regulation* of the waters of Lake Champlain and the Richelieu River and signed by

Ernest Marceau, Chairman.
P. W. St. George, C.E.
U. Valiquette, C.E.

It was recommended that:—A dam be placed across the Richelieu River (at the very point marked " Z " on plan No. 1) and, that the *existing canal*, from the said point to St. Johns, be abandoned in favour of the utilization of the deepened river itself."

This part of the present *proposed project* has, therefore, already been favorably reported on.

Power Development on Canal

As a detail, it is proposed to adopt the suggestion embodied in a plan prepared by C. L. Hervey and dated Montreal, 22nd February, 1910, for a canal in this same locality.

The suggestion is to place a *power house* at " Y ," and thus utilize for power purposes, the head of about 27 feet between the surface of the river above the dam, and the normal surface where the tail race from the power house would join the river.

To provide sufficient water, that portion of the canal between " Y " and " Z " would necessarily have a larger sectional area than the balance of the canal.

The power development indicated on Mr. Hervey's plan would be between 18,000 and 25,000 H.P. A part of this could be utilized in the lighting and operating of the canal and the balance, for industrial purposes.

As the tail race would be well above the forebay of the *plant* of the Montreal Light, Heat and Power Co. at Chambly, this proposed development would have no effect on the *power* output of this Company, and no infringement of their *water power* rights would result.

Similarly, the Town of Chambly and the other towns and villages on the Richelieu below Chambly could raise no valid objection to the proposed canal, as they would really have an *improved* water way connecting with Lake Champlain over that which now exists. Nor would water have to be diverted from the Richelieu into the St. Lawrence, other than possibly, the small quantity necessary for the operation of the lock at the Montreal end of the canal and even this could be obviated by using water from some of the small streams crossed by the canal on the St. Lawrence side of the watershed.

Profile of Canal

An approximate and preliminary profile of the proposed canal based on the *barometer* readings referred to above, is shown on drawing No. 5.

While the writer does not pretend that this profile is in any sense accurate (an actual survey would be required of course to determine the levels precisely) it clearly indicates the possibilities of the proposal and the comparatively low cost which the building of such a canal would entail.

The writer was much surprised to find so very low a summit between the watersheds of the Richelieu and St. Lawrence Rivers.

The canal as indicated on the profile, would, in fact, be merely a big ditch, for it is not proposed to give to it a greater sectional area than that found on the existing canal system on the St. Lawrence River, nor a depth greater than 14 feet.

Channel on the South Shore

In connection with this proposed canal, the vital importance of raising the level of the harbour at Montreal by building the *submerged dam* at Varennes at once becomes apparent.

Increased several feet in depth as it would be, the channel between St. Helen's Island and the South Shore with little or no dredging would at once become available for the passage of barges and other vessels from the canal to Longueuil and adjoining towns, and, of course, direct passage could also be made between the canal and wharves on Montreal Island.

No Possibility of Pollution

There is one point that might reasonably occur to the minds of those present, and that is, the effect of entering sewage on the pollution of the River consequent on the construction of the proposed dam; that is, to the comparative effect of sewage entering swiftly running water as at present or, into water moving slowly as it would do once the dam were in place.

When preparing the paper originally, the writer did not give much attention to this point for the reason that in so vast a body of water as the St. Lawrence River, it would seem that the varying effect would be too inconsiderable to notice.

It may, however, be of interest in this connection, as completely establishing the above conclusion, to note the following extracts taken from "The Final Report on Charles River Basin, Boston."

Extracts

"Basing its conclusions on the study of these conditions and on the reports of its engineer and special experts, the committee finds as follows:

Fresh water, gallon for gallon, disposes in a normal manner of more sewage than salt water; the tendency of salt water is rapidly to precipitate sewage in sludge at the bottom.

For the proper disposition of ewage in water, it is essential that the water be well supplied with oxygen. This is accomplished by the contact of its surface with the air, and this surface water is carried down by the action of the waves and currents, and *especially* by the vertical movement caused by changes of temperature. Bodies of fresh, nearly still water are well oxygenated to a depth of 25 feet or more in ordinary summer weather, and to much greater depths with the Autumn cold.

A comparatively still body of fresh water with animal and plant growths will dispose of a considerable amount of sewage admitted from time to time, and will tend to purify itself, even if no more fresh water is added.

Such a body of fresh water will dispose of more sewage if comparatively *still* than if in motion.

The popular belief that running water purifies itself more readily than *still* water is fallacious. It is found to be the fact that with oxygen present, and equally good conditions for proper bacterial growth, the still water purification is fully as energetic.

Conclusion

In conclusion, the writer hopes that in presenting this paper before the Montreal Branch, a discussion may be started eventually resulting in increased and improved harbour facilities for an enlarged and Greater Montreal.

The writer desires also to acknowledge his indebtedness to Percival W. St. George, M.E.I.C., for much valuable information as to ice conditions on the St. Lawrence River, and to other eminent members of *The Institute* for the encouragement given in the preparation of this paper.

Discussion

P. W. St. George, M.E.I.C., was surprised that he had not foreseen this scheme notwithstanding his long studies when working with the St. Lawrence flood commission. He would, however, like to hear from Mr. Cowie and Sir John Kennedy. The flood commission made exhaustive studies of ice conditions in the St. Lawrence and he drew particular attention to the fact that the St. Mary's Current was the "hot bed" forming frazil. If all rapids were dammed there would be no flooding, while, at the same time, there would be a magnificent heritage of water powers available. Referring to Mr. Lovelace's proposed canal to the Richelieu River he though that there were numerous advantages in the direct route, particularly in saving the long haul down to Sorel and back to Montreal. He moved a hearty vote of thanks to the author for finding out this scheme.

F. W. Cowie, M.E.I.C., congratulated the author on his original and comprehensive scheme and on the way he had touched upon the essential points in the development of the harbour. The present difficulties in the harbour of Montreal were the floods, currents and depth of water. If anything could be done to improve the present conditions no one would welcome it more than he would. He was afraid that the idiosyncrasies of a great river required life-long study. In the present case the problems had been considered since 1830 by the most eminent engineers and the success at the present time bears out his contention that fewer mistakes had been made in the development of the port of Montreal than in any other works of similar importance. Any engineer who would have courage to put a dam below Montreal would get little consideration, even he dumping of comparatively small quantities of material below Montreal brought forth outbursts of indignation from the municipalities bordering on the river. Mr. Cowie was of the opinion that the proposed dam would not eliminate the current inasmuch as the cross section of the river was only enlarged about twenty-five per cent and correspondingly the current would only be reduced by twenty-five per cent and the troubles would be mitigated and not overcome.

The troubles from the frazil should be taken up at different rapids and Mr. Cowie failed to understand why the development of the Lachine Rapids had not been undertaken.

The development of the port of Montreal has been his hobby for many years. There is no port in the world where such a service has been obtained at the same cost. In the past ten years the development of the port has been a romance. The debt has increased in this period from $10,000,000.00 to $27,000,000.00. Ten years ago the revenue amounted to $500,000.00 whereas today it reaches the sum of $2,000,000.00. With the elevators that were in operation ten years ago the revenue did not pay the interest on their cost and only about half the operating expenses, whereas today all the expenses are paid including operating and overhead charges. There are thirty miles of railway in operation today with a revenue of $500,000.00 compared with $67,000.00 ten years ago.

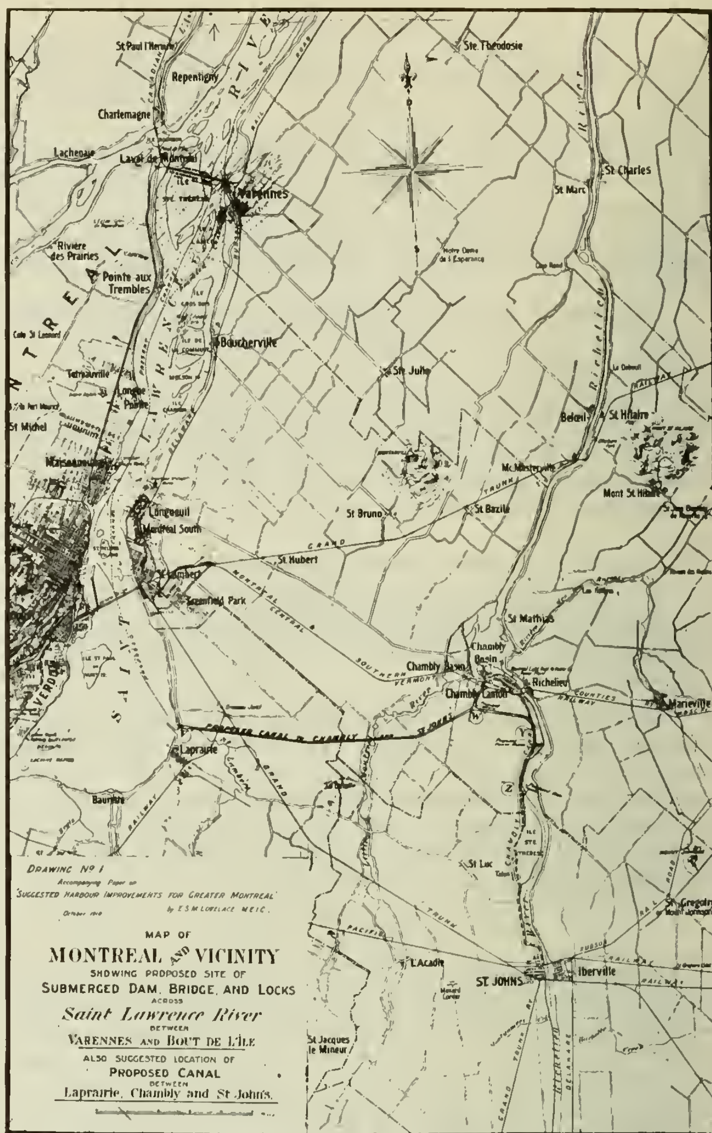
W. F. Tye, M.E.I.C., stated that the paper seemed to be on the right lines and appealed very much to him. Dredging seemed to have reached its reasonable limit. He referred to the tremendous asset the St. Lawrence River forms from the point of view not only of navigation but also of hydro-electric power. There is a lack of coal in Central Canada but the St. Lawrence forms a source of power better than coal. He made reference to the enormous development of the City of Pittsburgh which has been due to the supply of cheap fuel, whereas Montreal should be as favourably situated with regard to the availability of cheap power.

If the large ocean vessels are to continue to come to Montreal the navigation of the St. Lawrence must be improved. *The Engineering Institute of Canada* should interest the Government in the appointing of a commission to study the river as *a whole*. The commission should be composed of the best Canadian engineers. He did not think it necessary to go outside of Canada.

He seconded the vote of thanks to Mr. Lovelace for his exceedingly interesting paper.

K. B. Thornton, A.M.E.I.C., referred to the ice problems and confirmed the author's remarks regarding ice formation. His firm had made investigations and found that Lake St. Francis was absolutely free from frazil. He strongly advocated the canalizing of the river not only for the mitigation of ice troubles but also for the augmentation of hydro-electric power.

J. A. Jamieson, M.E.I.C., thought that the proposal supplied the imagination which is essential for progress



and the scheme should be well worth studying. Everybody is very interested in the progress of our harbour and in the trade by the St. Lawrence routes. He rather regretted that Mr. Cowie is so entirely satisfied over our harbour as this attitude does not look very hopeful for future progress. Montreal is unique in its situation of having the control of the harbour entirely free from commercial interests. There have been many difficult problems to work out and there are yet others.

A. D. Swan, M.E.I.C., stated that we may not all agree with Mr. Lovelace's problem in the question of the placing of locks below the harbour. Apart from their impediment to navigation they would be enormously expensive as they would cost, in his opinion, anywhere from $12,000,000.00 to $14,000,000.00.

E. S. M. Lovelace, M.E.I.C. (in answer to various discussions).

In connection with the discussion taking place after the reading of the above, the writer (*Mr. Lovelace*), would like to claim the privilege of making a few observations.

From some of Mr. Cowie's remarks the inference is, that, in defending the inception and administration of Montreal Harbour as it at present stands, he considers the paper in some sense, a reflection on both. The writer desires, therefore, to assure Mr. Cowie that, in the preparation of the paper, nothing of the kind was either intended or thought of.

We are all proud, and justly so, of what has been accomplished in the direction of making Montreal a terminus for ocean navigation.

Twenty or thirty years ago any proposition to dam the river and introduce locks below Montreal would have been considered so heretical, that, an engineer at that time, could hardly be blamed for not having brought forward a solution of this nature. But, as Mr. Jamieson so well has stated, contentment with what already has been accomplished, is apt to endanger progress in any direction. Conditions have changed, and are fast changing. Already we have seen the larger vessels of the Canadian Pacific Railway unloading at Quebec, so that, if Montreal is to retain its position as the head of ocean navigation, something must be done to give a greater depth of water in the channel.

As Mr. Tye has pointed out, dredging has almost reached its legitimate limit, and the building of dams, therefore, would appear to be the only alternative.

As a *separate* proposition, with only an indirect bearing on the development of Montreal Harbour, the writer is in complete accord with Mr. Cowie so far as the building of a dam at the foot of the Lachine Rapids is concerned, for, having some years ago assisted with the preliminary surveys and estimates of this very proposal, the writer is somewhat familiar with the enormous consequent development of power possible at this point.

When Mr. Cowie suggests, however, that such development at Lachine might well take the place of the proposed submerged dam at Varennes as a means of improving the harbour facilities at Montreal, then, the writer must register himself as being in disagreement with such a contention.

A dam below the Lachine Rapids would not lessen the St. Mary's Current, nor would it increase the depth of the water in the harbour.

It is somewhat doubtful too, as to what effect it might have in the prevention of floods. As Mr. St. George points out, there was a space in he Laprairie Basin above the Harbour, practically free of frazil, indicating, seemingly, that the frazil from the rapids above had been all lodged in the basin *above* this space.

If this were so, then the great mass of frazil found in the St. Mary Current, must have been formed there as a direct result of the current itself.

In fact, in the writer's opinion, a close study of the many cross sections accompanying the report of the Montreal Flood Commission, giving the disposition of frazil in the river, is almost conclusive as showing, that, where there is current there will be frazil, and that where there is slack water no accumulation of frazil will be found.

This opinion seems also to be borne out by the remarks which Mr. Thornton (an advocate of the efficacy of dams as presenting a solution of the question of frazil) was good enough to make.

Mr. Cowie, in concluding his remarks, expressed the opinion that only those who have made a life study, in season and out of season, of the St. Lawrence River, are qualified to speak on the far reaching consequences of a submerged dam below Montreal such as proposed.

To some extent the writer can agree with Mr. Cowie in this, but, in answer, would simply say, that having been brought up on the South Shore, where the formation of an ice bridge each year meant so much to the inhabitants, where the effects of flooding were so very disastrous, and where, in consequence, the discussion of ice conditions was an absorbing topic of conversation, the writer had opportunities of hearing expressed on all sides causes and possible solutions of the ice trouble, opportunities too, of himself observing the action of the ice under ever varying conditions. Having moreover, an intimate and special knowledge of the section of the river under discussion, not gained solely from the study of charts, but from actual first hand experience gained when camping year after year on the various islands, and from having to contend with the many shoals along the South Shore and with the currents in the different channels, the writer fells that his carefully considered opinion, as outlined in the paper, after making every allowance for possible overstatements or omissions, may be of some little value.

With regard to Mr. Swan's statement that the locks alone might possibly cost as much as twelve or fourteen million dollars, while the writer has not made any estimates, he was quite prepared to find that they might cost even more than this.

Twelve millions would not go very far dredging away the shoals, necessary for any harbour development on the South Shore opposite Montreal (and such development the writer understands has already been considered by the Harbour Board), whereas, with the increased depth due to a submerged dam as proposed, such dredging operations would be very largely decreased.

Whether, however, the scheme as a whole would cost twenty or even twenty-five millions, if assurance could be given that put into effect, the benefits suggested would largely be realized, then, in the opinion of the writer, no money ever invested by the country in its public works could be likely to bring a larger return.

* * *

L. M. Jones, M.E.I.C., City Engineer, Port Arthur, Ont., is preparing plans for the development of the City's water front. The front is to be developed so that all railways can secure access to the properties on the water front. These properties are to be improved and served by the dredging of slips for steamship approach.

* * *

It is proposed that the sum of $1,000,000. be expended on construction work in Kingston, Ont. half of which will be done by the federal and provincial Governments.

What The Engineering Institute Can Do

At an open meeting of the Toronto Branch of The Institute held at the Engineers' Club on Friday, February 28th, 1919, a number of papers were presented on the above subject showing the interest that has been aroused, and indicating the trend of thought in connection with immediate future activities of The Institute. The papers are reproduced here under the names of their respective authors.

E. M. Proctor, A.M.E.I.C.

The fundamental aims of *The Institute*, as set forth on the front page of *The Institute's* monthly publication, are as follows:—

1. To facilitate the acquirement and interchange of professional knowledge among its members.

2. To encourage original research.

3. To develop and maintain high standards in the engineering profession.

4. To enhance the usefulness of the profession to the public.

These are the ground work upon which all the activities of *The Institute* are based and I propose to make some suggestions as to what *The Institute* can do in relation to each one of them.

1. What can *The Institute* do to facilitate the acquirement and interchange of professional knowledge among its members?

The method which has been used in times past has been by means of technical papers read before the branches of *The Institute* or published in the Proceedings. This is and will continue to serve a very useful purpose towards the acquirement and interchange of professional knowledge and I believe should be made more general.

Visits and inspections of engineering works and institutions by the members of *The Institute* should be more often carried out. Only in this manner can first-hand information be obtained of many important contracts. If it is possible an evening or so before the inspection to have an illustrated lecture or talk upon the work which is to be viewed, the inspection on the following day would be much more interesting to the members, as they would know what to look for when they went on the work.

A feature which has been neglected to a large extent by engineering institutes is the training of its members in debate and I would suggest that the foremost engineering questions of the day should be debated by the members of *The Institute*. A senior member could be persuaded, I believe, to lead on either side of the debate and one or two junior members to follow up.

Such subjects as the following suggest themselves at once: –

"The advisability of building the Georgian Bay Ship Canal."

"Should the canals on the St. Lawrence be deepened and widened?"

"Should the City of Toronto purchase the Toronto Street Railway?"

"Should municipalities own and operate all public utilities?"

Etc., etc.

These are subjects that are live and very vital to the general public and by discussing them the members of *The Institute* would not only be doing themselves a great good, but would bring the engineering profession before the public and help to form public opinion on these great subjects, which after all are purely engineering problems.

Another way in which *The Institute* could facilitate the acquirement and interchange of knowledge would be for the Local Executive of *The Institute* to pay more attention to the library. There is no catalogue, except the card index at the library available and members do not know what books there are to which they could refer, without going to the library. An effort should also be made to secure the more up-to-date books on engineering subjects, and keep the library so that it is of use to the members.

2. What can *The Institute* do to encourage original research?

This is without question a very wide field and cannot be touched very easily without the expenditure of some money. It might be possible to work up a fund in *The Institute* which could be used to help defray the expenses of members who could find time to investigate problems of interest to engineers at large. The laboratories of the universities might be made available for some of this work and by an organized effort on the part of *The Institute* as a whole something might be done along this line.

3. What can *The Institute* do to develop and maintain high standards in the engineering profession?

The first thing that appeals to one under this heading is the financial remuneration of engineers, for how can an *Institute* whose members are so lowly paid, expect to develop and maintain high standards.

As a suggestion as to how the salaries of the engineers might be raised, I would suggest the following scheme.

Under the new by-laws of the Branch, there is a clause to the effect that the various branches of engineers could form sub-sections in *The Institute* to deal with subjects peculiarly affecting their branch. These branches could study the salary situation and bring in a report as to what they would consider to be a fair schedule of salaries. In the meantime, the Executive of the Branch could appoint a committee, whose duty it would be to collect data as to what engineers are being really paid in the different public services. Then with the reports of the different sections, and the special committee, before them the Local Executive could draw up a suggested schedule of salaries, this in turn being forwarded to headquarters. If each Branch carried out this program, there would be available for Headquarters enough data upon which they could act. A schedule of salaries such as I have suggested would be a very good step towards raising the general salaries of engineers, because the employer would know what to expect to pay and the applicant would know what he should ask.

Of course, in connection with such a scheme the practicing engineers would have their branch organization, which would draw up a suggested schedule of fees, etc.

Another subject, which is too often overlooked by engineers, is the fact that many commissions are being appointed in these days, which deal directly with engineering matters and it is a rare case when an engineer is appointed on one of these commissions. *The Institute* should insist inasmuch as they are able that at least one capable engineer be on each commission so formed.

The Institute should formulate an accepted code of ethics as to the relation of engineers to each other and to the public and when a member is elected to *The Institute*, he should undertake to obey the by-laws and ethics of *The Institute* and in the event of his not doing so, the penalty should be expulsion.

4. How can *The Institute* enhance the usefulness of the profession to the public?

I believe that this last clause includes all the former and if we, as engineers, live up to the three preceding fundamental aims of *The Institute*, we will carry out this last one to perfection.

*H. A. Goldman, C.E., A.M.E.I.C.**

Just twelve months ago tonight, on February 28th, 1918, a group of Toronto engineers came together at the house of one of them, and discussed the economic and social status of the engineering profession. After considering the matter thoroughly they decided to organize a new engineering society under the name of Canadian Association of Engineers, for the purpose of promoting and improving these economic and social conditions. And to work along the same lines as the American Association of Engineers.

Organization work was immediately started and subsequently several meetings were held in the rooms of the Engineers Club. At some of these meetings there were present the officers of the Toronto Branch of *The Institute* of last year, and some members of the council. After these representatives of *The Institute* listened to the arguments brought forward and to the discussions which followed, and after agreeing completely with the principles involved they made the following suggestions. Since the Canadian Society of Civil Engineers has undergone a thorough reorganization, even changing the very name of the society, and since under the new by-laws and constitution the scope of work is considerably widened so as to include such work as outlined by the new organization, they proposed, therefore, that the Canadian Association of Engineers should discontinue its activities until *The Institute* has had a chance to prove that it is willing and desirous to consider the economic problems of the engineer, as well as his technical problems.

At first the organizers of the new society were not inclined to give up their work immediately. But at one meeting held in May of last year, when this question in particular was discussed, several representatives of *The Institute* and a representative of the Canadian Engineer were particularly active in urging upon the organizers that because of the established existence of *The Institute*, because of its recognized standing and its membership of over three thousand, *The Institute* would be in a far better position to secure immediate results than a new organization could accomplish.

The question was taken to a vote and was carried almost unanimously that the Canadian Association of Engineers discontinue its activities until *The Institute* has had a chance to consider and tackle those economic problems.

It is rather an interesting coincidence that just one year later, to the very date, after that first meeting, the Toronto Branch of *The Institute* calls a meeting to discuss these very economic problems and presumably with the intention to start activities immediately to improve the existing conditions.

The coincidence of the two meetings occuring on the same day of the year seemed sufficiently interesting to call attention to it before proceeding with the regular subject matter of the paper.

To one who comes in close and intimate touch with the rank and file of the engineering profession, and who has the opportunity to discuss with them their attitude and feeling towards *The Institute*, it must be quite clear that *The Institute* will have to adopt some important and radical steps for the improvement of the economic and social conditions of the profession. Such steps are necessary in order to dispel the unrest and discontent that exists among engineers at present and in order to retain the confidence of the individual engineer in *The Institute*. One has only to refer to the numerous letters and correspondence that are published constantly in *The Institute Journal* and in other technical magazines to realize that such discontent is by no means confined to only one particular locality or one particular district. Coming as these letters do, from practically all parts of the Dominion, from the east and from the west, from the engineers employed in the government service and from the engineers connected with private concerns, from the superintendent of construction in the field and from the designer and draftsman in the office, these letters must prove conclusively that the trouble is wide spread throughout the Dominion.

The economic and social problems of the engineer can no longer be ignored by *The Engineering Institute*. No longer can the national society remain indifferent to the present position and status of the profession and still expect the support of the individual engineer. In the United States where the older conservative societies could not or would not open their eyes to see the true and exact position in which the engineer finds himself today, where by means of fictitious tables and diagrams they wished to deceive themselves and the rest of the world into believing that the engineer occupies the same financial level as men of other professions, there it became necessary to organize a new democratic national engineering society. And thus the American Association of Engineers was formed for the purpose of tackling these economic problems which had been ignored by the other societies.

Here, in Canada, we are, perhaps, more fortunate in that the existing national society has itself undergone a

*Paper read before the Toronto Branch of *The Engineering Institute of Canada* on February 28th, 1919.

reorganization, and in the face of existing conditions is said to be willing and desirous to adapt itself to present day requirements and assist the individual engineer in the solution of his economic problems as well as his technical problems. In this respect our opportunities to gain successful results are far better than those of our colleagues in the United States. It is far easier to accomplish results when one strong organization is working for the interests of all concerned than when several small groups are working separately, provided, however, that co-operation and action can be secured within that one organization.

The causes which have produced this general feeling of unrest and discontent are nominally two, poor pay and lack of recognition. Actually, however, the removal of one of these causes would gradually also eliminate the other. Give the engineer the proper pay that he deserves, and recognition will come as a matter of course. It is no secret to any one of us that no other thing has contributed so much to the degradation of the engineering profession and no other thing has affected so much the prestige of the engineer as the small financial returns for engineering services. It is idle and useless to blame the public for not giving the engineer the proper recognition. We must not forget that the public at large knows nothing of the amount of training that one has to go through to qualify himself for an engineer. The public has no idea of the nature of the problems that daily confront the engineer and the sound judgement and skill that he must exercise in order to solve these problems. The public knows nothing of these things and, therefore, cannot appreciate the importance of the engineer in terms of these attainments and qualifications. The public has but one method whereby to determine the value and importance of any commodity, or any class of people whose services the community requires and that method is by means of the usual medium of exchange, dollars and cents. The standing, importance and prestige of any class in the community is in direct proportion to the value of the services of the members of that class. If then the engineers themselves establish a low rate of pay for their services, the public can only take them at their own valuation and can only place them in a class and in a position to which such valuation entitles them. It must be evident then, that never will the engineers as a class occupy the same position in the community as the doctor or lawyer, until they raise the value of their services to the same extent as that of the men of other professions.

When speaking of the services of the engineer to the community, Mr. W. H. Finley suggests that the engineer, because of the nature of his education and training, would be the best qualified to solve the difficulties between labor and capital. It is surprising that such suggestion should be made at all, for what class of labor is there that has sufficient confidence in the engineer, as a class, to entrust them with their financial interests, when as a matter of fact, under the present economic condition organized labor consider the engineers inferior to themselves, more than that they consider them as a hopeless economic failure.

As an illustration of what labor thinks of the engineer, the Engineering News Record of New York tells of a well known engineer, of many years experience, in charge of construction work, who had occasion to give some order to a brakeman of a train. The answer of that brakeman was very prompt, "Who the hell are you to tell me how to do things when my pay cheque is bigger than yours?"

Another case is told of a well known railroad engineer, who while discussing with some fireman general railroad conditions was asked if he knew the reason why engineers receive such small pay. When the engineer answered that he did not know the reason, he received a rather unexpected reply. "You see," the fireman said, "the reason that the railroads pay you engineers such salaries as they do is because they are ashamed to pay you any less."

It was the pleasure of the writer to hear a lawyer compare the two professions, law and engineering, "Why," he said, "there is no comparison at all, it takes training, brains and ability to become a lawyer, but any darned fool can become an engineer if he only wants to waste his time."

These instances indicate where the wind blows, and what it is that is affecting the prestige of engineers, and why they are not recognized.

But there is even a more serious aspect to the matter than merely the prestige and the dignity of the profession, and we must not for a moment lose sight of it. The general disturbances in labor circles which are being reported from practically all parts of the globe are surely going to materialize into at least two definite results. In the first place labor in the future will receive a far greater share from the products of the industries than it ever received before. And, secondly, the cost of living is bound to remain high in direct proportion to the increased income of labor, and will never come down to the level of pre-war days. In that event the question naturally presents itself, what is to become of the salaried technical engineers who even before the war had a difficult task to make both ends meet. Organized labor will get a higher standard wage. Manufacturers will get higher profits by charging bigger prices for their commodities. The farmer will get a higher income by selling his products at increased prices. In the face of such conditions how are engineers going to exist. Are engineers to be the only victims of circumstances at whose expense the other classes will improve their material conditions, since they will have to pay the increased cost of commodities, while their own incomes remain the same.

Some remedy must be found to improve these conditions and so far but one feasible, practical and desirable remedy has been suggested, and that is, that *The Institute* should adopt a standard minimum salary schedule to be paid for various degrees and grades of engineering work. Such schedule to be based on the nature and responsibility of the work, and the technical qualifications required in order to perform such services.

It is realized, of course, that the adoption of such dominion wide standards would at first entail some difficulties in the enforcement of same. But on the other hand, we must not forget that the question of pay and salary of engineers is not an issue between engineers and the public, or even between the subordinate and his chief. As a matter of fact it is only a family affair, requiring just a little adjustment among the engineers themselves. Because in nearly all cases the pay and salary of one engineer is usually entrusted to the hands and to the judgment of another engineer, and if that second engineer could only have a guide as to what is actually the value of such services as he requires from his applicant, and since such a schedule would serve as a guide, there should be no difficulty in getting a square deal.

Furthermore the mistake must not be made that the demand for a square deal is confined merely to the younger men or to the juniors as some seem to be inclined to think. The truth of the matter is, that the profession is underpaid all the way down the line, that many men in full charge of departments with great responsibilities are just as much underpaid as their subordinates working under them, and readjustment must be made all the way up. During the last twenty years the economic conditions of this country have considerably changed. Cost of living was gradually mounting upwards and accordingly all classes of labor have demanded, and received, gradual increases of wages. The medical, law and other professions have followed suit and increased their fees to conform to the increased cost of living. Yet we find that in the case of the engineering profession, perhaps the only profession of which the members are receiving the same scale of salaries that they received twenty years ago. We must remember then, that so far as remuneration is concerned engineers are twenty years behind the rest of the world, and the longer we will wait with settling this question, the longer we will postpone it, the farther will we remain behind, and the more difficult will it become to adjust matters, and for this reason it is desirable to take prompt action in tackling this problem.

But there is even a more serious reason why *The Institute* should take prompt action in the matter. It is probably already known to most of us, that in recent months there has been formed in the United States a strong union organization of engineers and draftsmen, affiliated with the American Federation of Labor. That this new organization is making tremendous progress is evident by the fact that at one of the regular half monthly meetings of the Chicago branch, there were 122 new members enrolled at one time.

Whatever the opinion of some engineers may be as to whether or not it is desirable or possible that engineers should form a union, the matter is now an established fact. In the United States, where the engineers are already divided into so many different organizations, such a union will probably do more good than harm. Because at least so far as financial gain is concerned, there can be no doubt but that they will secure it, judging from the accomplishments of other organizations affiliated with the American Federation of Labor. Here in Canada, however, the creation of such a union might cause considerable harm to the profession, in that it would break up the power and strength which it is intended to be concentrated in one organization. If such a union should be formed in Canada, there is no doubt that not only juniors and the younger men would join it, but from the sentiments expressed by some full members of *The Institute* it may be taken for granted that even such would join the union. That that would be to the detriment and against the interest of *The Institute* can well be realized. And it is up to *The Institute* to take immediately such steps as will eliminate the necessity for the formation of such a union here.

I would, therefore, suggest that a salary committee be appointed to-night by this Branch. This committee to study this question thoroughly and prepare a schedule of minimum salaries for engineering services. At the same time the secretary should be instructed to communicate with the other branches and request them to prepare similar schedules. All these schedules to be submitted to the parent institute, who would review them and select from them final schedules for the different Provinces to be adopted by *The Institute*.

J. C. N. B. Krumm, A.M.E.I.C.

Anyone who is requested to write a five minute paper on the question: "What can *The Institute* do?" is confronted with a most difficult task; not because the field is so restricted, but from the fact that it is practically unlimited, and the difficulty is to condense it sufficiently to confine enough of it within that short time limit.

The writer will, however, endeavor to suggest lines; along which *The Institute* can do great work of benefit, not only to the engineering profession, but to the country.

The present and past status of the engineer, we all agree, is far below the level, which his usefulness and talent entitles him to maintain, and the only question, that remains and about which there, for several years, has been considerable discussion, is: "*Can this condition be ameliorated, and if so, what can be done, so as to make it most productive of results?*"

To the first question we can only give the conditional answer, that unless the individualism which has been altogether too prevalent within the engineering profession is rooted out and replaced by absolute solidarity, the engineering profession will forever stay where it is and has been.

This is not the time, however, for criticism of what has been done in the past. *The Institute* must now look forward and as one unit endeavour to successfully tackle the many problems which are ahead.

The first step towards solidarity is to make of *The Institute* a close corporation, and this *The Institute* can accomplish of itself.

It is gratifying to note the resolution in regard to legislation passed on the last annual meeting, and that the government takes immediate action is to be sincerely hoped for.

Should the government shelve the question, *The Institute* is confronted with two alternatives: one is to continue to travel in the same old rut; the other to take action themselves to make *The Institute* a close corporation.

It is the writer's opinion, that this could be accomplished by starting a vigorous campaign for eligible members throughout the Dominion followed by subscription by all members to a pledge, not to work for or with or employ any engineer who is not a member of *The Institute*.

This might to some savor to much to unionism; but, in the first place, it is without doubt the next best proposition; secondly, when considered in the right light, what difference is there in legislation by the government and action by *The Institute* to make it a close corporation. The result is the same.

Solidarity, however, will not be attained by only making *The Institute* a close corporation, as this is only an introductory step to the real work.

Absolute solidarity can be attained only by regulations forbidding the use of *The Institute* as a subterfuge for promotion of personal or corporation interests, of which there might be danger, when *The Institute* gains in power and influence.

The greater the factors the greater the product. This maxim can be applied to the engineering profession as a whole.

In order to become a factor, however, the engineer must have the social standing, to which his special training entitles him, and even demands of him, and as his usefulness depends on the authority he can command, it follows, that to gain a high standing is his economic duty to the country.

In our commercial age, this standing cannot be attained, without giving the engineer a good living wage. He must be placed beyond wants in order to represent the profession and to develop himself.

It is preposterous to exhort the engineer to uphold the dignity of the profession, unless he is provided with the necessary means of doing so, and this is better pay and position.

To expect good work from an engineer, who is worried how to make both ends meet, and who has to deny himself and his family many things, which make life worth living is next to persecution.

In order to be efficient in his work he must have a clear head free of financial worries, as only then can he concentrate his mind on the problems with which he has to contend, and it must be borne in mind, that upon the initiative and ability of the engineer the economic and efficient utilization of our country's resources depends.

Before the war the engineers, although to a certain extent grumbling over the state of affairs, have borne it rather patiently, until the cost of living started to go amounting, on account of the war, while their salary was practically stationary. A movement started, which now seems to have taken concrete form in the States as a union affiliated with the American Federation of Labor and this movement is already spreading into Canada. The formation of a union affiliated with labor would be one of the most deplorable episodes in the history of the engineering profession, and *The Institute* must at once take steps to forego it, by themselves championing the cause of the engineer. The writer would suggest that the branch make the recommendation that a committee be at once formed to prepare a schedule of fees and salaries for engineers.

The Institute can and also should give moral backing to engineers in public service, as city engineers, township and county engineers, whose lot is a sad one having to deal with refractory bodies as councils, etc. *The Institute* schedule of wages would prevent the councils cutting their engineers salary at their pleasure, as has too often been done. The moral backing of *The Institute* will also tend to dampen the energy with which these bodies expose the engineers to indignities of different kinds. In such case the engineer in question should be given opportunity to submit his case before *The Institute* and if he is in the right he should have the *solid backing* of *The Institute.*

Another step, that should be taken by *The Institute* is to endeavour to awaken interest in competitive designs, wherever these are feasible. This will bring the talented engineers to the fore front, while the country will get the best product that the engineering profession can produce. There is no reason why the same cannot be done here as is done in Europe, when a great and difficult project has to be considered.

The duties of the engineers are not only technical, they are also economic and political. The whole engineering profession is awakening to this fact, and their organizations are at last responding to the persistent demands, that greater interest and part should be taken in civic and social activities. As this field is altogether too large to consider in any but a very general way, the writer will only endeavour to point out a few things that *The Institute* can do to help along this great movement.

In this connection I would like to mention W. R. Ingall's recent presidential address before the Mining and Metallurgical Society of America in which he outlines the duties of the engineer to the public, and as this address is very eloquent and especially to the point it should be closely studied by every engineer.

The great problem which the country has to solve at present is re-construction, and in order to carry this to a successful conclusion a careful re-organization of the resources of the country will be necessary. In doing so it should see too, that the engineering profession will become a great factor. To further this *The Institute* should follow the example of the American Society of Civil Engineers and "adopt the principle of becoming an active national force in economic, industrial and civic affairs," and establish offices in Ottawa "to keep fully advised as to all matters in which the engineering profession should have a voice."

The statement has been made by one of our leading papers, that "it would appear, that Canada's total external debt, public and private, at this moment is not less than a quarter billion dollars, and that the eight million people within the Dominion must produce and export yearly goods to the value of over one hundred and sixty million dollars to pay the interest alone."

Now, this is only to pay interest charges, and if the principal is to be reduced, the production will naturally have to be so much more.

It must be borne in mind, that this amount must be over and above all imports for the same period.

If the country shall be able to manage this, the people of the Dominion must work hard and exercise the greatest thrift and economy; and here it again is, where the engineer should play a dominant role. We have got the natural resources and the problem before us is to make the most out of them, with the greatest economy. There is no production, where engineering problems of one kind or other are not involved, and it is *The Institute's* prerogative and duty to the country to endeavour to have this work done under the administration of engineers, so that it can be executed in the economic and efficient way. It is not enough to have engineers in subordinate positions; the head must also be an engineer. The money which has been borrowed, must be most economically expended and in the main on works, which will yield revenue instead of adding to the dead weight of unproductive debt.

As already stated economic reconstruction cannot be realized without the united efforts of the whole nation, and with the present attitude of labor the outlook is not very promising. Shortening of working hours and higher wages are beneficial only up to a certain point, beyond which they become most detrimental.

The writer is, on account of this, very doubtful about any foreign contracts for Canadian or American firms, except in lines, where other countries, for one reason or other, are out of the market.

One trade especially is bound to receive a serious setback, and that is the ship building trade, which most likely will dwindle down to, what it was before the war, and probably less.

As the excessive demands of labor tend to *decrease* production and the engineers problem is to *increase* production, it follows, that the engineer, if he shall successfully carry out his purpose must by all means at his disposal try to counteract any excessive labor policy, and this can be done only by taking a greater interest in and even enter into polictical life.

Could not *The Institute*, as soon as it has succeeded in organizing into a close profession, get in touch with all professional and other bourgeoisie organizations and form a professional congress, which would endeavour to promote harmonious relations between capital and labor, thus acting as a stabilizing factor? Such an organization would be a strong counter weight and—especially if it allied itself with the commercial and agrarian interests—would tend to curb the demands of the trades and labor unions, who, now, apparently do not know where to stop.

The stand, the engineer generally takes, is that it is below his dignity to take active interest in anything but sine and tan, stresses or transits, and this is one of the reasons why his status is low. He must, however, tear himself loose from this idea and develop a higher vision.

We have had several good examples of engineers, who have entered into public life and been highly successful.

In Norway, out of 10 cabinet ministers, 3 were engineers, and of them one of them was Prime Minister and one Minister of Foreign Affairs, holding, what in these times would be two most important portfolios. They guided the country successfully through four years of distress and danger.

This unfortunate war has principally been one of money and engineering and especially have the Canadian Engineers contributed to its successful conclusion, for which we owe them deep gratitude.

The engineering profession has thereby been given a great boost and it is our duty to see that the good work is kept up to the honour of the profession and benefit to the country.

I have here endeavoured to suggest some topics, on which to start discussion, as only this will start a movement in the right direction. There is a great task ahead of us and it will take a long time; but we do this not so much for ourselves as for the future generations of engineers.

George Phelps, A.M.E.I.C.

On the question of what *The Institute* can do for its members I take it that I am expected to confine my remarks as much as possible to some suggestions of a practical nature as to a line along which *The Institute* might with advantage take action.

Such suggestions should naturally have reference as far as possible to the advancement of the members as a whole, but I take it that it is permissible for me to speak from my own particular point of view only, with the hope that whatever may be of value in my remarks may be adapted to the particular requirements of other sections of *The Institute*. Whether or not we eventually get legislation which will make engineering a closed profession (which I may say in passing I hope before long will be the case) there are many things of a helpful nature which we can be doing now.

We are at present undergoing a process of reorganization made necessary by the widening of our scope, by changes which have lately taken place, and one of the first things necessary in any reorganizing process is to have a stock taking to see just where we stand and what we are worth. From the point of view of the municipal engineer then, I would suggest that *The Institute* causes to be prepared a list of all the cities and towns in the Dominion of say 5,000 inhabitants and over, giving the name of the engineer, what salary he is paid, whether he is a member of *The Institute*, what his qualifications are if he is not a member, also giving the number of assistants under him and any other items which may help toward giving a good general knowledge of our present standing. Such a list would, I think, help to make clearer the nest step to be taken; it could probably be best prepared through the branch secretaries; it would doubtless entail quite an amount of work, but I think it would be worth while and we should be prepared to pay accordingly for the information, which would of course be available to all the members.

It would doubtless be in the interest of the general public as well as ourselves if each such city and town had an Engineer to carry out its works whose membership in *The Institute* was a guarantee of his proper qualification for the position, and we should follow up the first step with an appeal to those engineers who are not members but who are duly qualified, asking them to join *The Institute*. Also when a vacancy occurs in any of the listed positions, it would, I think, be quite in order to approach he council of the city or town with the object of persuading them to make membership of *The Institute* a condition of the appointment; at the same time offering the services of *The Institute* in helping to find the right man for their work. In order to carry this out effectually, it would as a matter of course be necessary that membership of *The Institute* should carry with it a guarantee of engineering knowledge and experience in accordance with the grade of the member, and this in turn points to the necessity of entrance examinations for new members.

You will gather from the foregoing that I am in favor of using *The Institute* in the way of an exchange for men more than it has been used in the past, as well as an exchange for ideas, and by following up some system such as I have briefly indicated, I think we might before long arrive at a time when towns in need of engineers would naturally turn to *The Institute* first, for the help and advice which should be gladly given to them. But whatever might be done in this way would not be complete until the existing Municipal Act is amended in such manner that only properly qualified men can be appointed as city and town engineers, for which purpose the status of such engineers should be defined by legislation, and in the final outcome we arrive at the point, at which I think the majority of us are aiming, namely, a closed profession for engineers.

Such a list as I have suggested above might also form a basis for a schedule, fixing minimum salaries for municipal engineers and their assistants, which in itself is a most desirable step towards raising the standard of this section of the profession. It would not of course be feasible to have one fixed salary rate for all town engineers, irrespective of the location and size of town, but after such a list has been compiled and full information gathered as to existing salary rates, the grading of municipal engineers and fixing of their salaries according to grade should not be a very difficult matter. I know it will be objected that we cannot as things are prevent a town from appointing a cheap man if one can be got, and neither can we prevent man seeking a job from selling his services cheaply in order to get employment, but one thing we can do, and I would advocate some such measure as long as it may be found necessary, and that is, after having fixed our schedule, make expulsion from *The Institute* the consequence to any man accepting an appointment at less salary than the schedule rate.

Should some such measures for listing and grading engineers be considered generally advisable, I should imagine that those familiar with other branches of engineering could easily devise for those branches a scheme on similar lines for the same purpose.

* * *

International Commission Safeguards Public Health

Several years ago the Governments of Canada and the United States requested the International Joint Commission to investigate the causes and extent of pollution throughout the boundary waters between the two countries, and to recommend such remedies as would adequately safeguard the public health of the people on both sides of these waters. This investigation naturally fell into two branches. In the first case the Commission brought together and secured the views of representatives of the Federal, State and Provincial Boards of Health. As a result of this conference the Commission was able to outline in a general way the scope of its investigation. It then engaged a corps of sanitary experts, who under the general direction of Dr. Allan J. McLaughlin, of the Public Health Service of the United States, Dr. J. W. S. McCullough, Chief Officer of Health of Ontario, and F. A. Dallyn, A.M.E.I.C., Provincial Sanitary Engineer of Ontario, carried out what has been described as the most extensive bacteriological examination of waters the world has ever known. It embraced in fact the entire system of international boundary waters between the two countries, extending for a distance of some two thousand miles from the St. John River in the east to the Lake of the Woods in the west. One of the most gratifying results of these bacteriological surveys was the assurance that the great bulk of the Great Lakes water remains practically in its original purity, in spite of the fact that eight or ten million people have contracted the very bad habit of dumping all their sewage into these waters, and that the entire shipping of the Great Lakes, carrying in one season not less than fifteen million passengers, has followed the same evil practice. Serious pollution was found at many points along the boundary waters, and particularly in the Detroit and Niagara Rivers, where the cities of Detroit and Buffalo, with a number of smaller communities on both sides of the boundary, have been doing their best to make the water of these rivers unfit for human consumption. Severe epidemics of typhoid fever have for years past warned the lake cities that, while they were spending hundreds of millions of dollars on their streets and buildings, and parks, and in other ways adding to the comfort and convenience of their inhabitants, the most vital consideration of all, that of public health, was being grossly neglected. If the International Joint Commission should achieve nothing more than to awaken the cities of the Great Lakes to the vital importance of protecting their water supplies, it will have more than justified its existence.

Having completed the first branch of its investigation, that is as to the sources and extent of pollution, the Commission took up the very important question of remedies, and as an initial step held a conference in New York with a group of sanitary engineers, including men of international standing such as George W. Fuller, Earle B. Phelps, and George C. Whipple of the United States, and W. S. Lea, M.E.I.C., F. A. Dallyn, A.M.E.I.C., and T. J. Lafrenière of Canada. As a result of this conference and the subsequent deliberations of the Commission it was decided to adopt, at least tentatively, certain fundamental principles for the preservation of public health upon which the experts were in agreement. The most vital of these principles is that, while in certain cases where the ratio of water to sewage is unusually large the discharge of the latter into boundary waters may be made without danger to the public health, " effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns should be discharged into boundary waters." The other principles adopted relate to methods of sewage purification and water purification.

Field work in connection with the second branch of the investigation was carried out by a corps of sanitary engineers under the direction of Earl B. Phelps of the U. S. Public Health Service and F. A. Dallyn, A.M.E.I.C., of the Ontario Board of Health. The elaborate reports of the bacteriologists and sanitary engineers on the two branches of the investigation have already been published. The Commission has now issued its own Final Report to the two Governments, embodying its conclusions and recommendations. In that Report, after setting forth the character and extent of the pollution, and the remedies recommended, it is suggested that the two Governments confer upon the Commission's jurisdiction to regulate and where necessary to prohibit the pollution of boundary waters and waters crossing the boundary. While nothing has yet been done in the direction of conferring upon the Commission jurisdiction to carry out its own recommendations, the two Governments have, within the past few weeks, requested the Commission to draft rules and regulations designed to meet the needs of the situation.

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Increasing Remuneration

The branches have already been advised of the proposal of the Government to establish a higher basis of salaries for engineers employed by the Federal Government and have been urged to secure the co-operation of their local members of Parliament towards this end.

The Council strongly urges every member of the Institute to use his influence with his local member of the Dominion Parliament to secure support of this most important movement designed to give the engineers employed by the Government a measure of reward somewhat in keeping with their earning capacity. This means a much higher standing than at present enjoyed.

All the influence we possess should be used in this cause.

Joint Committee on International Affiliation

In his report to Engineering Council, Secretary Alfred D. Flinn, after his return to New York from attending the Annual Meeting of *The Engineering Institute of Canada*, at Ottawa, on February 11th, reported as follows:—

"At a luncheon in the Chateau Laurier attended by about 200 and in private conferences with President H. H. Vaughan and Secretary Fraser S. Keith, of *The Institute*, your Secretary discussed briefly the international affiliation of engineers. Many engineers of Canada desire some form of organized affiliation with engineers in the United States. Membership in Engineering Council is not feasible for a number of reasons, such as expense and fact of separate national governments. Informally it was agreed with President Vaughan that *The Institute* would, as a first step, appoint a few members to a joint committee to which Engineering Council would also appoint members, and that this committee would constitute the bond of affiliation for the present, while studying what mutual services may be rendered and what other arrangements may be made between the *Institute* and Engineering Council. It is recommended, therefore, that Engineering Council appoint members to such a joint committee on international affiliation.

"But the chapter on international affiliation does not end here. Secretary H. Mortimer Lamb, of the Canadian Mining Institute has visited Engineering Council's office, and has expressed the desire of his organization for some connection with Council. While your secretary was in Ottawa he had a call from Secretary Clyde Leavitt, of the Canadian Society of Forest Engineers. This is a very small organization, but it likewise wishes to be associated with Engineering Council, particularly in an international forest conservation committee. Under date of February 14th, a communication was received from Secretary Leavitt making various inquiries and suggestions in relation to this matter. Council should consider what ties it can form with these two societies."

Acting on said Secretary Flinn's suggestion, the Council of *The Institute* appointed the following to act as a committee, in conjunction with a similar committee of the Engineering Council:—H. H. Vaughan, Chairman; John Murphy and G. H. Duggan.

New Year Book

It will be necessary to start at an early date to revise the Charter, By-Laws and List of Members for the year nineteen hundred and nineteen. To make the list more complete and of more service than it has been in the past it is desired that every member send in to headquarters an item giving his present official position as well as his mailing address. You will find on going through the list that a great many members' home addresses are included, and their positions not mentioned due to the fact that there is no record of it at headquarters. On reading this notice would you kindly look in the nineteen hundred and eighteen list, find out if your name appears there in accordance with the above suggestion, and if not a brief letter to headquarters will insure the complete entry.

Schedule of Engineers' Salaries

At the railroad conference held by the American Association of Engineers on March 17th, a schedule of salaries for technical engineers was adopted. As this schedule if of interest to members of *The Institute*, particularly in connection with the movement on foot to assist the salary rating of engineers in this country, it is reproduced herewith:—

Maximum and minimum salaries per annum, depending upon extent and importance of duties

Chief Engineer—

In charge of entire railroad system, responsible for all engineering work and organization, including valuation....	$15.000	$9,000

Assistant Chief Engineer— In charge of portion of line or entire system; reporting to Chief Engineer; responsible for such work as may be assigned	$9,000	$7,200
District Engineer— In charge of two or more divisions; reporting to Assistant Chief Engineer; responsible for all maintenance of way and construction; or, responsible for either maintenance or construction on three or more divisions	6,000	4,800
Assistant District Engineer— Same territory as District Engineer; responsible for such work as may be assigned	5,400	4,200
Division Engineer— In charge of one division; responsible for all maintenance of way and permanent way work	4,800	3,600
Assistant Division Engineer— Same territory as Division Engineer—like responsibilities, reporting to Division Engineer	3,600	2,750
Resident Engineer— In charge of one residency; reporting to Division Engineer. In charge of construction work only. This position not required for maintenance of way.	4,200	3,000
Office Engineer—Field Engineer— Reporting to Asst. Chief Engineer. Duties as assigned	5,400	3,600
Engineer of Bridges— Reports to Assistant Chief Engineer or Chief Engineer; responsible for design, maintenance and construction of all bridges—wooden, steel and concrete.	7,500	6,000
Assistant Engineer of Bridges— Reports to Bridge Engineer, like responsibilities	5,400	4,800
Signal Engineer— Responsible for all signal construction, maintenance and operation on the system	7,200	4,200
Assistant Signal Engineer— Reports to the Signal Engineer, like responsibilities as assigned	4,800	3,000
Building Engineer— In charge of construction and maintenance of buildings as assigned; reports to Asst. Chief Engineer or Chief Engineer	6,000	3,000
Valuation Engineer— Responsible for all valuation work on entire system; reports to Assistant Chief Engineer or Chief Engineer	8,400	7,200
Assistant Valuation Engineer— Reports to Valuation Engineer; has like responsibilities	6,000	4,800
Chief Pilot Engineer— Reports to Assistant Valuation Engineer; responsible for Valuation work on two or more divisions or for a major branch of the work over the entire system	$4,800	$3,600
Pilot Engineer— Reports to Chief Pilot Engineer; responsible for work on one division	3,600	3,000
Engineer Accountant— Qualified to analyze and assemble statistics and prepare reports	3,600	3,000
General Superintendent of Motive Power— In charge of entire mechanical department; responsible for design and repair of all rolling stock and shop equipment	15,000	9,000
Assistant General Superintendent of Motive Power— In charge of a portion of the mechanical department as assigned by the General Superintendent of Motive Power	9,000	7,200
Mechanical Engineer— In entire charge of all design of new equipment and revision of old. In addition he may handle other duties of the department as assigned by the General Superintendent of Motive Power, to whom he reports	7,500	6,000
Assistant Mechanical Engineer— Performs such duties as assigned by the Mechanical Engineer and gives particular attention to the drafting force	4,800	3,600
Engineer of Tests— Inspects all new material and investigates failed material; reports jointly to General Superintendent of Motive Power and Chief Engineer, or better to operating Vice-President	7,500	6,000
Electrical Engineer— Responsible for all electrical construction and repair work in mechanical and building departments	8,000	6,000
District Electrical Engineer— Performs such duties as assigned to him by the Electrical Engineer. Looks after all electrical equipment in the mechanical and building departments	3,600	2,700
Shop Engineer— In charge of all shop lay-out work and machinery equipment. An efficiency man whose duties are to increase production and decrease cost	4,800	3,600
Chief Draftsman— Responsible for all work turned out by the drafting room. Capable of handling all classes of design	3,600	3,000

	Minimum salaries per month.		
*Leading Draftsman or Designer**— Capable of handling complete design in designated department	$200	to	$250
*Draftsman**— Reports to Leading Draftsman or independently as assigned. General drafting work	150	to	200
*Detailer**— Reports as assigned	120	to	150
*Tracer**— Reports as assigned. Qualified to prepare neat tracings	90	to	110
*Engineer Inspectors**— Reporting as assigned	150	to	225
*Instrument Man**— Responsible for technical work of making surveys and of laying out work in field	200	to	225
*Rodman**— Understands technique of making surveys and of laying out work in field	125	to	150
*Tapeman**— Responsible for making accurate measurements as directed	100	to	120

*Rates stated for junior positions cover the length of service in the respective positions. An increase of not less than $5 for each 6 months' service to be granted up to the maximum rate of the position.

The duties of Resident Engineer involve construction work of ordinary magnitude. Where exceptional work is undertaken it is assumed that the Assistant District Engineer, District Engineer or Assistant Chief Engineer will take charge personally.

The duties and qualifications attached to the positions named are generally well understood. Any schedule of rates promulgated should specify that the work actually performed should govern. Thus if a railroad calls a man an Assistant Engineer and he is actually performing the usual duties of a Division Engineer or other position, he should receive the pay of that position.

In the above schedule the rates for the higher positions do not apply to short lines, terminal railroads and roads of similar character.

The rates of pay for the higher positions on the smaller roads to be in proportion to the duties and responsibilities assumed, based upon above schedule.

This schedule not to operate to reduce any salaries now existing.

Expenses away from headquarters or in connection with moving headquarters to be allowed.

No pay for overtime.

Civil service rules to apply as to annual and sick leave.

Steel Bridge Specification

When the report of the Steel Bridge Specification Committee was presented at the Annual Meeting the proposed Specification had already been published in *The Journal*, but the correspondence in connection therewith was omitted from the Annual Meeting report.

In submitting the draft for publication in *The Journal* the chairman of the Steel Bridge Specification Committee, P. B. Motley, M.E.I.C., stated that the suggested Specification expressed the views of the Montreal members of the Committee and he suggested that all the branches discuss the proposed Specification through the medium of *The Journal* before the Specification was finally adopted. The out of town members of the Committee had been provided with copies of the Specification but with one exception, had not taken advantage of the opportunity to discuss it.

It is to be hoped that if there is to be any discussion on this important matter it will take place at an early date.

Memorial to Government

Previous to the Annual Meeting, suggestions had been made that *The Institute* memorialize the Government at the time of the Annual Meeting in the interests of the technical men in this country. A memorial was drawn up, which evoked some discussion and which was finally considered to cover too many points to receive the serious attention either of the Federal or Provincial Governments. As a result of the discussion it was amended and the direct application was limited to point out to the Government the value of technical men and the necessity of appointing trained engineers on commissions involving engineering work.

As the preamble to the memorial covers a number of points which have been suggested by our branches in the way of proposed memorials to the various Governments, this draft has been considered sufficient in breadth to direct the attention of the various Governments to the different points brought up.

The memorial reads:

To The Right Honourable Sir Robert L. Bordon, P.C., G.C.M.G., K.C., LL.D.,

And to The Honourable The Members of the Government of the Dominion of Canada.

This Memorial Humbly Sheweth:

The undersigned, on behalf of *The Engineering Institute of Canada*, consisting of over thirty-two hundred members of the profession in this country and the various industrial and technical interests which they represent, desire to lay before the Government certain considerations.

The war has demonstrated more than ever before the value of technical knowledge, and not its value only, but its absolute necessity. This fact was used to advantage by the Government of the United States on their entering the war by seeking the advice and co-operation of the great engineering organizations in that country. These organizations readily assented to the proposal and the result was a distinct advantage to the nation.

Many of the problems confronting this country to-day are of a technical nature and require, in their solution, the advice and co-operation of men trained to plan and act along definite constructive lines.

The technical men in Canada are one of the country's greatest assets and should be used to the fullest extent. It is known that it costs the country upwards of $2,000 for every man educated in an engineering school and it is also a fact that hundreds of these men after receiving their education leave the country—an economic loss of great importance.

At the present time thirty-six percent of the eligible membership of the engineering profession, as represented by *The Engineering Institute of Canada,* are on active service, ninety-seven percent of whom are officers, and with the plans of demobilization under way, it is anticipated that they will soon return to their own country. The immediate undertaking of national operations which will absorb these men in civil life will at the same time set in motion activity throughout the country in a manner that will tend to solve the entire problem of employment for the soldiers on their return.

It is Desired, Therefore:

That the Federal Government recognize the paramount value as a national asset of her highly educated and trained men and utilize to a greater extent men of engineering knowledge and training, especially in an executive capacity on commissions dealing with all affairs where engineering or construction is involved.

And your memorialists will ever pray.

Signed on behalf of the President and Council of

The Engineering Institute of Canada,
FRASER S. KEITH,
Secretary.

Harbour of St. John, N.B.

Inasmuch as a specific instance has arisen recently in the proposal to place the Harbour of St. John under a Commission it was decided by Council that a letter covering this point be forwarded to the Honourable Minister of Public Works.

The Hon. F. B. Carvell,
Minister of Public Works,
Ottawa, Ont.

Sir:—

The President and Council of *The Engineering Institute of Canada* have been advised that it is the intention of the Government of Canada to place the Harbour of St. John, N.B., under Federal control and under the jurisdiction of a Harbour Commission.

Inasmuch as we represent the opinion for the most part of the engineers in Canada, we beg to suggest to you that this is an engineering matter and, therefore, it is absolutely necessary that the Commission consist of men appointed solely on the basis of their knowledge of harbour work and their engineering and technical qualifications, which are an absolute necessity, to enable them to effectively direct such an important undertaking.

On behalf of the President and Council of *The Engineering Institute of Canada,*

I beg to remain,
Yours faithfully,
FRASER S. KEITH,
Secretary.

CORRESPONDENCE

Transitmen Need Help

Editor, *Journal:*—

I am very pleased to note in our very interesting *Journal* that *The Institute* has been doing something lately with a view of obtaining adequate salaries for engineers.

Being one of the younger members of the profession, I would like to point out the necessity of doing something for the transi man (the man in charge tomorrow) who gets the magnificient salary of $100.00 to $115.00 per month. A transitman receiving $100.00 per month is getting less than a section foreman,or a signalman at an interlocked crossing, while a transitman receiving $115.00 per month is getting less than a section foreman working ten hours per day or a B. & B. foreman working eight hours per day, yet he is expected to lay out work for both of them. He receives only as much or a very little more than some stenographers with two or three years experience.

Would it not be more equitable to pay transitmen better wages and according to their experience or service? In some cases transitmen are doing the work of assistant engineers and are qualified for the position of Resident Engineer at a salary of $200.00 per month, yet are receiving only the minimum rate for transitmen. I admit that $200.00 per month is not too much for the Resident Engineer but cannot see the reason for such a difference in salary. Would it not be logical and just for *The Institute* to try and enforce a minimum rate for each grade in our *Institute?* If this was done, a man would then be paid for his experience and ability.

I regret to say that a few railroad officials and members of the profession are not doing their share by hiring non-members of *The Institute* and are not doing all they could do for the younger members.

An Experienced Transitman.

Adaption of the Hydroplane to Exploration

Editor, *Journal:*—

It has occurred to me that while the Press of our Country has been advocating the use of the hydroplane as a quick and efficient means of forest protection and conservation that there still exists a far larger field for its use than this alone, by this I mean that when a new idea is launched it should cover its uses in general more than in particular, forestry in this case will be only a branch. Knowing the use of this new arm from experience overseas, I naturally am deeply interested in the subject. Incidently as an engineer with a fair experience of conditions in our Great North, I would like to suggest the many other ways in which the hydroplane could be of use insofar as the development of the great resources of our north country are concerned:—

Let us, for instance, consider the question of research, geological, hydrographic and agricultural. The sending of expert engineers by hydroplane, from an established base, say, Lake St. John, with the oblique photograph apparatus in common use in the theatre of war, which on the machine at an elevation of 1000 feet, can take a picture, showing the general lines of the country: lakes, mountains and rivers, with a vertical base of say, 500 yards, extending forward and outwardly for 6 miles, with the possible upper base of 6 miles, giving a very fair idea of the elevation and contours of the country.

The landing can be made upon our numerous lakes in that region which to my general knowledge, are never farther apart than a matter of 10 miles. Tests of soil such, for instance, as planting grain, corn, etc., the exploration of the geological formations, the sizing of water-powers, and the examination of fisheries, etc., can be made all of which would be invaluable data, to the provincial department of research. Also from the lumberman's point of view the examination of valuable timber and protection thereof, and a great many other things too numerous to mention.

The sister province, Ontario, I must say, has given an example of progressiveness insofar as the exploration and exploitation of their north country is concerned. It is a matter of common knowledge the great benefit that has been derived by the building of the Temiscamingue and Northern Ontario Railway, for the Ontario Government; and the projection of the Transcontinental Railway through the Abitibi, and the subsidizing of the Algoma Central, all of which have more than repaid their sponsors by opening up the great mine fields of Cobalt, Porcupine, and the fertile, clay-belt of the Abitibi.

Why could not this Province of ours, in view of the great demands which will be made by all returned soldiers for large public expenditures, not open a new railway for the development of our own north country, which is, no doubt, as rich as that of the sister province. There is very little doubt that such an investment would not only please the public, but would be an investment in the fullest sense of the word, and would bring magnificent results. It is a well-known fact that the credit of the country depends on its natural resources, but these natural resources must be in view and not in imagination. A practical way of proving these resources is by practical development. Heretofore, railway construction in the north, far from its base of supplies, has been a very serious problem; the country being virgin, and more or less, unknown, and distances great. It is obvious that, adapting the hydroplane to this particular branch of engineering would reduce the preliminary cost of survey by 50 p.c. and likewise reduce the duration of these surveys by at least the same amount. For instance, it is proposed to build a line from St. Félicien and Lake St. John, to that lake of mystery, called Mistassini. I roughly calculate the distance at 200 miles. With a base at St. Félicien, and using a small light Curtiss machine equipped with the oblique photograph apparatus (45 degrees), a reconnaissance survey could easily be made; and in the course of a month, with the data supplied by these photographs, a location could be tried, which, I am of the opinion, would fit in. The extent of line generally allotted to each party of engineers on this work, is roughly from 40 to 50 miles long; each working towards the other, so as to join up. On determining the line to be followed, from the reconnaissance survey, how easy it would be to place each party at the desired point where their survey is to commence by means of the hydroplane working from the base. The parties could also be supplied with provisions by the same method. In other words, I believe the aeroplane has arrived to stay, and is bound to revolutionize the old methods of the location engineer.

Again, the outline of our lakes, outlets and inlets in the north are in a large number of cases so imperfectly explored and known, that one can get but a vague idea from Government maps of what really exists there. All these could be quite clearly outlined and recorded, in exact position, by means of the hydroplane at a high altitude, using a photographic apparatus with telescopic lamps.

The machine that could be used for this purpose, would be the Curtiss biplane, carrying two men with a cruising radius of 4 hours, and a speed of 75 miles per hour, minimum, at the cost of $7,000.00 per machine. For transportation purposes, the Caproni triplane, which is manufactured in the United States, can carry 20 men, or 5000 pounds at the speed of 85 miles per hour, with a cruising radius of 5 hours, and costing $17,000.00.

Another advantage which must be considered is the employment of our young men who are returning from overseas, who have qualified as pilots and observers in the Royal Flying Corps. It is needless to say that much time and labor, beside expense, has been devoted to the training and development of these men, which expert knowledge should bring some results for the benefit of the country which has trained them.

In conclusion, I believe that a general idea has been given of the advantages of the aeroplane in the development of new countries, but it has been general more than technical. This is a matter that, if my suggestion should be favorably considered, could be gone into in detail, I am sure, to the satisfaction of interested parties.

Yours truly,

R. de la Bruere Girouard,
Lieut.-Col., A.M.E.I.C.

Action Requested

Editor, *Journal:*—

I feel that it would be wrong not to say a word in favor of the appointment of a Committee by *The Institute* to wait on the Civil Service Commission of Canada, with reference to a salary schedule for engineers.

It is time now that such comparisons of requirements and salaries as appeared in your January issue be corrected by the sheer weight of *The Institute* rather than by any other means. I hope that the committee appointed will realize the force of sentiment behind them, and that they have the support of the majority of the members of *The Institute*. From you, Mr. Secretary, we are looking for a full report from this committee from time to time. There is now being organized throughout the United States a union of engineers and draughtsmen to be affiliated with the American Federation of Labor, and it depends largely on the progress made by your committee whether or not this union will take root in Canada. You who detest the sound of this latter expression, will do well to catch up with the signs of the times, and read " Progress in Engineering Society Organization in 1918 " (See Engineering News-Record, January 23rd, 1919), and note particularly what the editor says with regard to new plans, new machinery, and new men.

Messrs. Committee; dont be afraid to talk salaries. It was part of the code of ethics of The Institution of Civil Engineers of Great Britain, when it was formed on January 2nd, 1818. In 1910, it became a part of the rules. A. B. Warburton and the Hon. Wm. Pugsley spoke at the Eleventh Parliament of Canada on January 17th, 1910, concerning the " Status of Engineers," and, thanks to our lawyer friends, these two men said a lot for us, but evidently they got no support from the then Canadian Canadian Society of Civil Engineers. Mr. Warburton stated: " When the Civil Service Act of 1876 was passed the engineers seemed to have been overlooked and in different acts that have been passed since that time as far as I have been able to see they are still out in the cold." Ye gods, we're out in the cold even yet in 1919, but the signs point to warmer weather soon.

As our friend said in your January issue: " Let us get at it and have a real one and have it over with."

Yours very truly,
THE OPPOSITION.

Employment Bureau

Editor, *Journal:—*

On page 278 of the issue of Engineering News-Record of Feb. 6, 1919, there appears a very good suggestion under the name of " Operating an Employment Bureau for Civil Engineers." It appears to me that the strong recommendation of this scheme is the fact that everyone of the Cornell graduates is included whether he is successful and satisfied or a misfit and carrying a grouch. It must have a tendency to make the successful and influential men take more or less interest in the welfare of the less successful and thereby open up channels by which those unsatisfied ones may attain a field of greater breadth and usefulness. It seems to me that before any great length of time the employers of engineering knowledge would begin to look to this bureau as a reliable place to fill their needs and the demand on it would continually increase. Thus it would be of double value—to the employer and to the employee. Why could *The Institute* not maintain such a bureau and, by so doing, direct desirable men to those positions which they are best suited to occupy?

I would like also to criticize to a greater or less extent your present column "Employment Bureau" in *The Journal*. Throughout the reading matter in *The Journal* we find very commendable pleas for higher salaries and legislation for the engineer. On this we all agree, but why, in the Employment Column, keep on publishing a list of those manifestly inferior position which do not carry enough salary to keep a man properly clothed. I have especially noticed some of the Civil Service openings in this regard. Do you not think *The Journal*, and thereby the profession is being cheapened in the public eye by these glaring inconsistencies. Why not refuse such advertising?

In the above, I have attempted not to knock, but to criticize constructively. If any of the points are worth consideration you are quite at liberty to use this in any manner you may think fit.

Yours truly,
N. L. SOMERS,
A M.E.I.C.

Basis of Legislation

Editor, *Journal:—*

In order to reach a satisfactory basis on which to build up legislation affecting the engineering profession, it becomes necessary to analyze the various lines of activity, and to determine the fundamental elements entering into the complex structure commonly known as engineering. There are three phases common to all branches of professional engineering: (1) Investigation; (2) Design; (3) Management.

Investigation or research consists in making measurements and analyses, in adjusting, compiling and coordinating data and in formulating conclusions or laws.

Design includes the application of the above principles to practical problems according to standardized methods and formulæ as well as individual initiative or invention.

Management covers the realm of executive control of construction and is dependent on the preceding divisions, with the addition of commercial and economic factors.

No one man can hope to master all these various phases. Even the most experienced must rely on the co-operation of his fellow-workers, each in his own respective sphere, and a lifetime may be well spent without attaining to the most lucrative position of manager. Those who occupy executive positions have the power to raise or lower the status of the profession according to their attitude toward those engineers who are associated with them in their work. I do not use the term " subordinate to them," as I believe of all organizations the engineering profession should be the most democratic. No form of legislation can accomplish the end we desire without a proper attitude within our own ranks toward the rights and interests of one another.

Sincerely yours,
G. B. McCOLL, A.M.E.I.C.

Overseas Correspondence

Cigarettes received in good condition. Thanks very much. It is so cheering to know that though we have so long away from home our friends do not forget us.

Lieut. J. R. S. SUTHERLAND, A.M.E.I.C.,
371st Company, R.E.,
B.E.F.,
France.

* * *

I wish to thank you and the Council and members for the gift of cigarettes which I received today.

Your kindness is very much appreciated.

Yours sincerely,
Major A. P. LINTON, A.M.E.I.C.,
1st Bridging Company,
Canadian Railway Troops,
Alexandria, Egypt.

February 18th, 1919.

REPORT OF COUNCIL MEETING

The regular monthly meeting of the Council was held at the rooms of *The Institute*, 176. Mansfield Street, on Tuesday, March 25th, at 8.15 P.M.

Present, Messrs. Walter J. Francis, Vice-President, in the chair; Arthur Surveyer, John Murphy, G. Gordon Gale, J. M. Robertson, R. A. Ross, H. H. Vaughan, A. R. Decary, Ernest Brown, G. H. Duggan.

Previous Minutes:—The minutes of the previous meeting were taken as read.

Secretary's visit to new Branches—Windsor and Niagara Falls:—The Secretary reported on his visit to Niagara Falls, where an enthusiastic meeting of about seventy-five engineers was held, with the result that an application was presented for the formation of a branch to be known as the Niagara Peninsula Branch.

At Windsor a meeting of about 40 took place, following a dinner, at the Chamber of Commerce. Everyone present spoke and it was seen that there was a lively spirit manifested in engineering affairs in the Border Cities.

Recommendations of Executive Committee:—The recommendations of the Executive Committee, which held two meetings since the last meeting of Council, were noted and approved.

Classifications:—Classifications for admission and transfer were considered for the next ballot.

The Secretary requested instructions as to what papers should be sent to the branches when referring applications of residents to the branch executives. It was decided that the record of the applicant when resident at a branch centre be sent in every instance to the Secretary of the branch for the consideration of the branch executive.

Special Legislation Committee:—The following delegates appointed by the branches as a special committee to meet at headquarters on April 5th, were approved:—

Ottawa Branch	R. F. Uniacke.
Montreal Branch	Arthur Surveyer.
Quebec Branch	A. R. Decary.
St. John Branch	C. C. Kirby.
Halifax Branch	C. E. W. Dodwell.
Toronto Branch	Willis Chipman.
Sault Ste. Marie Branch	Newton L. Somers.
Manitoba Branch	J. M. Leamy.
Calgary Branch	F. H. Peters.
Edmonton Branch	R. J. Gibb.
Vancouver Branch	A. G. Dalzell.
Victoria Branch	A. E. Foreman.
Hamilton Branch	E. R. Gray.
Saskatchewan Branch	G. D. Mackie.
Alberta Division Branch	F. H. Peters and R. J. Gibb.

Memorial to Government:—The opinions of Councillors and branches in respect of a proposed memorial were noted and the Secretary instructed to forward the amended memorial to the Federal Government and Provincial Governments.

Soldiers' Civil Re-establishment:—The Secretary's report of the meeting of representatives of *The Institute*, consisting of Lieut.-Col. C. N. Monsarrat, G. Gordon Gale and himself, with three of the Cabinet Ministers, on Saturday, March 1st, at the office of Hon. J. A. Calder, in Ottawa, at which time the letter of the President and Council offering the services of *The Institute* was presented, together with a letter from Col. A. Macphail, was approved. The Secretary outlined the situation in relation to the work being done by the Government in establishing offices to assist in the employment of returned officers. Lieut. F. S. Rutherford, A.M.E.I.C., was appointed by Major Anthes to establish offices, and both he and Major Anthes had expressed their desire for the co-operation of *The Institute*. The matter had also been taken up with the Canadian Mining Institute where co-operation was promised and also in Montreal with the Electrical Luncheon Club. The various branches had been written to with the suggestion that they appoint committees and a number of responses had been received.

The Ministers had expressed their pleasure at the offer of the President and Council and stated that they wished, when the details of co-operation of our *Institute* with the Government were worked out, to have them presented for approval. They agreed with the suggestion made that the Secretary be appointed by the Government in an official capacity in this connection.

Proposed organization of C.I.E.E.—A summary of the situation as outlined in the correspondence received with reference to a proposal to establish a Canadian Institute of Electrical Engineers, was presented, dealing with a proposal that had arisen in Toronto to establish a Canadian Insitute of Electrical Engineers in affiliation with the A.I.E.E. An abstract from the correspondence on the subject from A. A. Dion, A. H. Harkness, Chairman of the Toronto Branch, Professor Peter Gillespie, Member of Council, Toronto, was presented showing that they were strongly of the opinion that Council should take cognizance of the situation and endeavor to make *The Institute* still more attractive for electrical and mechanical engineers. Further correspondence was shown from John Murphy, Member of Council, who outlined his idea of the situation that he felt that the matter should be left with the electrical members of *The Institute*. He presented a suggestion of A. B. Lambe, to the effect that an effort be made to secure the proceedings of the American Institute of Electrical Engineers so that they could be supplied to members at a reduced rate. A similar suggestion was also forwarded by another member of both Institutes together with an outline of his views on the subject. A committee consisting of John Murphy, Chairman, W. A. Bucke and Julian C. Smith, was appointed to confer and make any suggestions in connection with the matter.

Committee on International Affiliation. The suggestion of Alfred D. Flinn, Secretary of the Engineering Council, was acted upon, to the effect that *The Engineering Institute of Canada* appoint a committee to co-operate with the committee already appointed by the Engineering Council, consisting of Charles F. Loweth, Henry A. Lardner and H. C. Parmelee, for the purposes of conferring with the suggested committee of *The Institute*. A committee consisting of H. H. Vaughan, Chairman, John Murphy and G. H. Duggan was appointed.

Date of Western Professional Meeting.—The date of the Western Professional Meeting to be held at Edmonton, as selected by the Western Branches for July 10th, 11th and 12th, was approved.

Reports of Committees:—The suggestions made at the Annual Meeting by the Committees on Roads and Pavements and Steam Boiler Specifications were approved, and the Report of the Committee on Steel Bridges was referred back for any recommended changes.

Advance to Ontario Provincial Division:—The request of Geo. Hogarth, Secretary of the Ontario Provincial Division for a grant of $50 for the Division was granted.

Ontario Provincial Division:—The officers of the Ontario Provincial Division were approved as follows:—

Chairman, J. B. Challies; Sec.-Treasurer, Geo. Hogarth; representing Toronto Branch, Geo. Hogarth; representing Ottawa Branch, J. B. Challies; representing Hamilton Branch, E. R. Gray; representing Sault Ste. Marie Branch, W. S. Wilson.

Non-Resident Members: W. H. Magwood, Cornwall; G. R. Munroe, R. L. Dobbin, Peterboro; J. L. Morris, Pembroke; R. J. McClelland, Kingston; G. H. Bryson, Brockville; A. C. D. Blanchard, Niagara Falls; T. H. Jones, Brantford; J. L. Weller, St. Catharines; S. B. Clement, North Bay; Jas. A. Bell, St. Thomas; L. M. Jones Port Arthur; W. A. Belanger, l'Orignal; and the local Councillors; also that when the By-Laws were amended, that E. R. Gray be Vice-Chairman.

Alberta Division:—The officers of the Alberta Division for 1919. were approved, as follows:—

Chairman, L. B. Elliot; Sec.-Treasurer, R. J. Gibb; representing Calgary Branch, F. H. Peters, S. G. Porter; representing Edmonton Branch, R. Cunningham, A. W. Haddow; non-resident members, E. N. Ridley, C. S. Dewis; and the local Councillors.

St. John Harbour:—Attention was drawn in a letter from C. C. Kirby to the fact that the Harbour of St. John was about to be taken over by the Government. A proposed letter, submitted by the Secretary, addressed to the Minister of Public Works, was considered and after slight amendments was ordered to be forwarded to the Government.

Secretary's Western Trip:—The Secretary was instructed to arrange to visit the Western Branches during June and July, at a time to make it convenient to be present at the Western Professional meeting at Edmonton.

Councillors Visiting Branches:—Approval was given to the proposal that members of Council when in other cities, should make it a point of getting in touch with the officers of the local branch and, if possible, arrange to address the members.

Niagara Peninsula Branch: The application to establish a branch of *The Institute* to be known as the Niagara Peninsula Branch, as follows, was approved:—

March 4th, 1919

To the Council,

The Engineering Institute of Canada,

Montreal, Que.

Gentlemen:

We, the undersigned corporate members of *The Engineering Institute of Canada*, hereby make formal application for the establishment of a Branch to be known as the Niagara Peninsula Branch: A. C. D. Blanchard, H. L. Bucke, Norman R. Gibson, Walter Jackson, John H. Jackson, G. F. Hanning, J. B. Goodwin, F. C. Jewett, W. P. Near, H. D. Dawson, Alex. J. Grant, W. H. Sullivan. J. C. Moyer, F. N. Rutherford, D. H. Fleming, A. S. Cook. R. H. Harcourt, Alex. Milne, H. M. Belfour, D. T. Black.

The following officers were approved: Chairman, A. C. D. Blanchard; Vice-Chairman, W. P. Near; Sec.-Treasurer, R. P. Johnson; and approval was given of an advance of $50 on account of rebates to be sent to the Secretary-Treasurer. It was suggested that electrical men be given full representation on the Executive of this Branch.

Border Cities Branch:—The name "Border Cities Branch" for the new Branch established at Windsor and adjacent cities was approved, and approval given for an advance on rebates of $50 to be forwarded the Secretary-Treasurer.

Miscellaneous Letters. The letter from Calvin W. Rice expressing appreciation of the courtesy extended to the representative of the American Society of Mechanical Engineers at the Annual Meeting of *The Institute* was noted.

Engineering Standards:—The acknowledgment by H. H. Vaughan of a subscription of $200 to the Canadian Engineering Standards Association was noted.

A letter from Gen. Mewburn to Col. Monsarrat in connection with *The Institute's* Roll of Honor was noted.

A letter from R. W. Macintyre with reference to Council matters was read and discussed.

Business to be Transacted at Council Meetings:—It was resolved that the regular monthly meetings of Council take up the more serious business, leaving matters of routine to be dealt with at an adjourned meeting two weeks later, and that the Executive Committee of the Council meet on Monday afternoon between the regular adjourned meetings and on one Monday afternoon preceding the regular Council meeting.

Daylight Saving:—The following telegram was sent addressed to the Acting Prime Minister: "Council of *The Engineering Institute of Canada* most heartily endorses daylight saving bill and strongly urges that Government take action therewith."

Federal Government Salaries:—In view of the resolution of the Manitoba and Quebec Branches, the Secretary was instructed to write each Branch giving the personnel of *The Institute* Committee, outlining the details of the situation and stating that the schedule of increases was not yet available.

Salary Schedule:—A resolution of the Quebec Branch suggesting that every member of *The Institute* take up the question with its local Member of Parliament of securing his support of the measure to be presented to the Government dealing with increased salaries, was read. In view of the importance of this matter, the Secretary was instructed to insert a display notice in *The Journal* bringing this to the attention of all members of *The Institute.*

Electro-Technical Committee:—The suggestion of Dr. L. A. Herdt that the Canadian Committee of the Electro-Technical Committee be continued for the present time was ratified.

Stationary Engineers of Quebec:—Note was made of a letter from the Montreal Branch stating that no bill for the stationary engineers of Quebec was at present before the Provincial Legislature.

Method of Classification:—Letters from three members were presented dealing with the subject of classification of applications and the Secretary was instructed to write giving an outline of the method of classification of such applications.

Availability of Lantern Slides:—It was resolved that lantern slides for various papers be prepared by *The Institute* and preserved for the use of all branches.

Affiliates:—It was resolved that a form for affiliates be designed, copies of which to be sent to the branches.

Resolution of Toronto Branch re reconstruction:—A resolution of the Toronto Branch with reference to reconstruction for the purposes of providing employment, was presented. It was decided that inasmuch as the suggestion outlined in the Toronto Branch is outlined in a Memorial going forward to the Government and, in view of the assurances of the Minister of Public Works, at the Ottawa meeting that every possible aid would be given to public works, it would be inadvisable to forward this resolution to the Federal Government. The Secretary was instructed to pass it on to the provincial divisions for their consideration and action, if considered advisable.

Resolution of Toronto Branch re co-operation regarding Legislation:—The Secretary submitted a resolution from the Toronto Branch with reference to co-operation between the Toronto delegate of the Committee on Legislation, Willis Chipman, and the various technical bodies in Ontario, which was noted.

Board of Examiners and Education:—The Committee of Board of Examiners and Education was re-appointed as follows:—H. M. MacKay, Chairman, Arthur Surveyer, Secretary, Ernest Brown, J. M. Robertson, R. deL. French, R. S. Lea, A. R. Roberts.

Elections and Transfers Effected

Members

Denis, L. G., B.Sc., of Ottawa, since 1910, Hydro-Electric Engineer, Commission of Conservation, Ottawa, Ont.; Gaines, E. C., B.S. (E.E.), of Montreal, in charge of crane and conveyor department, Dominion Bridge Company, Montreal; Hobson, Robert, of Hamilton, Ont., President, Steel Company of Canada, Hamilton; Hungerford, S. J., of Toronto, Assistant Vice-President, C.N.R., Canadian Government Railways, Toronto; Larson, C. H., B.S., of Cabri, Sask., municipal engineer, R. M. Riverside, Sask.; Palmer, R.. K, B.Sc., of Hamilton, chief engineer, Hamilton Bridge Company, Hamilton; Reid, J. A., B.Sc., of Cobalt, Ont., field enginer and mining geologist for M. J. O'Brien, Ltd.,Cobalt, Ont.; Tobey, W.M.M.A., of Ottawa, Assistant Superintendent and Geodesist of the Geodetic Survey, Ottawa; Wardwell, W. H., of Westmount, Que., 1918, Major U. S. Reserve; on special duty in France with the construction depar ment of the Aviation Section of the Signal Corps, Weeks, M. B., B.A.Sc., of Regina, Director of Surveys for the Province of Saskatchewan, Regina.

Associate Members

Bellows, W. S., B.Sc., of Fort William, Ont., member of firm, Fegles-Bellows Engr. Company, Ltd., Fort William, Ont., Brown, G. J., E. E., of Winnipeg, Man., assistant engineer of mechanical services, Province of Manitoba, Winnipeg; Buchanan, C. A., of Levis, Que., at present 4th-year student in civil engineering at McGill University; Duperron, A., B.A.Sc., of Montreal, since 1917, in charge of designing, Quebec Streams Commission, Montreal; Eager, A. H., of Winnipeg, Man., mechanical superintendent, western lines of the Canadian National Railways, Winnipeg; Howarth, C., of Calgary, Alta., since 1915; chief engineer, United Grain Growers, Limited, Calgary, Hubbard, F. W., of Hamilton, Ont., assistant engineer, T. H. & B. Railway on Port Maitland Harbor facilities; Huether, A. D., B.A.Sc., of Niagara Falls, Ont., instrumentman for Hydro-Electric Power Commission, Niagara Falls; MacPherson, A. R., B.A.Sc., of Hamilton, since 1909, with P. H. Secord & Sons, as superintendent and manager on building construction, etc., Hamilton; Milne, W. G., of Hamilton, Ont.; since 1910, with the Hamilton Bridge Company in various capacities, at present occupied with special features of ship construction; Mills, G. A., B.S. (E.E.), of Winnipeg, Man., electrical engineer. in charge of power and transmission with Winnipeg Electric Railway Co., Winnipeg; Morley, J. H., of Wabana, Nfld., since 1915 engineer in charge of Wabana Mines, Nfld.; Munroe, S., of Vancouver, resident engineer, maintenance of way department, C.N.R., Vancouver; Neville, E. A., B.Sc., of Windsor, Ont., assistant to city engineer, Windsor; Robinson, R. C., of Saskatoon, Sask., resident engineer, C.N.R., Saskatoon; Sandover-Sly, R. J., of Saskatoon, Campbellton, N.B., since 1911 town engineer, Campbellton; Sedgwick, A., (S.P.S., Toronto), since 1911 assistant engineer, Ontario Department of Public Highways, Toronto; Smaill, F. H., of Regina, Sask., with Saskatchewan Government as assistant in charge of survey party, at present overseas, Lieutenant in Canadian Expeditionary Forces; Timm, C. H., of Westmount, Que., since 1915 with Dominion Bridge Company, as chief draftsman in charge of mechanical superintendent's drawing office, Montreal; Vaughan, F. P., of St. John, N.B., engineer and manager, the Vaughan Electric Co., St. John; Viens, E., B. A., of Ottawa, Ont., since 1916, director of laboratory for testing materials, Department of Public Works, Ottawa.

Juniors

MacTavish, W. I., S.P.S., Toronto, of Toronto, Ont., since 1912, assistant engineer, Department of Public Works, Toronto; Nesham, L. C., B.Sc., of Ottawa, Ont., draftsman, Department of Railways and Canals, Ottawa; Owens, J. E., B.Sc., of St. John, N.B., since 1916, office engineer, St.J. & Que. Ry., St. John.

Transferred from the Class of Associate Member to that of Member

Armstrong, J., B.A.Sc., of Winnipeg, Man., divisional engineer, Greater Winnipeg Water District, Winnipeg; Bond, F. L. C., Major, B.Sc., of Montreal, serving in France for 2 years as company commander, 10th Batt., Batt., C.R.T., at present chief engineer, G.T.R., Montreal; Leamy, J. M., of Winnipeg, Man., since 1918, member of Federal Lignite Commission, Winnipeg.

BRANCH NEWS

Hamilton Branch

H. B. Dwight, A.M.E.I.C., Sec'y-Treas.

The Hamilton Branch of *The Engineering Institute of Canada* held an open meeting at the Recital Hall, Conservatory of Music, on the evening of January 30th, at which an interesting and instructive address was given by E. L. Cousins, A.M.E I.C., Chief Engineer of the Toronto Harbour Commissioners. His theme, which afforded him great scope for description, was the wonderful development which has, of recent years, transformed Toronto harbor. By a series of lantern slides he showed the plans of the four-mile harbor front and the reclamation of the Island, as well as the Don improvements. The whole scheme was a most comprehensive one. The Toronto Harbor Commission, assisted by large grants from the Dominion Government, have been enabled not only to do much preliminary work, but to put into active operation their well-defined plans for industrial development, and parks and recreation grounds so necessary as breathing spots for the citizens. While the harbor commissioners had many difficulties to encounter, by means of legislation they were able to acquire the riparian rights which were so essential to the completion of their improvements.

The series of slides, accompanied by the technical references to all the engineering work, was not only appreciated by the members of the Hamilton Branch of *The Engineering Institute*, but to the lay mind showed at a glance the results that may be accomplished by having a well-defined plan, with energy and skill to carry it forward, and the necessary Government aid and public support in an undertaking of as great magnitude as the reclamation of land and the advancement of the progressive plans now being perfected in the Toronto harbor. As these various slides were presented on the screen much interest was evinced by the audience in seeing the actual work being done, the construction and launching of steel ships; and learning of all the detail of reclaimed lands, suction dredge filling, concrete blocks, contract work and construction, which the Harbor Commission do by tender, the board with their engineering staff being open competitors.

E. R. Gray, A.M.E.I.C., Chairman of the Hamilton Branch, occupied the chair.

Halifax Branch

K. H. Smith, A.M.E.I.C., Sec'y-Treas.

At the regular meeting of the Halifax Branch, held on March 20th, W. G. Gordon, Transportation Engineer, Canadian General Electric Co., read an interesting and instructive paper on the subject of "Main Line Railway Electrification in Canada," with special reference to the Moncton-Halifax Line of the Canadian National Railways. The address was illustrated with lantern slides, and was largely attended by local and outside engineers and others interested in the subject.

Mr. Gordon is a son of Dr. Gordon, who lately resigned as principal of Queen's University, and formerly resided at Halifax.

In dealing with this subject, Mr. Gordon brought out the following points:—

In considering the electrification of any road which is at present steam operated, we have absolutely reliable data available, the data under steam operation, and we can determine the savings to be effected through electric operation. The latest heavy trunk line electrification to contribute data illustrating successful operation is the Chicago, Milwaukee and St. Paul Railroad. This line has in electric operation, 440 route miles, and has let contracts for the electrification of a further 220 route miles.

On a steam operated trunk line twelve per cent of the entire ton mileage movement of freight and passengers carried is represented in the cars and tenders required to haul the coal supply for the steam locomotive. When such a line is electrically operated from water power stations, it means that the total movement for railway coal and locomotive tenders is eliminated; and, even if partially or wholly operated from steam power stations, the movement for locomotive tenders is eliminated, and the movement for railway coal is greatly decreased. The benefit is self-evident of being able to apply this ton mileage in the movement of revenue tonnage.

The cost of maintenance of the electric locomotive is very much less than that of steam locomotive. The steam locomotive is a power plant which, owing to physical limitations, can attain only a certain capacity and efficiency. On the other hand, the electric locomotive, itself very efficient, can draw any amount of power desired from a system fed either by hydro-electric plants or highly efficient steam electric plants.

The continuous draw-bar pull of the electric locomotive is limited only by the strength of the draft rigging on the cars. Due to the power input available, draw-bar pulls can be maintained at speeds impossible with steam locomotives. This means that over any line trains of a heavier tonnage can be hauled at a much better scheduled speed than with steam locomotives. In the case where a single track steam line has reached its capacity, it would have to be double-tracked to handle increased ton mileage. Electric operation will obviate the necessity of double tracking, and permit of a large expanse in the ton mileage handled.

The cost of operation, as far as sub-station attendance is concerned, has been greatly reduced through the remarkable developments made in the last two years in automatic sub-station control. As to the reliability of the modern electric locomotive for continuous service, the returns just made public for last year show that the large number of electric locomotives operated by the New York Central lines were only inspected after each three thousand miles of running, and that the locomotives average 33,000 miles per detention.

It is of interest to note that in changing to electric operation there is practically no upsetting of the regular steam organization, as the locomotive crews, under instructions, readily become highly efficient in the operation of the electric locomotives. It must also be borne in mind that where the high tension power supply follows the railway line, a continuously increasing load is secured for power and lighting from points along, or near the lines.

With regard to the 187 miles of the present steam operated line of the Canadian National Railways, between Moncton and the Halifax Ocean Terminals, it can be shown that the electrification of this line is economically justified on the basis of sound engineering principles. In Halifax the Ocean Terminals have been laid out with a capacity of several times the present traffic, and with ultimate provision for many times the present tonnage, whereas the present line is a single track railway, with heavy grades. To increase the tonnage capacity of this line, several plans may be considered, including electrification, grade reduction on the present line, double tracking the present line without grade reduction, and construction of low grade single track on new locations.

During winter conditions of extreme cold the steam engine is at its worst, owing to the dissipation of heat, while the traffic conditions are most severe. This condition, instead of being detrimental to the operation of the electric locomotive, increases its service capacity, as the motors can more readily dissipate heat. Further, the tonnage traffic over the line can be largely increasd due to the electric locomotives being able to haul much heavier tonnage at higher scheduled speeds with almost an entire elimination of the failures and delays, at present due to steam operation.

Toronto Branch

W. S. Harvey, A.M.E.I.C., Sec'y-Treas.

Special Meeting

At a special meeting of the Toronto Branch called for Friday, March 28th, addresses will be given by Walter J. Francis, M.E.I.C., Vice-President; Arthur Surveyer, M.E.I.C., member of Council and Frederick B. Brown, M.E.I.C., Secretary-Treasurer, Montreal Branch.

An open meeting of the branch was held in the rooms of *The Institute* at the Engineers' Club, on Feb. 28th, 1919, at 7.45 p.m.

The following members read short papers on the subject, " What *The Institute* Can Do," the papers being followed by discussion:—E. M. Proctor, A.M.E.I.C; H. A. Goldman, A.M.E.I.C.; J. C. Krumm, A.M.E.I.C.; Geo. Phelps, A.M.E.I.C.; J. H. Curzon, A.M.E.I.C., also wrote on the subject, but was unable to be present, his letter, however, was read before the meeting by the Secretary. These papers dealt mainly with the economic and social status of the engineer. Many excellent suggestions were contained therein.

With regard to Mr. Goldman's paper, Professor Haultain volunteered to have a number of copies made to be sent to the various branches for distribution amongst the members. During the discussion Mr. Greigg suggested that the profession should become a university profession, i.e., university graduation should be essential. R. O. Wynne-Roberts, M.E.I.C., suggested that the Branch should take more interest in public affairs and that meetings should be arranged to take the form of debates on local questions.

Hugh Robertson, A.M.E.I.C., suggested that a register be signed by every member attending the open meetings, and no member should be eligible for office in any year unless he has attended a certain percentage of the number of meetings held the previous year.

With regard to the formation of an Employment Bureau, the following motion was moved by Mr. Wynne-Roberts and seconded by Mr. Proctor.

> " Inasmuch as two of the objects of *The Institute* are to promote the professional interests of the members and to enhance the usefulness of the profession to the public, and whereas one important manner in which this might be accomplished is by organizing some method of bringing engineers and employers into more intimate touch, one with the other, and giving engineers facilities of registering their requests for employment, and whereas it is desirable that *The Institute* should encourage each branch to have an employment bureau, working in co-operation with other branches for the above purpose, it is resolved that the Executive Committee of the Toronto Branch of *The Institute* be asked to appoint a small committee of, say, five members who shall consider how best to organize such a bureau, and to report on same to the Executive Committee, so that the matter shall be further discussed at a future general meeting." Carried.

Moved by Mr. Goldman and seconded by Professor Haultain:—

> " That a committee on salaries and fees be appointed to-night by this branch. This committee to study the question thoroughly and prepare a schedule of minimum salaries and fees for engineering services. At the same time the secretary should be instructed to communicate with the other branches and request them to prepare similar schedules. After these schedules are considered and passed by the branches they should be submitted to the parent *Institute* which should review them and select from them final schedules for the different provinces to be adopted by *The Institute*."

The following amendment to the above motion was moved by Mr. Wynne-Roberts and seconded by Mr. Proctor:—

> " That the executive of the branch appoint two sub-committees, one for *employees* and another for *employers*, to prepare schedules of minimum salaries and fees for engineering services. At the same time the Secretary should be instructed to communicate with the other branches and request them to prepare similar schedules. After these schedules are considered and passed by the branches they should be submitted to the parent *Institute*, which should review them and select from them final schedules for the different provinces to be adopted by *The Institute*."

The amendment was carried.

For " employees," *read* " engineers whose remuneration is in the form of salaries. "

For " employers," *read* " engineers whose remuneration is in the form of fees."

Moved by Mr. Proctor, seconded by Mr. Wynne-Roberts:—

"That a sub-committee be appointed to collect back dues of the branch members." Carried.

The following members were appointed to that sub-committee: Messrs. Proctor, Goedike, Phelps and Jack. Mr. Proctor to convene the first meeting.

Moved by Mr. Proctor, seconded by Mr. Wynne-Roberts:—

"That the branch by-laws be adopted as amended by the committee." Caried.

The meeting was well attended and adjourned at 10.30 p.m.

Special Resolution

At a special meeting of the Toronto Branch of *The Engineering Institute of Canada*, held on March 13th, 1919, the following resolution was moved by Mr. Wynne-Roberts and seconded by Mr. Worthington:—

"That whereas it is vital to the peace and welfare of the Dominion that, during the necessary period of reconstruction following the war, the number of unemployed be reduced as much as possible; and whereas the development of transportation, sanitation, power and public utilities generally is necessary to the development and prosperity of the country; and whereas the curtailment of needed public works during the last five years has retarded the development of the country; and whereas the speediest and most effective means to prevent the suffering, distress, and demoralization resulting from unemployment is afforded by public works; and whereas the public welfare and confidence, upon which industry generally depends, require that the construction of public works be vigorously prosecuted; therefore, be it resolved, that the Toronto Branch of *The Engineering Institute of Canada* desires to record its profound conviction that public works should be carried forward to the fullest extent consistent with sound judgment, not only for fundamental economic reasons, but for humanitarian reasons to furnish employment for all who can properly claim employment, especially returning soldiers; and be it further resolved that a copy of this resolution be forwarded to the Council of *The Engineering Institute of Canada*, with a request that copies of same be transmitted to such federal, provincial, and municipal authorities and public corporations as may be able in the opinion of Council, to promote the purposes of those resolutions, and to commend these authorities who already have such schemes in contemplation." Carried.

Alberta Provincial Division

R. J. Gibb, M.E.I.C., Sec'y-Treas.

Minutes of the second annual meeting held at Calgary, February 1st, 1919, in the Board of Trade Rooms.

The meeting was preceded by a luncheon at which twenty-four members were present, including delegates from Edmonton and other parts of the province. S. G. Porter, of Lethbridge, in the absence of Mr. Pearce, was elected to act as chairman of the meeting which started at 2.30 P.M., and called upon the acting secretary to read the minutes of the last annual meeting and of the meeting held in Edmonton, April 27th, 1918.

The minutes were approved as read and signed by the chairman.

The acting secretary then read his report of the work carried out by the division during the year, and on the motion of C. M. Arnold, seconded by Mr. Gibb of Edmonton, the report was approved and adopted.

Communications

Correspondence in regard to the summer professional meeting from L. B. Elliot of Edmonton, and the secretary of the Vancouver Branch was read. In view of representations made by this division, the Vancouver Branch decided to forego their request for this meeting to be held at the coast, and stated they believed the Victoria Branch would unite with them in supporting our claim to the holding of the next western meeting at Edmonton.

It was, therefore, decided to proceed with the necessary arrangements.

On the motion of C. M. Arnold—F. H. Peters seconding, it was resolved:

"That the work of organization of the western summer meeting be delegated by this division to the Edmonton Branch, and that the Calgary Branch be asked to co-operate with that branch, as far as possible." Carried.

A letter from the Edmonton Branch was read, stating that L. B. Elliot had been nominated by them as Chairman of the Alberta Division for the ensuing year, and R. J. Gibb for Secretary-Treasurer.

R. Cunningham and A. W. Haddow were elected to act on the Executive.

Accounts

The Secretary's report showed a balance at bank of $17.13, with one or two small accounts outstanding. In view of the necessity of providing funds for current expenses, it was moved by Mr. Peters, seconded by Mr. Houston, that the Calgary branch contribute a sum of $25.00 and the Edmonton branch $15.00.

Mr. Gibb suggested this motion be left on the table as he wished to raise the question of raising funds for legislative expenses.

The matter was discussed and it was thought this could be better settled at a conference of engineers which it was proposed to call shortly to discuss the question of legislation. Mr. Peters thought it would be preferable to call for a levy as this would show at once the engineers who were favorable to legislation: Mr. Gibb agreed to let the matter rest and the motion to vote the funds first mentioned. Carried.

Reports of Committees—Legislation

Mr. Peters, as chairman of the legislative committee, made a report on what had been done in this matter. The various steps taken were gone into in detail and the ground covered very fully. Opposition had developed from the mining engineers, and the Alberta Land Surveyors were not entirely in favor of the bill as presented to them. Conferences had been held and the mining men had decided to oppose the bill as they claimed they had not been given sufficient opportunity to discuss it. The discussions that had been held, however, led us to believe that a bill could be drafted that would meet with the approval of the opposing parties, and which would also receive more favorable consideration from our own Council who were working upon the draft of a uniform act for all the provinces, so far as this was possible. It had, therefore been decided to withdraw the act incorporating the "Alberta Institute of Professional Engineers" at the coming session of the legislature.

The support of all members was asked for in furthering the movement with the view to an amended act being submitted to the legislature next year.

Mr. Brown, city electrical engineer, was present and was asked to make a statement on legislation as affecting his branch of the profession. He gave it as his opinion that it would be as well to include all engineers. At a meeting recently held it was the consensus of opinion that it would be better if all engineers were included in one organization, as better results could be expected and we would benefit by an exchange of views and by co-operation. They were not opposed to legislation.

Mr. Gibb stated that the electrical engineers in Edmonton would like to be included in any act passed.

Mr. Gibb drew attention to the fact that the Saskatchewan act did not call for registration by branches and as the parent body were taking this act as a basis to work upon, it would be as well if a delegate were appointed to the annual meeting, that he should be instructed to impress the importance of this matter on the Council. The point was considered to be well taken and was left for the Secretary to deal with.

On the motion of Mr. Arnold it was decided to name Mr. Pearce as delegate to the conference on legislation to act for the division and also for the Edmonton Branch as he would be in Ottawa for the meeting representing the Calgary Branch. Agreed.

Mr. Peters drew attention to the large amount of work done by the executives of both the Edmonton and Calgary Branches in the matter of legislation, and would like to hear if the meeting approved of the actions taken.

P. M. Sauder, seconded by A. S. Chapman, moved that the meeting tender thanks to all those who had worked so hard to gain legislation and that the work done be commended. Further that a legislative committee be appointed by the new executive to carry on the work. Carried.

Mr. Arnold read a resolution which had been passed by the Calgary and Edmonton Branches in regard to the decision to defer action in presenting the proposed act to the present session of the Alberta Legislature and which had been transmitted to the parent body.

Mr. Marshall moved that the Alberta Division endorse this resolution and that the parent body be notified accordingly. Carried.

On the motion of Mr. Gibb, seconded by Mr. Houston, the Secretary was requested to ask Mr. Pearce to bring the matter of registration by branches before the annual meeting at Ottawa with a view to a clause of this nature being incorporated in the bill to be drafted. Carried.

Mr. Gibb stated he had been instructed by the Edmonton Branch to introduce the question of pooling of delegates' expenses, when attending general meetings of *The Institute*.

After some discussion it was the sense of the meeting that the idea was not workable, and Mr. Gibb agreed to let the matter rest.

Elections to Executive, 1919

Calgary Branch, F. H. Peters, Calgary; S. G. Porter, Lethbridge.

Edmonton Branch, R. Cunningham, Edmonton; A. W. Haddow, Edmonton.

Non-resident Members, E. N. Ridley, Strathmore; C. S. Dewis, Canmore.

Unfinished Business.

Reference correspondence on representation of engineers on the senate of the University of Alberta, the secretary will follow the matter up and request a reply to our previous letter.

General

Mr. Arnold presented a resolution urging the Provincial Government to proceed in the matter of a School of Technology in Calgary and assuring our support to such a policy, together with any service we might be able to give in the matter. It was decided to forward the resolution and send copies to the press.

Messrs. Craig, Elliot and Carter were nominated as delegates from the division to the Provincial Research Convention at Edmonton. The Secretary was requested to notify them accordingly and advise the Premier of their appointment.

Alberta Division

At a meeting of the Executive Committee of the Alberta Division held in February, L. B. Elliot, M.E.I.C., of Edmonton, member of Council, was appointed chairman and Robert J. Gibb, M.E.I.C., secretary-treasurer. Mr. Gibb is also secretary-treasurer of the Edmonton Branch.

Border Cities Branch

One of the most enthusiastic organization meetings yet held in any part of Canada was that of the engineers in the border cities including Ford, Walkerville, Windsor, Sandwich, and Ojibway following a dinner at the Chamber of Commerce quarters in Windsor at which about forty were in attendance.

At this meeting Alfred J. Stevens, M.E.I.C., presided, and called on the Secretary of *The Institute* to give an account of the aims, objects and activities of our organization. Following the Secretary's address every member present, and a number of non-members spoke, every one of whom expressed his intention of becoming an active supporter of the branch and taking a personal interest in its welfare.

An announcement regarding election of officers will be made at an early date. This branch will cover an important engineering centre, and from the manner in which it was started gives evidence of an active, aggressive, useful existence.

Ottawa Branch

M. F. Cochrane, A.M.E.I.C., Sec'y-Treas.

A meeting of the Ottawa Branch is called for March 27th, when a full discussion of the subject of the proposed provincial legislation defining the status of the engineers throughout Canada will take place.

The report of the Special Legislation Committee approved at the Annual Meeting of *The Institute* in Ottawa, on February 11th, provides:—

" That a Special Committee be formed, composed of one delegate appointed by each branch to meet at headquarters before the 15th of April, 1919, to draw up such sample legislation as it may deem necessary and advisable in order that the members of *The Institute* throughout the different provinces may ask for legislation on the same uniform basis.

" That this Committee be authorized to obtain the necessary legal advice on the matter.

" That this Committee shall submit the proposed legislation to the Council before the 1st of May, 1919."

" That the Council shall then ask by letter ballot, before the 1st of June, 1919, the opinion of all members of *The Institute*, regarding the adoption of the proposed legislation prepared by the said Special Committee of *The Institute*."

The managing committee of this branch have appointed R. F. Uniacke, M.E.I.C., as their delegate and the committee meet in Montreal on April 5th; they have called this meeting for the purpose of obtaining the views of the members and of instructing our appointed delegate on the wishes and suggestions of the branch.

The discussion will be led by A. A. Dion, Col. D. MacPherson, G. A. Mountain, John Murphy, W. S. Smart, Jas. White. As this is a question of such vital importance, especially at this time, it is hoped there will be a large and representative attendance and very full discussion. Members are referred to the following leading articles on this subject:

1.	*The Journal,*	March,	1919	.........page	173
2.	" "	Sept.,	1918	.... "	217
3.	" "	Nov.,	"	.... "	331
4.	" "	"	"	.... "	335
5.	" "	Dec.,	"	.... "	409
6.	" "	Jan.,	1919	.... "	26
7.	" "	"	"	.... "	27
8.	" "	"	"	.... "	32
9.	" "	Feb.	"	.... "	120

The Branch is to be favoured by the presence, on that evening of A. R. Decary, delegate from the Quebec Branch and A. G. Dalzell, delegate from the Vancouver Branch. Mr. Dalzell has recently met the Victoria, Calgary, Edmonton, Saskatchewan and Manitoba Branches and explained to them the attitude of British Columbia in regard to legislation and organization.

J. B. CHALLIES, M.E.I.C.
Chairman, Ontario Provincial Division.

Manitoba Branch

George L. Guy, M.E.I.C., Sec'y-Treas.

On February 28th, a meeting was held at the Engineering Building, Manitoba University. No paper was read, the meeting being confined strictly to clearing up a large amount of business which had accumulated from previous meetings.

Among other business done, the attached resolution pertaining to the centralization and execution of work pertaining to the development of Manitoba's natural resources, was passed and the Executive were instructed to present same to the local authorities.

A motion was passed appointing a committee to enquire into the present condition of engineering education in Manitoba, to make such recommendation to the branch as they saw fit.

G. C. Dunn, M.E.I.C., and J. M. Leamy, A.M.E.I.C., made a report on the annual meeting which they attended, as representatives of the branch.

On March 6th, an interesting paper was read by John Armstrong, A.M.E.I.C., describing the Greater Winnipeg Water District Tunnel under the Red River. The paper was profusely illustrated with lantern slides, and Mr. Armstrong lucidly explained the various difficulties which had arisen during the construction of this work, and the methods taken to overcome them.

It was decided to appoint a committee to co-operate with the Soldiers' Re-Establishment Committee and the Vocational Training Commission to assist them in any way possible, both as to the suitable arrangement of courses and the placing of men in positions upon completion of their course.

A resolution was passed calling upon the Dominion Government to properly remunerate engineers in the employ of the Civil Service, the Secretary being instructed to send a copy of this resolution to all the other branches, requesting that they bring pressure to bear upon various Federal Members to have this matter properly considered.

Local Notes

J. G. Sullivan, M.E.I.C., has been appointed Chairman of the Manitoba Drainage Commission.

W. M. Scott, M.E.I.C., and Harold Edwards, A.M.E.I.C., have been appointed by the Manitoba Public Utilities Commission to make a valuation of the Winnipeg Electric Railway property with a view to revision of their transportation rates, the work being under the direct supervision of George Guy, M.E.I.C., Engineer of the Commission.

Resolution Adopted

The following resolution was adopted by the Manitoba Branch pertaining to the centralization of work relating to the development of Manitoba's Natural Resources:—

Whereas in the Province of Manitoba are found the following:—Large and valuable deposits of gold, silver, copper, coal, iron, clay and building stone, etc.; large areas bearing a growth of wood suitable for pulp; many lakes and streams teeming with valuable food fishes; great stretches of arable land ready for the plough; immense areas of rich land which may be made available for agriculture by drainage or irrigation; and many water powers awaiting development.

D. H. McDOUGALL, M.E.I.C.
Newly elected President of Canadian Mining Institute.

And whereas the population of Manitoba is but a fraction of the number of persons, the resources of the province is capable of supporting.

And whereas it is expedient and wise that immediate plans be made for the economic development of all the aforesaid natural resources, utilizing all that has been done in the past, and keeping in view certain fundamental principles, which may be stated as follows:

1st.—That in order that systematic, orderly, logical and economical development may be carried on, it is necessary to determine the physical features of the provinces.

2nd.—That the information which may be derived from such a determination, can be made in such form as to be useful for the planning of water routes, highways, roads, drainage and irrigation projects, electric transmission lines, or for any other development work wherein a knowledge of such physical features is a necessary factor.

3rd.—That lines of communication interconnecting all parts of the province, by means of highways, roads and water routes is the first requirement in any comprehensive scheme of development, and that the provision and maintenance of these must precede or accompany the development of any or all of the above natural resources.

And whereas the cost of power and its equitable distribution is a primary factor in the development of natural resources.

And whereas the prosecution, completion and maintenance of all the works indicated herein will promote the prosperity and peace of the province, provide employment for many people, prepare for a vastly increased population and make the many problems connected with the redomestication of the soldier easier of solution.

Whereas the Province of Manitoba is about to acquire control over the natural resources within its boundaries. We expect that together with the present administrative commissions there will be formed new bureaus to deal with the development and protection of the different kinds of resources.

Therefore, be it resolved:—

That in this connection the Manitoba Branch of *The Engineering Institute of Canada* would strongly urge the appointment at once of a thoroughly practical scientific non-partisan board, with authority to correlate the economic policies of the above provincial agencies. The means for collection and methods of expenditure of public funds dealing with internal improvements, reclamation and conservation of natural resources should receive the ratification of this board. It should also assist in framing such legislation that might become essential in the developing of these resources to their highest industrial capacity.

Niagara Peninsula Branch

R. P. Johnson, S.E.I.C., Sec'y-Treas.

During the month of February, following a proposal made last year, some of the members of *The Engineering Institute of Canada*, resident at Niagara Falls proposed that a branch of *The Institute* be formed in the Niagara District.

A meeting was called to discuss the proposal and it was unanimously agreed that steps should be taken to form a "Niagara Peninsula Branch," provided that members living in St. Catharines would express themselves similarly. It was, therefore, decided that St. Catharines should be visited and an expression of opinion obtained from members resident there.

On March 3rd, members motored from Niagara Falls to St. Catharines to lay the proposition before the members in that city. The matter was discussed and it was decided to immediately proceed towards the formation of a "Niagara Peninsula Branch."

A general meeting of all engineers in the district was called on the evening of March 11th, with M. V. Sauer, M.E.I.C., of Toronto, in the chair. The General Secretary, Fraser S. Keith, was present and outlined the scope and functions of *The Engineering Institute* and its branches.

A short discussion followed during which questions, relating to the possible activities of the branch were answered.

A formal petition to the Council for a "Niagara Peninsula Branch," signed by twenty corporate members, was presented by the Provisional Secretary. The chairman then called for nominations for Provisional Officers and an Executive. This resulted as follows:

Chairman, A. C. D. Blanchard, M.E.I.C., Niagara Falls; Vice-Chairman, W. P. Near, A.M.E.I.C., St. Catharines; Secretary-Treasurer, R. P. Johnson, S.E.I.C., Niagara Falls.

Executive, N. R. Gibson, A.M.E.I.C., Niagara Falls; W. H. Sullivan, A.M.E.I.C., St. Catharines; A. J. Grant, A.M.E.I.C., St. Catharines; H. M. Belfour, A.M.E.I.C., Welland; H. L. Bucke, M.E.I.C., Niagara Falls.

The business was completed by 10 o'clock when the members adjourned to the dining-room of the LaFayette Hotel for supper and speeches. The newly-elected chairman occupied the chair at supper.

A register was passed around the table and from this it was learned that there was an attendance of sixty-seven.

A visit of four members from the Hamilton Branch: Messrs. Palmer, Darling, Jack and Pacy, was much appreciated, and a short address by Mr. Palmer was enjoyed.

In addition to these gentlemen, the following visitors were present: R. D. Johnson, New York City; J. A. Johnson, Niagara Falls, N.Y.; C. W. Larner, M.E.I.C., Philadelphia; F. H. Martin, Niagara Falls.

The engineers present represented industry, public and municipal works, railroads, power developments, etc.

After drinking to the new branch and singing a verse of "God Save The King," the meeting adjourned.

PERSONALS

W. G. Mawhinney (B. C. E., Man.), S.E.I.C., who returned recently from overseas has been appointed engineer to the Municipality of St. Clements with offices. at Selkirk, Man.

John F. Green, A.M.E.I.C., formerly construction engineer with the Carter-Halls-Aldinger Company of Winnipeg, has entered the firm of C. D. Howe and Company, consulting engineers, Winnipeg and Port Arthur. Mr. Greene who had been bridge engineer for the city of Spokane, Wash., and for the city of Calgary, Alta., will have charge of bridge and structural work while acting as manager for the Winnipeg office.

NORMAN COULSON MITCHELL, V.C., M.C., A.M.E.I.C., Winnipeg, whose thrilling heroism was reported at the Annual Meeting.

Sir Percy Girouard, C.M.G., D.S.O., Hon. M.E.I.C., arrived in Canada on March 17th, on a combined business and pleasure trip. His distinguished work in connection with the South African war is too well-known to require repetition. The part he played in the Great War was equally important and Canadians are proud of the position he occupies and the services he has rendered the Empire. Sir Percy is President of the Armstrong, Whitworth Company of Canada.

In a letter from Capt. J. W. B. Blackman, M.E.I.C., from the Canadian Railway Troops Camp at Liverpool, he advises that the statement contained in a previous issue of *The Journal* to the effect that he had resigned his position as city engineer of New Westminster was incorrect, as he proposes on arriving in Canada to return to New Westminster where his wife and family are at present residing. Capt. Blackman has recently been promoted from the rank of lieutenant as a recognition of the services which he has rendered since going overseas.

Major R. Douglas Galbraith, S.E.I.C., has been appointed superintendent of the professional and business occupation section of the Dominion and Provincial Employment Service in conjunction with the Soldiers' Civil Re-Establishment for the Toronto and Western Ontario district, with offices at 43 King Street, West. This office is one of many to be established and members of *The Institute* will be gratified to learn that already Major Galbraith's splendid success in this connection has definitely established the value of such offices.

Lieut. Ernest Peden, B.Sc., Jr. E.I.C., who went overseas with the 1st University Company and saw active service for eighteen months in France with the P.P.C.L.I., which period included engagements at Ypres in 1916, and at the Somme, returned to his home in Montreal West early in March. Lieut. Peden became a casualty last October, having spent some time previously as an instructor at Seaford, Sussex, England. Before going overseas he was engaged as demonstrator on bridge design and surveying, etc., at McGill University and has planned to engage in his previous profession of structural designing.

Lieut. F. S. Rutherford, A.M.E.I.C., has been engaged on an important undertaking for the Dominion Government for the past two months in the capacity of organizer for the professional and business occupation section for the Department of Soldiers' Civil Re-Establishment. Lieut. Rutherford has established offices at Ottawa and Toronto and is about to establish one in Montreal, for the purpose of assisting returned men in securing positions. In this work he will have the hearty support, sympathy and co-operation of the entire *Institute*. The details for the most effective working out of this co-operation are being consummated. Lieut. Rutherford proposes visiting all the important centres in Canada, where it will be necessary to establish such offices. The branches can, and are prepared to assist very materially in connection with this work and Lieut. Rutherford is assured of the heartiest co-operation of all the members of *The Institute.*

* * *

A. S. Clarson, A.M.E.I.C., who was formerly city engineer of Verdun and more recently been engaged in consulting engineering practice in Montreal, has been appointed, secretarial manager and permanent organizer of Canadian Building and Construction Industries with headquarters at Ottawa. It is Mr. Clarson's intention to make a trip covering the principal cities in the Dominion for the purpose of organizing branches in accordance with local conditions. Mr. Clarson's many years of engineering and business experience will stand him in good stead in his new position, to which he carries the best wishes of his fellow engineers in Canada for success.

In addition to being an Associate Member of *The Engineering Institute of Canada*, Mr. Clarson is a member, National Highway Traffic Association, New York; member, American Road Builders Association; Fellow of the Royal Colonial Institute of London; Member Montreal Board of Trade; Justice of the Peace for the City and District of Montreal; President and Life Member, St. George's Society of Montreal; Chairman of Joint Committee of the National and Kindred Societies of Montreal; President Christ Church Cathedral Men's Club.

A. S. CLARSON, A.M.E.I.C.
Secretarial manager, Association of Canadian Building and Construction Industries.

J. R. W. Ambrose, M.E.I.C., chief engineer of the Toronto Terminal Railway states that the new Union Station in Toronto will be ready for use not later than August. Within the next few weeks the scaffolding will be taken down, and after that the building will require only a little finish work.

* * *

At the inaugural banquet of the Association of Montreal Building and Construction Industries, held at the Windsor Hotel on February 27th, *The Institute* was represented by Walter J. Francis, Vice-President, and Fraser S. Keith, Secretary, who enjoyed the hospitality of the Association as their guests on this occasion. Mr. Francis was one of the speakers of the evening and responded to the toast "our guests."

OBITUARIES

Capt. J. A. Tuzo, A.M.E.I.C.

Details regarding the death on active service of Capt. J. A. Tuzo, A.M.E.I.C.

Captain Tuzo, born in New York, in 1875, was the only son of the late Dr. H. A. Tuzo, of Victoria, B.C., and Warlingham, Surrey, England. He was educated in England, studied engineering at Yorkshire College and was afterwards apprenticed to the Midland Railway Company. He came to Canada some twenty years ago and engaged in railroad construction and mining engineering in British Columbia and the Western States. At the time of the outbreak of war, Captain Tuzo was Assistant Chief Engineer on the construction of the Kettle Valley Lines, in charge of the section between Midway and Penticton, B.C. On completion of this section he returned to England, volunteered for active service and was granted a commission in the Royal Sussex Regiment.

Capt. TUZO, A.M.E.I.C.

He proceeded with his regiment to Bengalore, India, in January, 1916. After some months in India he was seconded for duty in connection with the reconstruction of the railways in German East Africa. In August, 1917, after a severe attack of fever he was invalided to India, but returned to duty in East Africa in November of that year. On completion of the work, Captain Tuzo was returning to rejoin his regiment and while waiting for a steamer to take him to India was attacked by blackwater fever and after an illness of two days died in the military hospital at Dar-es-Salaam.

Captain Tuzo was keenly interested in the development of southern British Columbia and was one of the pioneers in that district. He was a strong believer in its future and had many interests there. His sad death, occurring so soon after the opening of the railway through that section will be a great loss.

Captain Tuzo is survived by his widow, daughter of the late Lt.-Colonel Craufurd, Grenadier Guards and an infant son, by his Mother Mrs. Tuzo, Warlingham, Surrey, England, and his sister Mrs. J. A. Wilson, Ottawa.

* * *

George William Ross, B.Sc., Jr.E.I.C.

George William Ross was born March 26th, 1894, in Montreal and educated at the Westmount schools, graduating from the Westmount Academy,he then matriculated to McGill University from which he graduated B.Sc., 1915.

Each summer season during his course at McGill he spent on outside work, being two years with the Topographical Survey of the Militia Department, Canada, covering particularly northern Quebec, and a section of the United States boundary. For two years he was on construction work of the Transcontinental, especially no bridges. Upon the formation of the British Munitions Company he was engaged for their work in the United States, but was transferred to the local works at Verdun, where he became supervisor of the fuse department. Possessed of a tremendous determination as well as a capacity for work, he was never content, until after being refused for military service five times, he was eventually accepted as a private in the C.A.M.C., with a draft of which service he went to England in August, 1917. There he passed into the Royal Highlanders of Canada, from which unit he was commissioned in the Royal Engineers (Imperials) subsequently being attached to the Royal Air Force. It was while on an indefinite leave pending release from the Air Force and assignment to regular engineering duties that he went as the guest of the admiralty to visit the Grand Fleet, which he was never destined to see, as he died on the "Warspite" the day after his arrival at Scapa Flow, on Sunday, March 2nd, 1919, at the age of twenty-five. He was a junior of *The Engineering Institute of Canada*, Royal St. Lawrence Yacht Club and St. Andrew's Presbyterian Church, Westmount.

Those best qualified to know described him as a true Canadian, with a large useful career in prospect.

He was the third son of H. J. Ross, of Montreal, and Harriet M. Bissett, formerly of St. Johns, Que.

* * *

The following directors of the Canadian Good Roads Association have been appointed, on the nomination of the respective governments:—British Columbia, J. E. Griffith, M.E.I.C., Deputy Minister of Public Works; Saskatchewan, the Hon. S. Latta, Minister of Highways; New Brunswick, Mr. T. P. Regan, president of the New Brunswick Auto Association, St. John.

Dr. COMFORT A. ADAMS,

President, American Institute of Electrical Engineers, who expressed his firm conviction that the right step had been taken in Canada in making the change in our national organization designed to include all branches of engineering.

EMPLOYMENT BUREAU

Following out the principle adopted by the President and Council of *The Engineering Institute* to assist in every way to help returned soldiers and those out of employment to be effectively placed, this department of *The Journal* is open, free of charge, to contain announcements of all engineers and technical men who desire to take advantage of it. It is anticipated that the organization to carry on this work throughout Canada will be effectively completed very shortly. In the meantime those requiring positions should get in touch with the nearest Branch, and also make use of the columns of *The Journal* for this purpose.

At an open meeting of the Toronto Branch, held on February 28th, at the Engineers' Club, Toronto, it was resolved that the Executive Committee of the Branch appoint an Employment Bureau Committee to consider the question of co-operating with the Parent *Institute* and such other Branches as have or may appoint a similar committee.

The Executive Committee of the Toronto Branch, at a meeting held on the 5th of March appointed the following members to be the above mentioned Employment Bureau Committee:—W. Cross, M.E.I.C., E. T. Wilkie, M.E.I.C., T. H. Hogg, A.M.E.I.C., A. L. Mudge, A.M.E.I.C., and R. T. G. Jack, A.M.E.I.C., with power to add. It was found that A. L. Mudge could not attend so R. O. Wynne-Roberts, M.E.I.C., was appointed in his place.

At a meeting of the Employment Bureau Committee held on the 20th of March, E. T. Wilkie was appointed chairman and W. Cross, secretary.

Situations Vacant

Consulting Engineer.

Experienced man required for consulting work in connection with natural gas. Apply Box No. 35.

Engineering Salesman.

Several electrical graduates desired to fill positions open for salesmen with electrical company. Preference given to returned men. Address Box 33.

Engineering Salesman.

Engineer required who is thoroughly conversant with modern steam boiler practice, one who would be able to sell water tube boilers, economizers, stokers, coal and ash handling systems, pumps, etc., and also look after the engineering work in connection with the installation of such plants. This offers a splendid opening with a consulting, sales and contracting engineering firm doing business in the west. Address Box No. 36.

Instrument Man.

Instrument man for six months engagement starting May 1st, experienced man for general railway work, including re-survey, a short job on re-location and staking out concrete culverts—all under the direction of company's engineer. Applicant must have had experience and be competent to pick up and re-center curves, trace old alignment and with some experience on location. Salary $150.00 per month and living expenses. Apply stating experience and references to General Superintendent and Chief Engineer, Algoma Central and Hudson Bay Railway Company, Sault Ste. Marie, Ont.

Employment wanted

Returned soldier, Captain, three years active service, fourteen years experience in construction, desires a permanent position as construction superintendent. Address Box 1 P.

* * *

HAVE **YOU** EMPLOYED
A RETURNED SOLDIER ?

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* For 1919 † For 1919-20 ‡For 1919-20-21

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And a member from each branch.

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N. M. THORNTON	"
J. H. KENNEDY	Vancouver
NEWTON J. KER	"
T. H. WHITE	"

Preliminary Notice of Application for Admission and for Transfer

20th March, 1919.

The By-Laws now provide that the Council of the Society shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in May, 1919.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ARCAND—CHARLES LOUIS, of Three Rivers, P.Q. Born at Three Rivers, Nov. 22nd, 1880. Educ., Three Rivers Classical Coll. 1901, asst. engr., P.W.D. of Canada, Three Rivers dist.; 1903-07, in chg. of works as principal asst. engr., on constrn.; 1907 to date, asst. dist. engr.

References: E. D. Lafleur, J. Lamoureux, J. Bourgeois, B. Grandmont, D. A. Evans, J. A. Lefebvre.

BALL—ALFRED NEPEAN, of Regina, Sask. Born at Grenfell, Sask., Dec. 1st, 1890. Educ., B.Sc., (C.E.) Queen's Univ. 1914. D.L.S. and S.L.S. Summer 1912, rodman, G.T.R. Ry.; summers, 1913-14-15, asst. to E. W. Murray, dist. surveyor and engr., Regina; 1916-18, officer in chg. of location of railway lines and on gen. constrn. and maintenance on light rys., with 9th Can. Ry. Troops.

References: W. A. Begg, H. G. Phillips, E. W. Murray, S. Young. D. A R. McCannel.

BARNES, HAROLD ERNEST RADCLYFFE, of Dartmouth, N.S. Born at Bloxholm, Eng., Sept. 7th, 1885. Educ. The grammar schools at Sleaford and Snettisham, Eng., A.M.I.M.E., London, Eng.; 1901-05, articled under city engr., Lincoln, Eng.; 1905-06, bldg. inspector under city engr., Lincoln, Eng., in chg. of drainage scheme, etc. at Clayton & Shuttleworth, Ltd., eng. works; 1906-10, eng. asst., Lincoln; 1910-13, asst. borough engr., Doncaster, Eng., including constrn. and maintenance of public highways, etc.; 1913-14, supt. constrn. of pier and reinforced concrete cable bldgs., Halifax, N.S.; 1914 to date with M. & D. Dept. Royal Engrs., 3rd Div. Officer, M.D. 6, Halifax, as civilian foreman of works in chg. of gen. constrn. works.

References: T. S. Scott, W. P. Morrison, J. F. Pringle, R. W. McColough, J. G. W. Campbell, W. Hollingworth.

BATE—CHARLES BENJAMIN, of Ottawa, Ont. Born at Ottawa, Dec. 23rd 1891. Educ. B.Sc., Queen's Univ., 1915. 1909-10, on location, C.N.R.; one summer with Topog. survey branch; at present on active service, as an engr. officer.

References: J. A. Macphail. L. Malcolm, J. M. Rolston, L. W. Gill, J. G. Gwillim.

BUCK—HAROLD W., of Hewlett, N.Y. Born at New York City, May 7th, 1873. Educ., Ph. B., Yale Univ., E. E., Columbia Univ., 1895. 1896-1900. asst. to ch. engr., light dept., Gen. Elec. Co.; 1900-07, ch. engr., elec. dept., Niagara Falls Power Co., Canadian Niagara Power Co., and Cataract Power & Conduit Co., of Buffalo, N.Y., responsible for all elec. eng. connected with constrn.; 1907-19, vice-pres. of Viele Blackwell & Buck, engrs., N.Y., in responsible chg. of dsgning and constrn. of plants.

References: R. F. Hayward, H. Holgate, J. C. Smith, F. G. Clark, W. N. Ryerson.

BUCKLEY—PETER BURTON, of Montreal. Born at Genoa, Italy, March 29th, 1891. Educ., B.Sc., McGill Univ. 1915. With Royal Engrs., 2 yrs. in France, and 1½ yrs. on Italian front; became staff captain to ch. engr.; demobilized Feb. 1918 and returned to Canada.

References: C. H. Mitchell, H. M. MacKay, J. B. Porter, E. Brown, A. R. Roberts, C. M. McKergow.

BUTLER—ALBAN W. L., of St. Catharines, Ont. Born at Flintshire, N. Wales, Oct. 19th, 1882. Educ. English Coll., Bruges; I.C.S. 1901, articled to J. & P. Higson, mining and civil engrs.; 1903-04, asst. mgr., colliery work, Bryn Mawr, Wales; 1904-07, asst. on surveys and colliery layouts, England; 1907-10, with C.N.R., as topographer and Instr'man on location and constrn.; 1910 (4 mos.) in chg. of party on concrete pipe line. Ont. Power Co.; 1910 on Welland Ship Canal staff as instr'man; 1912, asst. engr.; Aug. 1915-Oct. 1918 with C.E.F., Major, C.M.G. Corps; 1919 to date, asst. engr., Welland Ship Canal.

References: G. H. Hanning, C. H. Mitchell, J. L. Weller, W. H. Sullivan, E. Oliver.

BUTLER—FRANK LEE, of Winnipeg, Man. Born at Terre Haute, Ind., March 11th 1874. Educ. high school and special studies. 1894-1909, in operating dept. of Vandalia R.R.; 1909-1911, first as supt., later vice-pres. and gen. mgr., D. & I.M.R.R., in chg. of operation, maintenance, constrn., etc.; 1911-14, gen. mgr., and later receiver of the A.J. & P. R.R., in full chg. of property, track, electrification, etc.; 1914-18, gen. mgr., C. & W. T. Ry.. in chg. of property; April 1918 to date, gen. supt., Winnipeg Elec. Ry., in chg. of operation, equipment, etc.

References: W. P. Brereton, G. L. Guy, J. G. Sullivan, E. V. Caton, A. H. O'Reilley, S. Wilkins.

CAMPBELL—JAMES G., of Windsor, Ont. Born at Glasgow, Scotland, July 24th 1882. Educ., Glasgow & W. of Scot. Tech. Coll. 1898-1903, apprentice with Somervail & Co., Dalmuir, Scot.; 1904, deftsman, with Cleveland Bridge Co., Yorkshire, Eng.; 1905-06, with Montreal Locomotive & Machine Co.; 1907, dftsman and checker with Structural Steel Co., Montreal; 1908-11, in chg. of detailing on bridges, bldgs., etc., Structural Steel Co.; 1912-17, asst. ch. dftsman. Structural Steel Co.; Sept. 1917 to date, structural engr., with Can. Steel Corp., Ojibway, Ont.

References: M. J. Butler, W. A. Bowden, A. J. Meyers, J. L. Brower, J. W. Seens, E. E. Kerrigan.

CLAXTON—GEORGE, of Shawinigan Falls, Que. Born at Kings Lynn, Eng. Oct. 14th, 1884. Educ. 4 years tech. Inst. Kings Lynn, 2 years tech. Inst. Birmingham, Eng. 4 yrs. articled pupil (C.E.) with H. J. Weaver, M.I.C.E. Gloucester, Eng. 1½ yrs. J. & L. Lea, Birmingham, Eng. 1½ yrs at H. M. Office of Works, Birmingham; 2 yrs. instrument man Shawinigan Water & Power Co., 7 years with Belgo Pulp & Paper Co., in charge of construction and designing etc.

Reference: C. R. Lindsay, N. Goodman, R. Rinfret, H. Dessaulles, J. W. Hayward, E. G. M. Busso.

COURCHESNE—CHARLES EDWARD, of St. Irenee, Que. born at Quebec April 5th, 1891. Educ. B.S. Laval 1912; Quebec Land Surveyer 1914; 1912-13 instrument man with Gastonguay & Giroux; 1913-14 draughtsman on T. C. Ry. 1914-16 practicing as land surveyor in Quebec City; 1916 to present time instrument man on the Q. & S. Ry.

References: A. J. Macdonald, J. N. R. Beaudet, M. Lefebvre, R. Savary, G. K. Addie, C. E. Gauvin.

DAWSON—KENNETH LOCKHART, of Halifax, N.S. Born at Halifax, Jan. 7th, 1893; education B.Sc. (C.E) Nova Scotia Tech. College May 1917. 1910, 6 mos. Asst. to Town Clerk, Sackville, N.S. 6 mos. clerk in office of Gen'l. Supt. Alberta Div. C.P.R. Calgary; 1911-12 agent at Lille, Alta. for West Canadian Collieries; 1913-14, labor foreman and Asst. to Supt. for the J. S. Metcalf Co. Charlottetown, P.E.I. 1914-15 auditor for Goff & Co., (boots & Shoes); 1916 dftsman with W. E. Barrett for the N.S. Tramways & Power Co., reinforced concrete designer and chief dftsman with same firm on the Municipal Abattoir, Halifax; 1917 Chem. engineer & Asst. Supt. Gas. Dept. N.S. Tramways & Power Co.

References: P. A. Freeman, F. R. Faulkner, J. W. Roland, H. Donkin.

DEAN—CLAYTON DEWITT, of Teronto, Ont. Born at Decewsville, Ont., June 28th, 1888. Educ. B.A.Sc. Univ. of Toronto, 1911; summer of 1907 on Govt. survey of G.T.P. Ry.; summer 1909 on location party in Man. & Sask., C.N.R.; 1910 to date with Imperial Oil Ltd. as follows:—up to spring 1912 dftsman & designer; 1912-13 engr. in chg. of constrn. of plant, Fort William; 1913-16, designer and asst. to ch. engr. and mech. supt., Sarnia; Sept. 1916 to present time, tech. and process advisor to directors on constrn. and mfg matters, Toronto.

References: A. A. Kinghorn, E. D. Gray, E. L. Cousins, E. G. Hewson, G. C. Parker, L. I. Stone, R. O. Wynne-Roberts, F. Barber.

FAWCETT—THOMAS, of Ottawa, Ont. Born at Barningham, Eng. Oct. 28th, 1848; Educ. D.L.S. & D.T.S. O.L.S. (High School & Albert Univ.) 1872-75 land surveys in Manitoba and Northern Ont. ;1878-81 preliminary surveys in Ontario and N.W.T.; 1882-3 sectional system of surveys along C.P.R. (Base line and standard meridian surveys); 1885 exploration survey from Kenora to Albany River and Lake St. Joseph; 1886-7 establishing sectional points in Ry. belt in B.C.; 1888 exploratory surveys Athabasca River etc. 1890-96 surveys in Manitoba and Sask. 1897-99 gold commission and director of surveys in Yukon territory; 1900-02 private practice O.L.S.; 1903-07, contract surveys for Dominion & Ont. Govts.; 1908 resurvey of the 4th meridian; 1909 correction surveys and investigation; 1910 observer in Geodetic survey of Canada; 1911 to present time engineer in charge of Boundary commission.

References: W. P. Anderson, M. J. Bulter, N. J. Ogilvie, D. H. Nelles, Willis Chipman, J. B. Challies.

FELLOWES—KENNETH CAMERON, of Niagara Falls, Ont. Born at Riviere Du Loup, Que., Aug. 28th, 1889. Educ. 3 yrs. S.P.S. 1909 (3 mos.) res. engr. etc., G.T.R., Toronto; 1910 (5 mos.) with Smith, Kerry & Chase, Cobalt; 1911-12, (10 mos.) rodman and inspector, Toronto Filtration Plant; 1912 (5 mos.), leveller on grades for water mains, Toronto; 1913 (4 mos.) engr. in chg. of dock, National Iron Works, Toronto; 1913-15, asst. engr., P.W.D., Ont.; 6 mos., instr'man on Chippawa development, Hydro-Elec. Power Comm. of Ont.

References: T. K. Thomson, E. L. Cousins, G. Hogarth, A. C. D. Blanchard, F. F. Longley, C. L. Fellowes, F. L. Fellows.

FRASER—DONALD JOHN, of Ottawa, Ont. Born at Mount Forest, Ont. May 1st, 1883; Educ. B. A. Queens Univ. 1907; D.L.S. 1911; 1907 asst. in charge of levelling party; 1907-11 in charge of primary party; summer 1912 in joint charge of secondary Triangulation Alaska Boundary, Portland Canal, and Glacier Bay Districts; 1913 Canadian attache to American party on Alaska boundary; 1914 to date in charge of section in adjusting Div. Geodetic Survey of Canada.

References: J. J. McArthur, N. J. Ogilvie, J. D. Craig, J. L. Rannie, L. O. Brown, B. E. Norrish, M. F. Cochrane, T. H. G. Clunn.

HEROUX—JOSEPH EDMOND, of Quebec, P.Q. Born at Yamachiche, P.Q., March 4th, 1887. Educ. C. E., Laval Univ. 1915; 1907-10, with Dalbe Viau, architect, Montreal; vacations 1910-11-12, with Dom. Pub. Wks.; 1913, with Marius Dufresne; 1914 with Prov. Roads Dept., Quebec; 1915-19 with Roads Dept., Prov. of Quebec as follows: 1915, asst. bridge engr.; 1916, bridge engr.; 1917 to date, supervising gen'l road constrn.

References: G. Henry, A. Fraser, J. E. Gibault, A. R. Decary, A. Lariviere, A. B. Normandin, J. A. Buteau, A. Pepin.

JAMIESON—DAVID WILSON, of Ottawa, Ont. Born at Ottawa, Sept. 4th, 1882. Educ., matric. McGill Univ., 1 yr. S.P.S. 1904-07, with Niagara Constrn. Co. and Ontario Power Co., in chg. of field party; 1907 (6 mos.) on railroad constrn.; 1908-1911, with J. B. McRea on water power surveys, etc.; 1911-13, res. engr., Que. & Sag. Ry., Quebec; Mar. 1913 to date, asst. to dist. engr., P. W. D., Ottawa, in chg. of hydraulic data, surveys, etc.

References: S. J. Chapleau, J. B. McRea, C. R. Coutlee, A. Langlois, S. A. DesMeules, J. Murphy.

KEARNEY—THOMAS, of Montreal. Born at Donegal, Ireland, July 19th, 1887; Educ. B.Sc. 1911; B.E. 1912, National Univ. Ireland; from 1913 to date asst. engineer. Can. Nat. Rys. Montreal work including supervision of construction, ballasting grades, surveys and estimates, etc.

References: C. H. N. Connell, A. F. Stewart, H. K. Wicksteed, A. F. Belanger, E. W. Oliver, W. P. Chapman, C. V. Johnson.

KENNEDY—SAMUEL SINNOTT, of Winnipeg, Man. Born at Uxbridge, Ont. Dec. 24th, 1877; Educ. I.C.S. (mech. diploma) and 2 yrs Armour Inst. Chicago, Mech. engineering; 1895-98 machinist apprentice; 1898-1904 machinist on installation and repairs with I.C.R. Chicago; 1904-10 with D. H. Burnham & Co., Chicago, as follows:—1904-07 mech. dftsman on heating, ventilating, sanitary and power plant equipment; 1907-10 ch. mech. draftsman, including preparation of plans and specifications for equipment; 1910-11 dsgning engr. on pumps, valves heating and ventilating specialties Iroquois Eng. Co. Chicago; 1911-12 engr. in charge of mech. and sanitary equipment dsgning and supervising for J. B. Atchison, Arthitect, Winnipeg; 1912 to present date, consulting heating, ventilating and sanitary engr. Winnipeg.

References: F. W. B. Scholefield, J. M. Leamy, T. L. Roberts, T. Kipp. J. Rochette, A. W. Lamont, F. H. Farmer, H. A. Bowman.

KIRBY—THOMAS HALDER, of Winnipeg, Man. Born at Ottawa, Ont., Feb. 25th, 1891. Educ., B.Sc., (C.E) McGill Univ., 1913. Summer 1911, inspector on sewer constrn., Winnipeg; summer 1912, office work, with C. C. Chattaway, Wpg.; 1913 to date, with Greater Wpg. Water Dist., as follows: dftsman. on location; instr'man on ry. constrn.; office engr. on aqueduct constr., and at present asst. engr. In 1918 was with C.E.F.

References: W. G. Chace, W. D. Mackenzie, M. V. Sauer, D. L. McLean, J. Armstrong, G. F. Richan.

LOCKE—THOMAS JOHNSON, of Shelburne, N.S. Born at Lockeport, N.S., Sept. 8th, 1872. Educ., B.A., Acadia Univ., 1891. 1891-94, in prov. engr's office, Halifax; 1894-98, leveller on survey, Yarmouth, later res. engr. on constrn., Feb. 1898 was appointed asst. engr., and from 1905 to date, dist. engr., P.W.D., in responsible chg. and supt of various dredging operations.

References: L. H. Wheaton, E. D. Lafleur, W. A. Hendry, W. G. Yorkston, A. R. Dufresne, R. McColl, W. P. Morrison.

LOUNSBURY—WILLIAM MORRIS, of Ottawa, Ont. Born at Village of Cathcart, Ont., Dec. 21st, 1884. Educ., high school, passed prelim. exam. O.L.S. Exam. Board. 1903-04, rodman, transitman, etc., on survey; 1905-07, asst. (under articles) on gen. land surveys and municipal eng. work; 1907-08, under articles with town engr., North Bay; 1908-10, associated with L. O. Clarke of Clarke & Lounsbury, in chg. of eng. office at Cobalt; 1911-12, supervising mining development, Procupine, Ont.; 1913, lake water scheme, Ottawa; as asst. engr.; 1915 to date, asst. engr., in chg. of test borings; P. W. D., Canada.

References: H. M. Davy; E. D. Lafleur, C. H. Attwood, C. R. Coutlee, A. St. Laurent, A. Gray, U. Valiquet.

MACAULAY—HARRY DONALD, of St. John, N.B. Born at St. John, N.B., Aug. 2nd, 1888. Educ., 1st and 2nd yr. in C.E., at Univ. of N.B. 1907, with T.C. Ry.; 1909-10, rodman, B. & A. Ry.; 1910-12, rodman and instr-man on constrn. and valuatiou work, C. & N. W. Ry.; 1212-13, res. engr. on constrn.; C.N.R.; 1913-14, transitman on location, St. J. & Que. Ry.; 1914 to date, asst. engr., P. W. D., on staff of engr. in chg. of St. John Harbour.

References: A. Gray, A. R. Crookshank, H. Longley, A. R. Dufresne, K. M. Cameron.

MACDONALD—RODERICK FRANCIS, of Sault Ste. Marie, Ont. Born at Big Pond, N.S., Aug. 24th, 1882. Educ., B.A., St. Francis Xavier Univ. 1907. 1907-10, with N.T.C. Ry., 1907 (6 mos.) as rodman and topog. on location, and 1908-10, as rodman, instr'man, dftsman and asst. engr.; 1910-11, asst. engr. and dftsman, Dom. Iron & Steel Co.; 1911-13, asst. engr., on A. E. Ry; 1912-14, res. engr., A. C. Ry.; 1914 (5 mos.) engr. in chg. of hydrographic survey party, Can. Copper Co.; 1914(5 mos.), office engr. and dftsman, L. H. & N.O. Ry.; 1915 (5 mos.) office engr., and dftsman, Sudbury Suburban Elec. Ry.; 1915-17, constrn. engr., Algoma Steel Corp; 1917-19, field engr., in chg. of hydrographic surveys and dam constrn., Spanish River Pulp & Paper Mills.

References: R. S. McCormick, B. E. Barnhill, T. S. H. Wurtele, J. A. Boyle, P. B. Duff.

MACDONALD—WALTEREL WOOD, of Ottawa, Ont. Born at Ottawa, May 20th, 1893. Educ., Ottawa Coll..; passed exam. matric. for McGill Univ.; completed night course in hydraulics at Scranton Inst. Summer 1910-11, with Hydro-Elec. Comm., as rodman, dftsman., etc.; 1912, in waterworks dept., Ottawa, supervising all constrn. of new city water mains; later asst. on pitometer survey of Ottawa; 1913, res. engr. on constrn. of dam, in chg. of supervision, etc.; asst. with R. S. & W. S. Lea, consl. engrs., Montreal; 1911-16, asst. engr. on aqueducts, water mains, etc., work including surveys and preparation of plans; 1915, associated with J. B. McRea, conslt. engr., in chg. of pipe scheme for Ottawa; 1916, mech. engr., in chg. of all mech. matters in connection with Ottawa Water supply; Sept. 1916 to date, city waterworks engr.

References: J. B. McRae, A. F. Macallum, R. S. Lea, J. Murphy.

MACLEOD—JOHN WILLIAM, of Thorburn, N.S. Born at Scotsburn, N.S., July 9th, 1877. Educ., B.A., 1910, M.A., 1911, St. Francis Xavier Univ., B.Sc., McGill Univ., 1914. 1909-12, associate prof. of mathematics, St. Francis Xavier Coll.; 1912-14, asst. engr., Halifax Ocean Terminals; 1915-16, organized Greenwood Coal Co. Ltd., Thorburn, in chg. of survey and constrn. of spur line; 1916 to date, director and sec'y, Greenwood Coal Co., in chg. mine surveying, etc.

References: D. H. McDougall, R. E. Chambers, J. B. Porter, H. M. Mackay, J. Blizard, J. J. MacDouald, M. A. Fullington.

MARBLE—WILLIAM OSCAR, of Vancouver, B.C. Born at Hampstead, N. H., March 9th, 1876. Educ., private tuition. 1895-1900, dftsman and asst.engr., city engr's office, Haverhill, Mass.; 1900-08, on eng. staff of Purdy & Henderson, N.Y.; dsgning structural steel, etc.; 1908-09, in chg. of Purdy & Henderson eng. office, Boston, Mass.; 1909-17, western mgr., for Purdy & Henderson (Canada) in chg. of constrn.; 1917 to date, associated with Hodgson & King, engrs. and contractors, Vancouver, in sole chg. of constrn.

References: J. P. Hodgson, R. F. Hayward, A. D. Creer, P. P. Brown, R. Rome, E. K. Adamson.

MARTINDALE—ERNEST SMITH, of Ottawa, Ont. Born at Mount Healy, Ont., May 20th, 1886. Educ., B.A.Sc., Toronto Univ., 1911. D.L.S., 1911. Summers 1909-10, asst. on surveys; 1911-12, chief of party on Dom. land surveys in S. Alta.; 1913-14, chief of party on surveys in N. Sask.; 1915, chief of party on (stadia) water area survey in N. Alta.; 1916, chief on surveys in S. Alta. and Sask.; 1917-18, with Topographical Survey Branch; at present, chief of party on miscellaneous surveys.

References: G. B. Dodge, G. H. Blanchet, G. H. Ferguson, G. C. Cowper, J. A. S. King, A. L. Cumming, E. P. Bowmau.

MARTINEAU—J. OMER, of Quebec. Born at Quebec August 7th, 1893; Educ. B.Sc. C.E. Queens Univ. 1915; 1913-14, asst. to engr. in chge. Dom. Public Wks.; Aug. 1914. Apr. 1915, with Can. Engrs.; 1916 to date engr. Dept. of Roads of the Prov. Govt. of Quebec, preliminary inspections in highway constrn. plans, specifications and estimates on same.

REFERENCES: Alexander Fraser, A. Larivière, R. Savary, G. Henry, Jos. Lefebvre, L. N. Boulet.

MATHER—RICHARD H., of Montreal. Born at Minneapolis, Minn., April 30th, 1889. Educ., B.Sc., McGill Univ., 1913. Vacations, 1910-11 (7 mos.) with Westinghouse Works, Pitsburgh, Pa.; 11 mos. with Can. Westinghouse Co., Hamilton, Ont.; 2¼ yrs., in elec. dept., McGill Univ., first as junior, then senior demonstrator; 4 mos., cable eng. dept., Northern Elec. Co.; 1916-19, with Sir W. G. Armstrong, Withworth & Co. Ltd., England, in chg. of installation and maintenance of all elec. gear in their Newcastle area; has just returned from England.

References: L. A. Herdt, C. V. Christie, E. G. Burr, G. Robertson, A. R. Roberts.

McCLYMONT—HERBERT ROSS, of Toronto, Ont. Born at Dalbeattie, Scotland, Sept. 9th, 1883. Educ., E. E. and M. E. course, Glasgow, Univ. A.M., B.I.E.E., 1900-03, apprentice in workshops and test rooms, Siemens Bros., London, Eng.; dsgn. of railway motors, etc.; 1906-07, with Lancashire Dynamo Co., as senior dftsman. on dsgn. of generators and motors; 1907-11, efficiency engr., and chemist, Central London Elec. Ry. Co., in chg. of all testing, etc.; 1911-16, with Siemens Co., of Canada, as ch. constrn. engr., first for western div'n, later for all Canadian territory; Aug. 1916 to date, with Kerry & Chace Ltd., consl. engrs., Toronto, as principal asst., elec. engr., making reports, tests, and acting in advisory capacity, etc.

References: J. G. G. Kerry, A. L. Mudge, F. W. Thorold, A. S. Cook, F. J. Bell and J. B. Harvey.

McCOLL—CHARLES ROSS, of Sandwich, Ont. Born at Chatham, Ont., July 20th, 1881. Educ., B.Sc., Queen's Univ., 1908, O.L.S., 1909. 1907-14, with Owen McKay, Walkerville, as asst., in gen. municipal eng., including sidewalks, drainage, survey work, etc.; Jan. 1914 to date, private practice, gen. municipal eng. and survey work, also town engr., Sandwich.

References: O. McKay, M. E. Brian, A. J. Stevens, J. N. Stanley, B. E. Norrish, R. O. Sweezey.

McFAUL—WILLIAM LAWRENCE, of Sault Ste. Marie, Ont. Born at Owen Sound, Ont., March 7th, 1889. Educ., B.A.Sc., Toronto Univ., 1913. 1911 (6mos.), inspector of roads and sidewalks, Port Arthur; 1912, (6 mos.) asst. city engr., Sault Ste. Marie; 1913-14, asst. engr., on street ry. constrn., Port Arthur; 1914-16, asst. city engr. and 1916-17, city engr., Sault Ste. Marie; Nov. 1917, Jan. 1919, with C.E.F., and O.M.F.C., as lieut., Can. Engrs. on active service, Feb. 1919 to date, city engr., Sault Ste. Marie.

References: L. M. Jones, P. Gillespie, E. R. Gray, J. W. LeB. Ross, L. R. Brown, A. G. Tweedie.

McKIEL—HAROLD WILSON, of Sackville, N.B. Born at Gananoque, Ont., Sept. 4th, 1888. Educ. B. A. (honors in Chem.) 1908, B.Sc. (honors, Chem. eng.) 1912, Quee's Univ.; 1911 (8 mos.) chemist, Can. Cement Co.; summer 1912, Assoc. Dept.. under Dept. of Mines, Queen's Univ.; one summer research chemist with Br. Chem. Co., Trenton, Ont.; 1913 Prof. of Chemistry, Mount Royal Coll., Calgary 1913 to date, Prof. of Mech. Engr. at Mount Allison Univ.; 4 yrs. member representing Mount Allison on committee on engr. educ., 5 yrs. Sec'y. and Registrar, Faculty of A.Sc., Mount Allison Univ.

References: J. Gwillim, S. J. Fisher, K. S. Pickard, H. W. Read, B. E. Norrish, L. Malcolm.

MYLREA—THOMAS DOUGLAS, of Toronto, Ont. Born at Liverpool, Eng. Jan. 17th, 1886; B.Sc. (C.E.) Univ. of Ill. 1909; 1909 inspector of concrete highway bridges, Ill. Highway Comm.; 1910-12 with American Bridge Co., as timekeeper on constrn and dftsman, etc.; 1912 (4 mos.) checker with A. Bolters Sons Bridge Co., Chicago; 1912-13 checker and later chief draftsman Dom. Bridge Co., Winnipeg; 1913 designer Harkness & Oxley, Toronto; 1914-(7 mos.) science master, Ingersoll Coll. Inst.; 1914-1917 engr. of tests, Toronto City Architects Dept.; July 1917 to date ch. engr. Trussed Concrete Steel Co., Toronto.

References: P. Gillespie, A. H. Harkness, C. R. Young, Thos. Taylor, A. W. Connor.

NICHOL—FREDERICK THOMAS, of Toronto, Ont. Born at Beeton, Ont. Dec. 15th, 1884; educ. B.A.Sc.; June 1911 to August 1914 designing engineer with C. W. Noble, Toronto; Aug. 1914 to Nov. 1918 Major with C.E.F.; responsible for design of reinforced concrete structure consisting of factories, office buildings and schools; at present engineer with Archibald & Holmes Ltd. Toronto.

References: C. W. Noble, A. R. Holmes, A. E. Nourse, P. Gillespie, C. P. Van Norman.

PERRY—PHILIP CARLETON, of Regina, Sask. Born at Fort William, Ont., July 27th, 1889. Educ. public schools, I.C.S.; 1906-09, rodman and inspector G. T.P. Ry., Fort Willam; 1909-10 (4 mos.) rodman, Northern Pyrites Co.; 1910(8 mos.) inspector, G.T.P. Ry.; 1910-11, levelman and topog., A.C. Ry., Sault Ste. Marie, Ont.; 1912 to date with G.T.P. Ry. as follows:—1912-14, dftsman and instr'man, Fort William; 1915-16, rodman, Fort William and Edmonton; 1916-18, instr'man on maintenance, Edmonton; Sept. 1918 to date, asst. res. engr., Regina.

References: G. C. Dunn, G. Murray, J. N. deStein, R. P. Graves, R. W. Ross.

PETRIE—JOHN BERNARD, of Wabana, Nfld. Born at Victoria Mines, N.S., March 28th, 1872. Educ., common school and I.C.S. engr. apprentice. Was with Dom. Coal Co., as follows:—engr. and machinist, and 2 yrs. as ch. engr., No. 2 colliery; 2 yrs., boiler and mach'y inspector, Glace Bay, N.S.; and for 8 yrs., mech. supt., of Dom. Iron & Steel Co., Wabana.

References: F. W. Angel, C. B. Archibald, T. A. Bown, J. B. Gilliatt, J. J. McDougall, J. S. Whyte, D. H. McDougall, T. J. Brown.

PETTINGILL—ERNEST LOCHLIN, of Copper Cliff, Ont. Born at Wellington, Ont. Oct. 22nd, 1891. Educ. B.Sc. Queens Univ. 1916; summer 1911 with Dept of Indian Reserves; 1912 dftsman, C.N.R. Winnipeg; 1913 instr. man International Nickel Co., 1914 instr'man and inspector for Cedar Rapids Mfg. & Power Company; 1915-19 with Inter. Nickel Co., as follows:—1915 instr'man; 1916 asst. to supt. of constrn; 1917 engr. in charge of constrn. work at Creighton Mine; 1918 in charge of constrn. work at O'Donnell Roast Yard; and at present representative on constrn. of storage dam.

References: J. B. D'Aeth, J. C. Street, A. M. E. Allaire, W. J. Bishop, E. A. Stone.

PONTON—GERALD MUNGO, of Ottawa, Ont. Born at Belleville, Ont. May 8th, 1888. Educ. Min. engr. Toronto Univ. 1909; 24 mos. surveying, mill work, assaying, etc., during vacations, 1909 asst. engr. Trent Valley Canal; 1910 geologist and assayer. W. C. Collieries; 1911-13, member of firm Harrison & Ponton, consl. engr. and land surveyor, Calgary and Edmonton; 1914 geologist for E. D. & B. C. Ry. and Peace River Oil Co., locating field and supt. drilling; 1915 metallurgist Phelps Dodge & Co., New Mexico, Arizona, and Mexico; 1916 Lieut. Can. Engrs. Tunnelling Co. C.E.F.; 1917 supervisor metallurgical div. Imperial Munitions Board; 1918 supervisor production and distribution of explosive and metallurgical products; at present is officer with Imperial M. Board.

References: H. E. T. Haultain, John Bates, Lesslie Thompson,

PORTER—JOHN HENRY, of Hamilton, Ont. Born at Hagersville, Ont., March 28th, 1878. Educ., Ont. Normal School. Dftsman., Hamilton Bridge Works; 1901-02, detailer, Virginia Bridge & Iron Co., Roanoke, Va.; 1902-05, checker and estimator, Brown Ketcham Iron Works, Indianapolis, Ind.; 1905-11, checker, and from 1911 to date, dsgning engr. and estimator, Hamilton Bridge Works Co.

References: C. H. Marrs, J. G. Jack, J. A. McFarlane, E. H. Darling, D. A. Williamson, E. H. Pacy.

PURSER—RALPH CLINTON, of Ottawa, Ont. Born at Windsor, Ont., April 7th, 1886. Educ. B.A.Sc., Toronto Univ., 1907; D.L.S., 1910. Summers 1905-06, on O.L.S. subdiv'n.; 1907-08, transitman on alignment; Detroit River Tunnel Co.; 1909 (7 mos.) asst. on D.L.S. subdiv'n and retracement surveys; 1910-11, office work and gen. field work, J. J. Newman, O.L.S.; 1911 to date, chief on D.L.S. miscellaneous field work.

References: G. B. Dodge, G. H. Ferguson, J. A. S. King, G. C. Cowper, M. E. Brian, T. W. Brown.

RALSTON—NORMAN CHESTER, of Shelburne, N.S. Born at Amherst, N.S. Dec. 17th, 1887. Educ. Dalhousie Eng. School; 1907 (6 mos.) on constn. of pile wharf; April 1909 to date, asst. dist. engr. P.W.D. Western N.S., work including surveying and reporting, inspection, drafting etc.

References: D. E. Lafleur, W. G. Yorkston, R. McColl, W. P. Morrison, J. R. Freeman.

RICHARDS—JOHN DAVID, of Regina, Sask. Born at Cardiff, Wales, Sept. 5th, 1880. Educ., tech. educ., in E.E. and physics at South Wales Univ. 1910. 1901, wireman with Edwards & Armstrong; 1902-03, in business as elec. engr., and representative of Greenwood & Batley, of Leeds, Eng., at Cardiff, Wales; 1904, with Can. Gen. Elec. Co., as constrn. foreman; 1912-13, meter engr., Regina; 1914-16, on dsgn. and constrn. of new lay-out for towns, etc.; Oct. 1917 to date, meter engr., for Regina.

References: E. A. Markham, J. M. Mackay, D. A. R. McCannell, R. O. Wynne-Roberts, M. L. Wade.

RICHARDSON—FREDERICK LEEDS, of St. John, N.B. Born at Maple, Ont., Dec. 10th, 1888. Educ. B.A.Sc., Toronto Univ. 1910; with Harvey & Miller, Toronto; with C.N.R. eng. staff on concrete work; 1910-13 with Miller, Cumming & Robertson, Contractors; 1913-15, supt. Ashbridge Bay Dock and steel conduit, for Roger Miller & Sons, Toronto; 1915 with Can. Stewart Co. on Toronto Harbor improvements; 1916-18 with Public Works of Canada, in chg. of inspection; at present, res engr. St. John, on constrn. of breakwater and dry dock at Courtenay Bay.

References: A. Gray E. L. Cousins, E. W. Oliver, A. R. Dufresne, A. Gibson, F. Barber, T. F. Willsie, J. G. R. Wainwright.

RICHARDSON—WILLIAM HENRY STEWART(Capt.), of Belleville, Ont. Born at Toronto, Ont., Jan. 24th, 1894. Educ. Coll. Inst., Hamilton; prelim. exam. for O.L.S. 1913, course in military engr. 1915; 1911-14 in chg. of surveying parties, J. W. Tyrrell & Co., Hamilton, Ont.; 1915-16, in chg. tunnelling operations and field fortifications, B.E.F., France; 1917 to date, transitman, G.T.R.

References: G. H. Frith, E. G. Hewson, J. B. Nicholson, W. Walker, L. I. Stone.

RICKARDS—CHARLES SELBY, of Hamilton, Ont. Born at Banff, Alta., Nov. 20th, 1896. Educ., Calgary Coll. Inst. 1914-15, on erection of wireless telegraph stations, Baskino Ltd. and Diamond Oil Co., Calgary; 1915-16, hydrographical eng. with Dept. of Interior; 1916-18, apprentice, Can. Westinghouse Co., at present erecting engr., Can. Westinghouse Co., work consisting of testing and installing elec. apparatus.

References: H. U. Hart, W. F. McLaren, K. C. Berney, H. B. Dwight, E. R. Gray,

SHAW—WILLIAM JOHN, Jr., of St. Thomas, Ont. Born at London, Ont., June 9th, 1880. Educ., Coll. Inst. Since 1901 with Michigan Central RR., as follows; 1901-05, rodman and dftsman.; 1905-07, instr. man.; 1907-18, asst. div. engr.; 1918, acting div. engr., and at the present time div. engr.

References: J. A. Bell, F. A. Bell, R. L. Latham, G. A. McCubbin, F. J. Ure.

SIMPSON—BRUCE NAPIER, of Toronto, Ont. Born at Toronto, Ont., Oct. 13th, 1892. Educ. B.A.Sc. Toronto Univ. 1914; 5 mos. time-keeper, Cream Hill Mine; 5 mos. with Geolog. Survey of Can.; 5 mos. with Comm'n. of Conservation on Water power reconnaissance; 8 mos. inspector roads and side walks, Toronto; 5 mos. on Lake of Woods investigations; 5 mos. on reservoir storage with N. R. Gibson, consl. engr. for the Elec. Power Co.; 15 mos. lieutenant in artillery, C.E.F., at present asst. in hydrometric work, Hydro-Elec. Power Comm'n.

References: N. R. Gibson, H. G. Acres, T. H. Hogg, M. V. Sauer, J. Mackintosh.

STEVEN—JOHN OTHMAR BOYER, of Campbellton, N.B. Born at Richibucto, N.B., Oct. 15th, 1889. Educ., high school and bus. coll. 1908-11, with I.C. Ry., Monction, N.B.; 1911-13, rodman; 1913 to date, sr. dftsman., Can. Nat. Rys., Campbellton.

References: R. A. Black, J. S. O'Dwyer, R. H. Emerson, J. L. Wilson, C. B. Brown, S. B. Wass, G. E. Martin, A. R. MacGowan.

STUART—WILLIAM HENRY, of Winnipeg, Man. Born at Cheltenham, Eng. Aug. 2nd, 1884. Educ. studied law at Univ. of Minn., but did not complete course.; 1905-14, with G.T.P.R. as topog., dftsman., transitman, and as res. engr., at Prince Rupert, (1911) was in complete chg. of entire work; has just returned after 2½ yrs. on active service as officer and will resume work on rlys.

References: E. H. Pierce, A. L. Ford.

TRIPP—HARRY HOLLISTER, of Edmonton, Alta. Born at Homer, N.Y. Jan. 31st, 1886; Educ. C. E. Cornell Univ. 1908, Vacation 1905 rodman on drainage, Ithaca, N.Y.; summer 1907 rodman highway dept. N.Y. state; 1908-09 rodman on Barge Canal; 1909 (rodman 5 mos.) C.P.R. Cranbrook, B.C.; Aug. 1909-May 1915 transitman C.P.R. Cranbrook and Edmonton; 1915 (7 mos.) res. eng C.P.R. Edmonton; 1915 ch. clerk in Dist. Engr's office Calgary; 1916 7 mos. res. engr. Winnipeg, T.C.P. Ry.; July 1916-Feb. 1918 res. engr. C.P.R. Kenora, Ont.; 1918 to date div. Engr. C.P.R. Edmonton.

References: F. S. Rosseter, F. W. Alexander, J. C. Holden, R. C. Harris, C. Flint, H. W. McLeod, Frank Lee.

WALCOT—JOHN BEVAN, of Montreal. Born at Edinburgh, Scotland, June 25th, 1890. Educ. Geo. Watson's Coll., Edinburgh; passed final exam. as D.L.S. 1918. 1911-12, with C.P.R., Montreal; 1912-14, with C.N.R., on Mt. Royal Tunnel and terminal constrn., as rodman and instr'man; 1914-15, field and office work, town of Mount Royal, C.N.R.; 1915-17, asst. to D.L.S.; 1917 to Feb. 1918 with Walter J. Francis & Co., asst. on field and office work; 1918, in C.E.F., Can. Engrs., (discharged Dec. 1918), Jan. 1919 to date, asst. on field and office work, W. J. Francis & Co.

References: W. J. Francis, F. B. Brown, W. Kennedy, Jr., J. L. Busfield, W. E. Joyce.

WEEKES—ABEL SENECA, of Edmonton, Alta. Born at Glencoe, Ont., Feb. 17th, 1866. Educ., high school, O.L.S., 1890, D.L.S., 1892, A.L.S., 1911, S.L.S., 1912. 1887-90, apprentice with Coad & Robertson, surveyors and engrs.; 1890-92, engr. for several townships in Ont., including Clinton, work being chiefly drainage; 1893, land surveying; 1894-97, private practice in Alta., also a small amount of mining eng.; 1897-1902, private practice in Yukon, and some mining eng.; 1903-04, Dom. Govt. surveys; Nov. 1904, to date, in the eng. dept., C.N.R., in continuous chg. of a party on surveys, also laying out drainage schemes and various railway work.

References: A. T. Fraser, T. W. White, T. Turnbull, E. M. M. Hill, D. Shaw, M. H. Macleod, W. Burns.

WICKWIRE—DWIGHT STANLEY, of Halifax, N.S. Born at Milford, N.S., Jan. 8th, 1883. Educ., eng. course, Dalhousie Coll. 1907, drafting in city engr's office, Halifax; 1908, dftsman, T.C.Ry., St. John; 1909, instr'man, Salmon River viaduct, N.B.; 1911, res. engr., T.C.Ry.; 1912, res. engr., on constrn., C.N.R., North Bay, Ont.; 1915, land surveying; 1916, to date, with Pickings & Roland, Halifax, on survey of Halifax.

References: E. Brydone-Jack, C. O. Foss, B. M. Hill, J. W. Roland, A. F. Stewart, F. W. W. Doane.

WILSON—BARRY, of St. John, N.B. Born at St. John, N.B., Dec. 28th, 1889, Educ., Hamilton School of Technology; eng. apprentice course, Can. Westinghouse Co., Hamilton. 1910, installation and construction of hydro-elec. plants for Calgary Power Co.; 1910-11, with City of Winnipeg Power Co.; 1913-18, Hydro-Elec. Comm. of Ont., and works electrician, Steel Co. of Canada; 1918, to date, city electrician, St. John, N.B.

References: H. U. Hart, H. B. Dwight, G. G. Hare, A. R. Crookshank, A. Gray W. C. Ewing.

WINFIELD—WILFRED ARTHUR, of Halifax, N.S. Born at Derby, Eng., Feb. 11th, 1880. Educ., M.E. and E.E. courses, I.C.S. 1896-1900, with N. S. Telephone Co.; 1903, Eastern Supt. of same; 1903-09, Gen. Mgr. of Telephone Co. of P.E.I., responsible for administration, design, operation, etc.; 1909-17, Supt. of Cape Breton District of Mar. Tel. & Tel. Co., responsible for administration and operation of that territory, including prelim. design, execution of work, etc.; 1907, to date, Gen. Supt. of plant, Mar. Tel. & Tel. Co., Halifax, responsible for design, etc., of constrn work, including wire plant, central office equipment etc.

References: J. S. Cameron, A. M. McMaster, W. A. Hendry, C. M. Odell, F. A. Bowman.

WOOD—JAMES ROBERT, of Edmonton, Alta. Born at Alexandria, Scotland, April 26th, 1887. Educ., A.R.T.C., Royal Tech. Coll., Glasgow, Scot., 1911. 1904-09, apprentice. 1911-12, res. engr. on industrial works, Woodstock, Ont., and Montmorency Falls, Que.; 1912-14, dftsman and res. engr., John Galt Eng. Co., Winnipeg and Calgary, preparing gen'l and detail plans, etc.; 1914-17, farming; 1917-18 (5 mos), dist. engr., Nelson, B.C., on hydrometric survey.

References: J. S. Costigan, G. M. Wynn, J. Haddin, R G. Swan, E. L. Miles, J. B. Challies.

YOUNG—ARTHUR GEORGE, of Toronto, Ont. Born at Spanish Town, Jamaica, March 5th, 1891. Educ., B.Sc. (C.E.), Carnegie Inst. of Technology, 1916. 1908-10, asst. supt., maintenance of macadam roads and bridges, P.W.D., Clarendon, Jamaica: 1910-12, asst. supt. in chg. of constrn, P.W.D., Jamaica: 1913 (2 mos.), on drainage and municipal work as field and office asst. to country engr., Valparaiso, Ind.; 1914-15 (summers), structural dftsman, with Mond Nickel Co., Coniston, Ont.; 1916-19, designing and detailing in plate and structural steel, Mond Nickel Co.; at present, structural checker and detailer on bridge work, Hydro-Elec. Power Comm., Toronto.

References: C. V. Corless, J. F. Robertson, T. U. Fairlie, F. B. Goedike, H. Wykes.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

CADDY—ARTHUR EDWARD, of Campbellford, Ont. Born at Cobourg, Ont., May 10th, 1866. Educ., Coll. Inst. 3 yrs. apprentice. 1882-86, transitman, etc., on surveys in N.W.T. & Ont., with E. C. Cady; 1889-95, dftsman, Central Bridge & Eng. Co., Peterboro; 1894-95, transitman on Trent Canal; 1895-96, dftsman, with Massillon Bridge Co.; 1896-97, ch. dftsman, Brackett Bridge Co., Cincinnati, O.; 1897-1901, engr. in chg. of squad of dftsmen, Carnegie Steel Co., Pittsburg, Pa., dsgning and detailing bldgs., bridges, etc.; 1901-04, engr., with American Bridge Co., in chg. of dfting room, and later in chg. of Canton, O., plant, and dsgn., etc.; 1904-08, engr. in chg of detailing, Riverside Bridge Co., Wheeling, W.Va.; 1908'15, ch. engr., of Dickson Bridge Co., dsgning and mfg. steel bridges and bldgs.; 1915 to date, asst. engr., dept. railways and canals, in chg. of constrn. of Trent Canal.

References: J. M. R. Fairbairn, A. J. Grant, J. G. G. Kerry, A. L. Mudge, W. P. Parker.

DOBBIN—ROSS LEONARD, of Peterboro, Ont. Born at Lindsay, Ont., Sept. 19th, 1882. Educ., B.A.Sc., Toronto Univ., 1911. Summers 1908-09, in machine shop, Can. Gen. Elec. Co., Peterboro; summer 1910, shop inspector for Duckworth Boyer Co., Lachine; 1911 (3 mos.), shop inspector for Can. Inspection Co., 1911, res. engr. with Walter J. Francis & Co., on Moose Jaw Water Supply; 1913, res. engr., City of Moose Jaw; 1914 (5 mos.), erection inspector, Dom. Insp. Co., Toronto; July, 1914, to date, waterworks Supt. with Peterboro Utilities Comm. in full charge of water supply and dsign.

References: Walter J. Francis, Peter Gillespie, Wm. Kennedy, Jr., R. H. Parsons, H. G. Hunter.

LOUDON—THOMAS RICHARDSON, of Toronto, Ont. Born at Toronto, Sept. 1st, 1883. Educ., B.A.Sc., Toronto Univ., 1906, grad. S.P.S., 1905. 1901-03, hydrographic surveys; 1904-05, roadway dept., Toronto; 1906-07, mng. engr., McVicker Engine Co., Galt, Ont.; later on staff of Toronto Univ.; 1908 (5 mos.), with Kitchener Elec. Power plant; 1909, with Lackawanna Steel Co.; 1910, with Provincial Steel Co.; 1911, on expert inspection of structural and steel plants, R. W. Hunt Co.; 1911-12, with J. W. Moffatt, on design and operation of elec. furnaces; 1912, to present time, asst. prof., eng. faculty, Univ. of Toronto, also member of firm, James, Loudon & Hertzberg, consl. engrs., in full chg. of design and erection, etc.; May, 1916, to July 1918, with C.E.F. (Major), second in command of 1st batt., Ry. Troops, at present, C.R.C.E., Mil. Dist. No. 11, in full chg. of eng. and constrn. by military authorities.

References: W. J. Francis, A. L. Hertzberg, T. K. Thompson, C. R. Young, P. Gillespie, J. W. Moffatt.

MAGWOOD-WILLIAM HERBERT, of Cornwall, Ont. Born at Mornington, Ont., July 25th, 1870. Educ., matric. Coll. Inst. 1891-97, on surveys; 1897-98, rodman and instr'man on survey and constrn., O. & N.Y.Ry.; 1902-05, private practice; 1905-11, member of firm Magwood & Walker; 1912-15, member of Magwood & Stidwill; engaged in municipal eng., including design and constrn. of bridges, bldgs., roads, etc.; also acted as res. engr., N.Y.C.R.R.; 1915-17, with C.E.F., on active service; 1917, to date; resumed former occupation, also town engr. for Cornwall, Alexandria, Maxville and other rural municipalities.

References: T. H. Dunn, C. H. Fullerton, C. D. Sargent, A. H. Harkness, A. L. Killaly, J. H. Moore.

McCUBBIN—GEORGE ALBERT, of Chatham, Ont. Born at Burford, Ont., Feb. 10th, 1869. Educ., Toronto Univ., 1888, O.L.S., 1895. 1892-95, apprentice, O.L.S.; 1895-1910, in partnership with Jas. A. Bell; 1897-03, Ont. Govt. Surveys; location and constrn., of C.P.R., Tillsonburg to Ingersol; at present, municipal eng., drainage and highway engr. for 10 townships and engr. for Lambton County, Ont.

References: J. A. Bell, A. W. Campbell, W. A. McLean, O. McKay, G. Hogarth, F. J. Ure, F. A. Bell.

MCDOUGALL—GEORGE KINGHORN, of Montreal. Born at Three Rivers, Dec. 25th, 1882. Educ., B.Sc., McGill Univ., 1904. 1904 (6 mos.), in Bullock Co. shops, Cincinnati, O.; 1904-06, high voltage research work, Niagara Falls: 1906-07, representative on constrn., at Louisville, Ky., of Indianapolis & Louisville Traction Co., 1908(9 mos.), in N.Y. office of R. D. Mershon; 1908-14, asst. to treas'r, Shawinigan Water & Power Co., and sales mgr., Can. Carbide Co.; 1914 to date, consl. engr., making reports, designing, installation, etc.

References: J. C. Smith, R. S. Kelsch, R. M. Wilson, R. D. Mershon, L. A. Herdt.

McLEAN—NORMAN BERFORD (Major), of Ottawa, Ont. Born at Cornwall, Ont., Jan. 15th, 1872. Educ., Royal Mil. Coll., 1892. 1892-98, asst. engr., Soulanges Canal; 1898-1901, asst. engr., P.W.D., on surveys, wharf constr., etc.; July 1901, to date, on staff of River St. Lawrence Ship Channel, dredging, surveys, laying buoys, etc.; Oct. 1915-Sept. 1918, on active service with 124th Batt., and at present res. engr., Ship Channel.

References: V. F. W. Forneret, C. R. Coutlee, W. J. Stewart, A. J. Grant, F. A. Wise.

MURDOCH—GILBERT GRAY, of St. John, N.B. Born at St. John, N.B., Oct. 13th, 1876. Educ., public and grammar schools. Deputy Land Surveyor, N.B.; 1895 to date, in gen. private practice, work including surveys, designing, in chg. of constrn., etc.

References: C. L. Wetmore, R. H. Cushing, C. C. Kirby, C. B. Brown, A. Gray, J. A. Grant.

REDMOND-AUGUSTINE V., of Winnipeg, Man. Born at Kingston, Ont., May 16th, 1878. Educ., B.Sc., Queen's Univ., 1903. 1904-07, leveller, transitman and acting engr., in chg. of location, G.T.P. and N.T.R.; 1908 (10 mos.), res. engr. on location and constrn. of water supply, Canon City, Col; 1908-09, res. engr. on constrn., T.C.Ry.; 1909-1915, div. engr., on constrn., T.C.Ry.; 1916-17, res. engr. and acting div. engr., Can. Govt. Ry.; 1917-18, div. engr., C.G.Ry.; Jan. 1919, to date, dist. engr., Can. Nat. Rys.

References: C. B. Brown G. Grant, T. S. Armstrong, J. A. Heaman R. F. Uniacke, W. A. Duff.

THORNE—HARVEY, of Windsor, Ont. Born at Dartmouth, N.S., Oct. 11th, 1882. Educ., B.A., Dalhousie Univ., 1905; B.A.Sc., McGill Univ., 1911. Summer, 1908, with C.P.R., as rodman and leveller on maintenance; summer, 1909, on A.Q. & W.Ry., transit and level work; summer 1910, rodman, leveller and gen. instr't work, H. & E.Ry.; 1910-14, on eng. staff of Trussed Concrete Steel Co. work, including reinforced concrete dsgn., checking, estimating, etc.; 1913-14, as engr. and branch mgr. at Halifax, N.S.; 1915-17 with Can. Salt Co., Windsor, as constrn. engr., in chg. of dsgn and erection of concrete additions, etc., and maintenance; Dec. 1917 to date, on eng. staff of Can. Steel Corp., as dock div. engr. in chg. of inspection of contract for vessel slip and unloading docks at Ojibway, Ont.

References. E. G. Henderson, C. S. L. Hertzberg, J. A. Brown, E. G. Cameron, R. Carlyle, J. S. Nelles.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

BOTHWELL—ROBERT SCOTT CLEMENS, of Toronto, Ont. Born at Toronto, April 25th, 1893. Educ., B.A.Sc., Toronto Univ., 1917. 1911-12, on railroad constrn. as rodman, etc.; 1913, asst. instr'man with railway and bridge dept., Toronto; 1914 (5 mos.), instr'man, roadway dept., Toronto; 1915 (5 mos.), asst. engr., P.W.D., Midland, Ont.; 1916-1917, field engr., P.W.D., Toronto Harbor improvements; 1917-18, engr. for Can. Steel Corp., Ojibway, Ont.; 1918 (7 mos.), engr. in chg., Canadian Stewart Co., Toronto; Oct. 1918 to date, engr. in chg. of dredging at Norfolk, Va., for Jas. Stewart & Co., N.Y.

References: W. E. Bonn, A. E. Eastman, F. Moberly, E. L. Cousins, P. Gillespie, E. T. Wilkie.

LYE—RUSSEL G., of Toronto, Ont. Born at Stratford, Ont., Oct. 3rd, 1891. Educ., B.A.Sc., Toronto Univ., 1915, graduate of No. 4 school of Military Aeronautics, R.A.F. 1906, apprentice in machine shop, Stratford, Ont; 9 mos.; 1909-10, (4 mos.), as rodman, 5 mos. as concrete and piling insp., on the St. C. P. C. & B. Elec. Ry.; May-Sept., 1910; May-July, 1911, (8 mos.), topographer on exploratory surveys with Speight & Van Nostrand; Aug. and Sept., 1911, transitman on townsite of Missinabie, N.T.Ry., with Speight & Van Nostrand; 4 mos. as asst. in charge of complete survey (topographical) of the islands in Toronto Bay for City Surveys Dept., 16 mos.; 6 mos. as Asst. Dist. engr.; 10 mos. as Dist engr., on highway and bridge constr. with the northern development branch of Ont.; 10 mos., June 1917-April, 1918, as active pilot, which embodied the following experience: School military aeronautics, studying theory of aeroplanes, flight and engines; guns; experience as sky pilot. Has International Aero Pilot's certificate.

References: L. McK. Arkley, Prof. P. Gillespie, C. T. Lount, J. Sinton, C. H. Fullerton.

McLERIE—ALLAN GORDON, of Toronto, Ont. Born at Windsor, Ont., Dec. 7th, 1888. Educ., high school and I.C.S. 1909-11, rodman, dftsman, instr'man; 1911-13, res. engr., T.C.Ry., Winnipeg; 1913 (9 mos.), res. engr., Banff-Windermere Road, B.C.; 1913-14, res. engr., Greater Wpg. Water Dist.; 1914-16, asst. div. engr., G.W.W.D.; 1916-18, supt. of constrn., Walbridge Aldinger Co., Detroit, Mich.; Mar., 1918-Mar., 1919, lieut., Royal Air Force, Toronto; at present, res. engr., C.N.R., Toronto.

References: A. M. Macgillivray, W. G. Chace, W. W. Bell, A. H. Aldinger; G. F. Richan.

MOONEY—JOHN PATRICK, of St. John, N.B. Born at St. John, N.B., May 13th, 1893. Educ., B.Sc. (C.E.), N.B. Univ., 1916. 1910-11, dftsman and estimator; 1911-12, in office of H.H. & H. C. Mott, architects; 1916-17, engineer with firm B. Mooney & Sons, Gen. contractors, etc., in complete charge of estimating, drafting, etc.; Sept. 1917, to date, manager of B. Mooney & Sons, estimating and erecting buildings, etc.

References: H. G. Hunter, A. K. Grimmer, John A. Stiles, G. G. Murdoch, Geo. N. Hatfield.

PEDEN—ERNEST, of Montreal West, P.Q. Born at Montreal, June 10th, 1889. Educ., B.Sc., McGill Univ., 1912. 1907-11, in detailing office and as dftsman, Dom. Bridge Co., Lachine; summer, 1912, dftsman, engr., etc., Cedar Rapids Mfg. & Power Co.; 1912-14, checker and designer, Dom. Bridge Co., and later, foreman. Can. Asphalt Co.; 4 years military service, as lieut., Can. Machine Gun Corps.; at present, designer, Purdy & Henderson, Montreal.

References: H. M. MacKay, F. S. Keith, P. L. Pratley, A. Peden, J. E. Openshaw.

STINSON—JOHN NICHOLS, of Ottawa, Ont. Born at Toledo, Ont., June 19th, 1885. Educ., B.Sc., Queen's Univ., 1914. 1912 (5 mos.), rodman on subgrade constr., C.N.R.; 1913 (2 mos.), instr'man and timekeeper, on highway constrn.; 3 mos., asst. to municipal engr., Cornwall, Ont; 1914, res. engr., on highway constrn., Dom Parks Branch, Dept. of Interior; Jan., 1915, to date, acting first asst. highway engr., Dom. Parks Branch, on civil eng. work connected with location and constrn. of highways.

References: A. W. Gray, J. M. Wardle, C. H. Attwood, T. H. G. Clunn, R. Cunningham, J. G. Cameron.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

AVERY—CHARLES RUGLAS, of Toronto, Ont. Born at Niagara-on-the-Lake, Ont., June 4th, 1891. Educ., M.A.Sc., Toronto Univ., 1913. Summers 1910-11-12, in maintenance dept., C.P.R.; 1913, on staff of Internat. Joint High Comm., investigating pollution of Greater Lakes, in chg. of all float work; 1913-14, asst. to prov. sanitary engr., on research work; Feb. 1915 to Mar. 1st, 1919 on active service in different capacities (discharged Mar. 12th.).

References: R. B. Young, E. R. Gray, P. Gillespie, F. S. Rutherford, J. S. Galbraith, C. R. Young.

DROLET—JOSEPH HENRI ARTHUR EMILE, of Quebec, P.Q. Born at Quebec, Dec. 30th, 1887. Educ., Ecole Poly. 1909, and commercial course. With La Cie F. X. Drolet as follows: 2 yrs. as mech. dftsman., and at present supt. of foundry, doing converter operations, chemical analysis, etc.

References: F. C. Laberge, J. Ruddick, T. A. J. Forrester, A. Buteau, J. E. Gibault, I. E. Vallée.

KIRKPATRICK—PAUL CHESTER, of Ottawa, Ont. Born at Parrsboro, N.S., Nov. 13th, 1889. Educ., B.Sc. (C.E.), McGill Univ., 1916. 1913 (5 mos.) with C. G. Ry., as instr'man and rodman; 1916 (5 mos.) asst. metallurgist, Dom. Bridge Co., Longue Pointe plant; 1916-17, asst. res. engr. on constrn. of dam, Fraser Brace & Co.; 1917-18, gen. eng. work in shipyard; 1918 (3 mos.), res. engr. and asst. supt., on constrn. of dam; 1918 (5 mos.) on power development survey in chg. of field work, Shaw. Water & Power Co.; 1918-19, asst. res. engr., constrn. of dam, Fraser Brace & Co.

References: C. Luscombe, J. B. D'Aeth, J. H. Brace, H. S. Grove.

LINDSAY—CHARLES CRAWFORD (Capt.) of Quebec, P.Q. Born at Quebec, Nov. 26th, 1889. Educ., B.Sc., McGill Univ. 1915. 1908-09, rodman, N.T.C. Ry.; 1910 (6 mos.) miner and drill-runner, Little Nipissing Mine, Cobalt; topog. on location, instr'man and asst. res. engr., on constrn., G.T.P. Ry., in Sask. & Alta.; 1911-13, asst. engr. and surveyor with Smith & Keith, also with Hon. J. L. Cote, civil engrs. and surveyors; 1914 (5 mos.) asst. engr. and surveyor, with J. E. Girard; 4 yrs. on active service as captain in Royal Engrs., work included water supplies, railway constrn., etc.; has recently returned and is at present unemployed.

References: H. M. MacKay, E. Brown, J. L. Cote, N. Cauchon, J. E. Girard.

McCRUDDEN—HARRY ELSMERE, of Westmount, Que. Born at Buenos Aires, Argentine Rep. Dec 1st, 1892. Educ. B.Sc. Arts McGill Univ. 1915; 1910 with M. & S C. Ry., later timekeeper with McDonell & O'Brien; 1911 (5 mos.) Asst. dftsman and topog. constrn. dept C P.R; April 1912; Sept. 1914 drftsman, instr, man acting res. engr. on constr. C.P.R.; March 1915-Jan. 1918 on active service as Lieut. C.F.A.; at the present time Asst director's representative, engr. details and Orthopaedic and Surgical Appliances Branch, Soldiers Civil Re-establishment, Montreal.

References: K. Weatherbe G. R. Ballock, W H. McCaan, C. A D'Albadie, C. W. R. Ramsay, Chas. Luscombe, E. N. Martin, H. W. B. Swabey.

WRIGHT—ATHOL CHOATE (Capt.), of Ottawa, Ont. Born at Hull, Que., Sept. 2nd, 1879. Educ., high school. 1899-1904, mining, prospecting and surveying with M. & S C. Ry., later timekeeper — W. Ont. and B C.; 1904-08, instr'man, T C. Ry.; 1908-11, res. engr on constrn. T.C. Ry.; 1911-14, res. engr., on constrn., C.P Ry.; 1915-16, asst. camp engr., in responsible chg. of road and bridging operations, Petewawa; 3 yrs. with C.E.F., Can Engrs. at present is captain and adjutant, Halifax.

References: J. E. Beatty, J. H. Holliday. J. F. Pringle, J. M. Silliman, N. J. Slater.

ENGINEERING INDEX

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AERONAUTICS

AEROPLANE PARTS

Radiators. The Aeronautical Radiator, S. R. Swenson. Aerial Age, vol. 8, no. 25, Mar. 3, 1919, pp. 1256-1261 and 1286, 14 figs. Types and designs in general. Study of coefficient *D*; the nose radiator.

AEROSTATICS

Airship Operations. British Airship Development and Operations, Aviation, vol. 5, no. 12, Jan. 15, 1919, pp. 758-759, 1 fig. Figures relative to man power required for operating airships, casualties per flight mileage, and non-flying days.

Commercial Airships. Airships for Commercial Purposes. Flight, vol. 11, no. 5, Jan. 30, 1919, pp. 144-148. Relative advantages of airships and aeroplanes; development and potentialities or rigid airships and aeroplanes; commercial considerations relating to airships. Officially issued by Air Ministry.
The report of the Civil Aerial Transport Committee. Flight, vol. 11, no. 4, Jan. 23, 1919, pp. 119-125. Main or terminal aerodrome; intermediate landing grounded; airship for commercial purposes; correspondence relating to fog on the Newfoundland coast. (Continued from p. 27.)

Dirigibles for Transport. Value of Dirigibles for Aerial Transport, Henry Woodhouse. Flying, vol. 8, no. 2, Mar. 1919, pp. 137-143, 7 figs. Relative advantages of airships and airplanes; progress in heavier-than-air and lighter-than-air machines 1914-1918; technical advantages in designs of airships. From report of Civil Aerial Transport Committee.

Military Balloons. Military Aerostatics, H. K. Black. Aerial Age, vol. 8, no. 24. Feb. 24, 1919, pp. 1166-1167, 4 figs. Free ballooning. (Continuation of serial),

AIRCRAFT PERSONNEL

Flying Sickness. Flying Sickness Martin Flack. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 21-22, 1 fig. Record or experiences of aviators and tests.

Tests for Flyers Medical Aspects of Aviation, L. E. Stamm. Aeronautics, vol. 16, no. 275, Jan. 22, 1919, pp. 111-113, 3 figs. Physical and mental requisites for aviation work. (To be continued). Paper before Roy, Aeronautical Soc.
The Wear and Tear of Flying, T. S. Rippon. Flight, vol. 11, no. 4, Jan. 23, 1919, pp. 108-109. Methods used by French physicians in examining pilots; American tests.

APPLICATIONS

Aerial Ports. Organization of Aerial Ports, Gino Bastoji, Aviation, vol. 6, no. 1, Feb. 1, 1919, p. 35. Future developments. From Rivista die Transporti Aerei.

Commercial Aviation. Commercial Aviation in the Light of War Experience, F. H. Sykes. Aeronautics, vol. 16, no. 274, Jan. 15, 1919, pp. 81-83. Concerning safety, base and repair facilities, operation of flying roads, meteorology and aerodrome management. Abstract of lecture before Lond. Chamber of Commerce. Also in Flight, vol. 11, no. 3, Jan. 16, 1919, pp. 84-88.

Mail Service. Aerial Mail in the United States and Abroad, Otto Praeger. Flying, vol. 8, no. 2, Mar. 1919, pp. 144-147 and 174-177, 5 figs. Programs proposed and in operation; equipment; coöperation in Post Office Dept. and U. S. Army.
The World's Aerial Mail and Passenger Services. Aviation voc. 5, no. 12, Jan. 15, 1919, p. 755. Operating and projected services.

Passenger Traffic. Aerial Travel for Reconstruction, G. Holt Thomas. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, p. 12. Visualization of transaction of business through instrumentality of aerial navigation.

Patrol Work, Forest. Use of Airplanes in Forest Patrol Work, Henry S. Graves. Aviation, vol. 5, no. 12, Jan. 15, 1919, pp. 754-755. Present service.

Regulations. Future Air Traffic and Necessary Regulations to Govern Same, Alan R. Hawley. Flying, vol. 8, no. 2, Mar. 1919, pp. 149-154, 6 figs. Problem of utilizing military airplanes and employing demobilized aviators.
To Regulate Aerial Navigation, Henry Woodhouse. Flying, vol. 8, no. 1, Feb. 1919, pp. 33-42, 70 and 72, 15 figs. Study by British Aerial Transport Committee and Act this committee has drafted for regulation of aerial navigation.

Safety. The Reliability of Aircraft Travel, Mervyn O'Gorman. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 5-7, 1 fig. Statistics of accidents; question of reliability of engines.
The Report of the Civil Aerial Transport Committee. Flight, vol. 11, no. 5, Jan. 30, 1919, pp. 150-155. Memorandum of research in regard to meteorology; summary of work, prior to war, of Public Safety and Accidents Investigation Committee of Roy. Aero Club & Aeronautical Soc. (Continued from p. 125).

Surveying and Mapping. The Aero Radio Surveying and Mapping, John Hays Hammond. Flying, vol. 8, no. 2, Mar. 1919, pp. 160-161, 3 figs. Writer's system of aerial radio survey.
Topographic Surveying by Aerial Photography, Arthur Broek, Jr., and L. J. R. Holst. Aviation, vol. 6, no. 2, Feb. 15, 1919, pp. 75-78, 9 figs. Use of aerial photography to making contour maps. Inspection of aerial negatives and interpretation of direction by means of them.

Transcontinental Flight. Aerial Transportation, Evan J. David. Flying, vol. 8, no. 1, Feb. 1919, pp. 64, 66, 75-76 and 78, 2 figs. Review of progress. Squadron of four Army training planes is reported to have completed transcontinental flight.

DESIGN

Aeroplane Design. Aeroplane and Seaplane Engineering, H. C. Richardson. Aerial Age, vol. 8, no. 24, Feb. 24, 1919, pp. 1171-1173, 1180 and 1182-1183, 2 figs. Paper presented before Soc. Automotive Engrs.
Report of the U. S. National Advisory Committee for Aeronautics. Aeronautics, vol. 16, no. 275, Jan. 22, 1919, pp. 116-117. Activities of Committee between Oct. 4, 1917, and Oct. 10, 1918. (To be continued).

Cooling System. The Loomis Cooling System for Aircraft. Mech. Eng., vol. 41, no. 3, Mar. 1919, pp. 255-256, 3 figs. System embodies nose radiator, adjustable booster and expansion tank with positive ejection.

German Design. Trend of German Airplane Design. Automotive Industries, vol. 40, no. 5, Jan. 30, 1919, pp. 262-265, 3 figs. Summary of features of captured enemy machines. Issued by Technical Department, Aircraft Production, Ministry of Munitions.

Incidence Wires. Incidence Wires in the Strength Calculations of Wing Structures, John Case. Aeronautics, vol. 16, no. 273, Jan. 8, 1919, pp. 46-51, 4 figs. Discusses accuracy of method outlined in preceding installment. (Continued form vol. 15, p. 607).

Inspection. Some Avoidable Dangers in Airplane Construction, Walter O. Adams. Am. Mach., vol. 50, no. 8, Feb. 20, 1919, pp. 365-366. Points out some avoidable dangers and suggests standardized inspection for elimination of defective small parts.

Research. Full Scale Aeroplane Experiments, W. S. Farren. Aeronautics, vol. 16, nos. 273 and 274, Jan. 8 and 15, pp. 53-56 and 84-86. Scope of experimental research undertaken by Royal Aircraft Establishment. Abstract of paper before Royal Aeronautical Soc.

Rigging. Rigging, F. W. Halliwell. Flight, vol. 11, nos. 4, 5 and 6, Jan. 23 and 30, Feb. 6, 1919, pp. 107, 132-134 and 176-179, 18 figs. Manufacturing particulars in construction and erection.

Struts. Design of Airplane Struts, W. H. Barling and H. A. Webb. Aviation, vol. 6, no. 2, Feb. 15, 1919, pp. 79 and 82-83, 6 figs. Effect of tapering on strength. Paper before Roy. Aeronautical Soc.
The Spacing of Interplane Struts, John Case. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 18-20, 15 figs. Computations for various types and cases.

Wing Spar Stresses. Wing Spar Stresses, H. A. Webb and H. H. Thorne. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 8-11, 8 figs. Formulæ and bending-moment diagrams.

ENGINES

Aeromarine Engine. The Aeromarine Type L 6-Cylinder Aero Motor. Aerial Age, vol. 8, no. 24, Feb 24, 1919, pp. 1164-1165, 4 figs. Describes motor designed for training and sporting machines.

American Engines. American Aero Engines, G. Douglas Wardrop. Aerial Age, vol. 8, no. 25, Mar. 3, 1919, pp. 1242-1251 and 1283, 10 figs. General data of Liberty 12, King-Bugatti, Curtis K-6 and K-12, Hispano-Suiza, Duesenberg model H. Lawrence 60-hp. air-cooled engine, Union 6-cylinder aeromotor, Knox 12, Hall-Scott A-8, and 80-hp. Le Rhone.

Carburetors. A New Principle in Carburation. Aerial Age, vol. 8, no. 25, Mar. 3, 1919, pp. 1223, 2 figs. Brown carburetor said to operate automatically at all speeds.

Characteristics. Characteristics of Leading Aero Engines. Aerial Age, vol. 8, no. 25, Mar. 3, 1919, pp. 1252-1254. Tables of dimensions and data.

Curtiss. The Curtiss Model K-6 and Aircraft Engine. Aviation, vol. 6, no. 2 Feb. 15, 1919, pp. 83-84, 1 fig. General design.
The Curtiss Model K-6 and K-12 Aero Motors. Aerial Age, vol. 8, no. 21 Feb. 3, 1919, pp. 1030-1034, 10 figs. Form of construction adopted gives minimum center distance between cylinders, together with placing of accessories and accessibility of various parts for inspection or overhauling.

Design. The Design of Aeroplane Engines—XV, John Wallace. Aeronautics, vol. 16, no. 274, Jan. 15, 1919, pp. 77-80. 6 figs. Cam design; choice of cam; calculations for profile; process of laying out cam; valve-lift diagram; gas velocity; cams for radial engines. (Continuation of serial).

Duessenberg. Duessenberg Sixteen-cylinder Aircraft Engine. Automotive Industries, vol. 40, no. 4, Jan. 23, pp. 214-218, 13 figs. Weight 1250 lb.; 700 hp. on direct drive and 800 on geared. Said to be the largest aeroplane engine produced in U. S.

Liberty. Liberty Engine Tests. Mech. Eng., vol. 41, no. 3, Mar. 1919, pp. 249-253 and 295, 8 figs. Authentic data on performance tests of the standard high-compression army-type 12-cylinder Liberty engine.
The Liberty Aircraft Engine, J. G. Vincent, Automotive Industries, vol. 40, nos. 6 and 7, Feb. 6 and 13, 1919, pp. 323-327 and 378-385, 8 figs. Feb. 6: Chronological history of development, with remarks on incidents and military requirements that affected its design. Paper before Soc. Automotive Engineers. Feb. 13: Discussion of various features of design, with reasons for their adoption; performance of planes equipped with engine.

Magnetos. Standardized Magnetos for Aircraft Engines. Aviation, vol. 6, no. 1, Feb. 1, 1919, p. 37, 1 fig. Features of Dixie types.

Napier. Napier " Lion " Aero Engine G. Douglas Wardrop. Aerial Age, vol. 8, no. 25, Mar. 3, 1919, pp. 1262-1264, 7 figs. English 12-cylinder model used by Capt. Lang in establishing world's altitude record of 30,500 ft.

Rotary. The 80-hp. Le Rhone Airplane Engine. Aviation, vol. 6, no. 2, Feb. 15, 1919, pp. 70-73, 8 figs. Principles of rotary engines; features of design; performance graph; specifications.

Stresses. The Design of Aeroplane Engines—XVI, John Wallace. Aeronautics, vol. 16, no. 275, Jan. 22, 1919, pp. 102-105, 10 figs. Inertia forces; loads on cam and tappet; stresses in camshaft; torsion of camshaft.

Thermal Efficiency. Importance of High Thermal Efficiency in Aeroplane Engine Design and Construction, Charles W. Burrage. Aerial Age, vol. 8, no. 24, Feb. 24, 1919, pp. 1168-1170, 3 figs. Graph showing difference in characteristics of various aeroplane power plants.

Valves. Valve Dispositions in High-Speed Aircraft Engines, John Wallace. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 34-36, 5 figs. Computations of valve areas in theoretical engine under assumed conditions.

INSTRUMENTS

Ignition Interrupter. Douglas Automatic Airplane Ignition Interrupter. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, pp. 372-373, 2 figs. Safety device for stopping engine when propeller breaks or other breakage occurs.

MATERIALS OF CONSTRUCTION

Coatings for Boats. Tests of Moisture and Water Resistance of Various Coatings on Small Boat Construction, Henry A. Gardner. Inst. Indus. Research, Washington, D. C., 10 pp., 3 figs. Following coatings conforming to aeronautical specifications of Navy Dept. were tested: Raw linseed oil; acetate dope; oil graphite; spar varnish; and enamel

Fabrics. Properties of Aeroplane Fabrics, E. Dean Walen. Aeronautics, vol. 16, no. 274, Jan. 15, 1919, pp. 87-90, 8 figs. Methods used by Bur. of Standards in developing a cotton fabric as a substitute for linen for aeroplane wing coverings.

MILITARY AIRCRAFT

Airships, British. The Role of British Airships in the War, W. Lockwood Marsh. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 13-17, 8 figs. Various types and their uses; war incidents.

War Department, U. S. Aeronautics, George O. Squier. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 33-35. Information on work done by Aeronautics Branch of War Dept.

MODELS

Air Screw. Model Aeroplanes—XX, F. J. Camm. Aeronautics, vol. 16, no. 275, Jan. 22, 1919, pp. 109, 4 figs. Designing the air screw.

Motor. Model Aeroplane Building as a Step to Aeronautical Engineering. Aerial Age, vol. 8, no. 21, Feb. 24, 1919, p. 1177. 2 figs. Illustrations of redesigned Ford motor.

Performance. Model Aeroplane Building as a Step to Aeronautical Engineering. Aerial Age, vol. 8, no. 21, Feb. 3, 1919, p. 1045, 1 fig. Checking possible performance of machine. (Continuation of serial).

Power. Model Aeroplane Building as a Step to Aeronautical Engineering. Aerial Age, vol. 8, no. 25, Mar. 3, 1919, p. 1269, 2 figs. Minimum power required for flying.

PLANES

Armored Planes. Armored Aeroplanes, H. A. Webb. Aeronautics, vol. 16, no. 274, Jan. 15, 1919, pp. 74-76, 6 figs. Comparison of vulnerabilities of square and round bodies.
The Fokkers-Junkers Armored Biplane. Aviation, vol. 6, no. 1, Feb. 1, 1919, p. 36, 1 fig. Wing construction.

Bristol. The " Bristol " Machines. Flight, vol. 11, no. 4, Jan. 23, 1919, pp. 100-105, 25 figs. Types developed of monoplane, biplane and triplane design.

Curtiss. The Curtiss Type 18-2 Triplane. Aviation vol. 6, no. 2, Feb. 15, 1919, pp. 74-75, 2 figs. Dimensions and weights.

De Haviland. The De Haviland, or " Airco," Machines, Flight, vol. 11, no. 2, Jan. 9, 1919, pp. 36-45, 40 figs. Development of this type and features of ten models desigend.
The Enclosed D. H. 4. Flight, vol. 11, no. 4, Jan. 23, 1919, p. 111, 2 figs. Views of totally enclosed two-passenger aerial limousine.

Helicopters. The Helicopter, M. A. S. Riach. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 23-25. Problem of direct-lift flying machine in light of modern airscrew analysis.

Loening. Description of the Loening Monoplane. Aviation, vol. 5, no. 12, Jan. 15, 1919, pp. 759-762, 5 figs. Construction, engine installation and performance.

Martin. The Martin K-III. Scout, Aeronautics, vol. 16, no. 275, Jan. 22, 1919, pp. 106-108, 4 figs. Details and performance. From Aerial Age. Biplane has wing span of 18 ft., weights 350 lb. and is equipped with 40-hp. A.B.C. engine.

Sopwith. The Sopwith Machines. Flight, vol. 11, no. 6, Feb. 6, 1919, pp. 163-174, 56 figs. Stages in evolution; classification, dimensions, weights of the 21 types produced.

Standard. The Standard Model E-4 Mail Aeroplane. Aerial Age, vol. 8, no. 21, Feb. 3, 1919, pp. 1036-1037 and 1034, 7 figs. General dimensions, weights and details.

Sundstedt. Airplanes for the Transatlantic Flight. Sci. Am., vol. 120, no. 9, Mar. 1, 1919, pp. 202 and 215, 4 figs. Sundstedt biplane. Upper plane has a spread of 100 ft., lower plane 71½ ft.: equipped with 2 Hall-Scott engines rated at 220 hp. each: weight 10,000 lb.: estimated speed 80 mi. per hr.

Sundstedt-Hannevig. The Sundstedt-Hannevig Seaplane. Aerial Age, vol. 8, no. 24, 1919, pp. 1162-1163 and 1183, 5 figs. Designed for long-distance flying over sea.

PRODUCTION

Le Pere. Production of Le Père Planes Was Well Started, J. Edward Schipper. Automotive Industries, vol. 40, no. 6, Feb. 6, 1919, pp. 303-304, 4 figs. Manufacturing details.

PROPELLERS

Calculator for Propellers. A Convenient Calculator for Propellers, E. P. King. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 31-33, 3 figs. Chart intended to simpliy theoretical work on propeller performance by blade-element method.

Torque. Propeller Torque, J. Morris. Aeronautics, vol. 16, no. 273, Jan. 8, 1919, p. 52, 1 fig. How it arises and its action in the case of both geared and ungeared engines.

SPECIFICATIONS, AEROPLANE

Seaplanes. Navy Issues Seaplane Specifications. Aviation, vol. 6, no. 2, Feb. 15, 1919, pp. 73-74. Schedule for furnishing plans, supervisory assistance and construction of seaplanes.

TRANSATLANTIC FLIGHT

Airship vs. Aeroplane. Possibilities of an Atlantic Air Line. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 41-42. Airships versus airplanes.

VARIA

Metric System. The Metric System and the Aeronautical Industry, David Scott. Aeronautics, vol. 16, no. 272, Jan. 1, 1919, pp. 26-27. Plea for adoption of metric system by Great Britain.

National Advisory Committee. National Advisory Committee Report. Aviation, vol. 5, no. 12, Jan. 15, 1919, pp. 750-753. Recommendations regarding future development of American aeronautics; power plants for aircraft; materials for aircraft.

Progress in 1918. Aeronautics, Times Eng. Supp., year 15, no. 531, Jan. 1919, pp. 14-15. Survey of developments in 1918.
Aeronautics in the United States, 1918, George O. Squier. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 2, Feb. 1919, pp. 53-114, 17 figs. Review of development of military aeronautics in United States up to date of armistice.

Wind Velocity, Determination of. Determination of Wind Velocity and Direction by Means of Sound Waves (Sur une méthode de détermination de la vitesse et de la direction des vents, par temps couvert, à l'aide de sondages par le son), M. Bourgeois. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 22, Nov. 25, 1918, pp. 769-772. Balloon carries fireworks timed to explode at regular intervals; motion of halloon is recorded at each explosion, which serves to compute height.

RAILROAD ENGINEERING

ELECTRIC RAILWAYS

Center-Rail Traction. Center-Rail Traction for Mountain Railways, C. Noble Fell. Ry. Engr., vol. 40, no. 468, Jan. 1919, pp. 12-14, 5 figs. Electric center-rail permanent way (Fell system.)

Freight Handling. Freight Transportation by Local Electric Railways (Le transport des marchandises sur les voies ferrées électriques d'intérêt local), Lucien Pahin. Revue Générale de l'Electricité, vol. 5, no. 3, Jan. 18, 1919, pp. 114-117. Survey of developments in United States, England and France by congestion of railroads.

Locomotive. An Electric Rail Locomotive. Motor Traction, vol. 28, no. 723, Jan. 8, 1919, p. 26, 1 fig. Equipped with battery of 120 cells of Edison GII type; ampere-hour capacity, 275.

Tie Renewals. Tie Renewal Cost Reduction Deserves Serious Study, R. C. Cram. Elec. Ry. Jl., vol. 53, no. 7, Feb. 15, 1919, pp. 308-315, 6 figs. Place to begin is in specification and maintenance; use of suitable preservatives, provision for good drainage, liberal spacing, prompt removal of defective ties.

ELECTRIFICATION

French Railways. Consequences of the Electrification of French Railways from the Viewpoint of the Exploitation of the Telegraph and Telephone Lines (L'électrification des chemins de fer français; ses conséquences au point de vue de l'exploitation des lignes télégraphiques et téléphoniques), A. Mauduit. Annales des Postes, Télégraphes et Téléphones, vol. 7, no. 4, Dec. 1918, pp. 499-525. Investigations of the Compagnie du Midi lead writer to establish that in electrified lines with small traffic and where current does not exceed 100 amp., usual protective devices will permit successful operation of telegraph and telephone lines running parallel to track; not so, however, when rail current exceeds 1000 amp.-km., in which case soil return is not judged advisable in telephone or telegraph line.

Partial Electrification of a Great Railway System (Electrification partielle d'un grand réseau de chemins de fer), Victor Sabouret. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 130, no. 6, Nov.-Dec. 1918, pp. 344-363. Project of Compagnie d'Orleans comprising electrification of 3000 km. of railway.

New Zealand. The Electrification of Railways in New Zealand, E. Parry. New Zealand Jl. Sci. & Technology, vol. 1, no. 6, Nov. 1918, pp. 323-328. Relative merits of steam and electric haulage; importance of a comprehensive system of electric-power supply in its bearing upon railway electrification; evolutional process of main-line electrification in New Zealand.

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Ambulance Trains, British. British Railways Under War Conditions. Engineer, vol. 127, no. 3291, Jan. 24, 1919, pp. 73-75, 11 figs. Ambulance trains. Fifteenth article.

British. Railways. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 30. Services given to Government by British railways during war; progress in standardization; rolling-stock construction.

LABOR

Camps. Some Modern Camps for Maintenance Men. Ry. Maintenance Engr., vol. 15, no. 2, Feb. 1919, pp. 49-53, 13 figs. Buildings provided by four of the roads in Chicago district.

LOCOMOTIVES

Training of Engineers. The Training of the Locomotive Engineer. Ry. Gaz., vol. 30, no. 1, Jan. 3, 1919, pp. 27-28. Paper before Instn. Locomotive Engrs.

Australian Locomotives. Locomotive Built by Australian Government, J. O'Toole. Boiler Maker, vol. 19, no. 2, Feb. 1919, pp. 40-41, 2 figs. Type 2-8-0. Total heating surface, 2421 sq. ft.; Walschaerts valve gear and Robinson superheater used.

Coal Consumption. The Economical Use of Coal in Locomotives. Ry. Gaz., vol. 30, no. 2, Jan. 10, 1919, pp. 63-64, 2 figs. Abstract of report issued by engineering staff, Univ. of Ill.

Firebox, Thermic-Syphon. New Type of Locomotive Firebox. Ry. Mech. Eng., vol. 93, no. 2, Feb. 1919, pp. 71-73, 2 figs. By introduction of thermic syphons evaporating efficiency of boiler is materially increased.

Pennsylvania 2-10-2. Pennsylvania Lines 2-10-2 Locomotive. Ry. Mech. Eng., vol. 93, no. 2, Feb. 1919, pp. 63-66, 5 figs. General description, drawings and principal data.

Powdered-Fuel Engines. Locomotives. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 30. Designs developed in 1918, particularly the powdered-fuel engine.

Standard. Standard 2-6-6-2 Type Locomotive. Ry. Mech. Eng., vol. 93, no. 2, Feb. 1919, pp. 74-77, 6 figs. General description, drawings and principal data.

The Standard Heavy Santa Fe Type Locomotive. Ry. Age, vol. 66, no. 7, Feb. 14, 1919, pp. 389-392, 6 figs. General description, principal data and drawings.

Stokers. The Elvin Mechanical Stoker. Ry. Mech. Eng., vol. 93, no. 2, Feb. 1919, pp. 103-106, 4 figs. Description of stoker for locomotives ,made by Elvin Mechanical Stoker Co., New York.

Superheaters. Modern Locomotive Engine Design and Construction—XLIV. Ry. Engr., vol. 40, no. 468, Jan. 1919, pp. 3-12, 24 figs. Considerations relative to design and construction of different types of superheaters for any working temperature. (Continuation of serial.)

Three-Cylinder Engine. Great Northern Railway Locomotive Performance. Ry. Gaz., vol. 30, no. 3, Jan. 17, 1919, pp. 89-98, 18 figs. Haulage of 1300-ton coal trains between Peterborough and London by a three-cylinder engine.

OPERATION AND MANAGEMENT

Fuel Conservation. Recent Papers on Fuel Conservation. Ry. Mech. Eng., vol. 93, no. 2, Feb. 1919, pp. 66-69. Abstracts of several railway club papers prepared by fuel experts and describing methods of saving coal.

Government Ownership. State Ownership and Operation of Railways. Ry. Gaz., vol. 30, nos. 1, 2 and 3, Jan. 3, 10 and 17, 1919, pp. 11-14, 48-51 and 86-88. Digest of evidence given before commission of inquiry in South Africa concerning advantages and disadvantages of state control of railways.

The National Railway Question of To-Day, Francis Lee Stuart. Proc. Am. Soc. Civil Engrs., Papers & Discussions, vol. 45, no. 2, Feb. 1919, pp. 53-60. Facts which led up to Federal control; competition and Government ownership.

To-Day's Railroad Problem in the States, Theodore P. Shonts. Ry. Gaz., vol. 30, no. 2, Jan. 10, 1919, pp. 57-58. Claims that most economical operation can be attained under private ownership.

Loading, Maximum. Maximum Car Loading, William H. McClymonds. Proc. Pacific Ry. Club, vol. 2, no. 10, Jan. 1919, pp. 16-22. Economics of loading a car to its utmost safe carrying capacity.

Speeds, European. European Train Speeds. Ry. Gaz., vol. 30, no. 3, Jan. 17, 1919, pp. 80-85. Survey of highest, longest and fastest non-stop runs, speed of trains between two places and geographical distribution of principal service. (To be continued.)

Stores, Handling. Handling of Stores on the Santa Fé, Charles E Parks. Ry. Gaz., vol. 30, no 2, Jan. 10, 1919, pp. 59-61. Organization to look after waste material.

Train Dispatching. Getting Trains Over the Road. J. A. Shockey. Proc. Pacific Ry. Club, vol. 2, no. 10, Jan. 1919, pp. 10-16. Duties and responsibility of a train dispatcher.

Organization of a Train Dispatcher's Office and Duties of the Chief Dispatcher, C. E. Norton. Proc. Pacific Ry. Club, vol. 2, no. 10, Jan. 1919, pp. 6-10.

PERMANENT WAY AND BUILDINGS

Ballast. Maintenance of Railway Roadbed by Cleaning the Ballast (L'entretien des voies ferrées par le soufflage du ballast). Génie Civil, vol. 74, no. 5, Feb 1, 1919, p. 94, 1 fig. Methods based on maintaining solidity of supporting parts of ballast by removing vegetation, etc., by air jet, to insure percolation of water into roadbed and trenches.

Track Support, Concrete. Concrete Railway Track-Support. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 58-60, 2 figs. Details of proposed continuous concrete slab support.

ROLLING STOCK

Automobile Cars. Forty-Foot Automobile Cars for Illinois Central. Ry. Age, vol. 66, no. 8, Feb. 21, 1919, pp. 440-443, 4 figs. Single-sheathed type with steel end, especially designed for carrying various types of lading; general description and principal data.

Axles. Notes on Railway High Capacity Wagon Wheel Axles, H. Kelway-Bamber. Jl. & Tran. Soc. Engrs., vol. 9, no. 12, Dec. 1918, pp. 189-204 and (discussion) pp. 204-214, 9 figs. British 10-ton wagon axle; methods of ascertaining stresses; method of calculating dimensions, etc.; specifications for axle steel; factors of safety.

Lumber for Car Construction. Lumber for Car Construction. Hermann von Schrenk. Ry. Mech. Eng., vol. 93, no. 2, 1919. pp. 85-88, 3 figs. Selecting proper grades to secure strength and lasting power, increasing service by preservatives. From address before Western Ry. Club.

Standard Cars, U. S. Standard Cars for the United States Railways. Ry. Gaz., vol. 30, no. 3, Jan. 17, 1919, pp. 101-102, 6 figs. Standard design for 70-ton hopper wagon.

Standards for Freight Equipment. Standards for the Maintenance of Freight Equipment, H. L. Shipmen. Ry. Age, vol. 66, no. 9, Feb. 28, 1919, pp. 495-497. Keeping up the condition of cars to meet demands of traffic; uniform classification of repairs. From a paper before the Western Railway Club.

SAFETY AND SIGNALING SYSTEMS

Alternating-Current Signaling. Alternating Current Signaling. Ry. Engr., vol. 40, no. 468, Jan. 1919, pp. 15-17, 7 figs. How system was developed, how it operates, and results that have been obtained. (To be continued.)

Automatic Signaling. Automatic Signals Expedite Freight Movement. Ry. Signal Engr., vol. 12, no. 1, Jan. 1919, pp. 4-7. Study of conditions of Northern Pacific; table showing information.

Many New Conditions Affected Signaling Last Year. Ry. Signal Engr., vol. 12, no. 1, Jan. 1919, pp. 11-23. Review of progress made in automatic block and interlocking construction developments and personnel of signal field.

Signal Lamps, Focusing A Method of Focusing Signal Lamps, S. C. Hofmann. Ry. Signal Engr., vol. 12, no. 1, Jan. 1919, pp. 30, 1 fig. Details of focus tube for focusing R. S. A. semaphore lamps, claimed to have given satisfactory service.

Suggestions for Improvements. Railway Signalling Under Federal Control, A. G. Shaver. Ry. Signal Engr., vol. 12, no. 1, Jan. 1919, pp. 9-10. Writer's reason why signal engineers should report to operating officers' reforms which could be accomplished.

Ties, Zinc-Treated, and Current Leakage. Influence of Zinc Treated Ties on Signal Operation. Ry. Maintenance Engr., vol. 15, no. 2, Feb. 1919, pp. 65-66 Experiences of various engineers. Discussion at convention Ry. Signal Assn.

SHOPS

Boiler Shops. Among Railroad Boiler Shops—VI, James F. Hobart. Boiler Maker, vol. 19, no. 2, Feb. 1919, pp. 49-50 & 60, 5 figs. Devices developed for special work; front-end staging, handling locomotive tenders and special tools.

Canal Zone Shops. Our Canal Zone Dry Docks and Repair Shops, R. D. Gatewood. Am. Mach., vol. 50, no. 8, Feb. 20, 1919, pp. 336-339. General description of Balboa facilities.

Roundhouse, Concrete. An Unusual Concrete Roundhouse at Proctor, Minn., Wm. E. Hawley. Ry. Age, vol. 66, no. 8, Feb. 21, 1919, pp. 428-430, 5 figs. Saw-tooth roof applied to circular building; cantilever beams support walls over entrance doors.

Safety Devices. Safeguards in Railway Shops, Frank A. Stanley. Ry. Mech. Eng., vol. 93, no. 2, Feb. 1919, pp. 93-96, 9 figs. Description of certain safety devices used at various shops of Southern Pacific.

Welding. The Oxy-Acetylene Process in Railroad Shops, W. L. Bean. N. E. R. R. Club, Jan. 14, 1919, pp. 247-261. Development; notes on apparatus selection; accessories; instruction of welders.

TERMINALS

PHILADELPHIA. The Port of Phila., George S. Webster. Jl. Engrs. Club, Phila., vol. 35-12, no. 169, Dec. 1918, pp. 549-551. Administration; recent additions; possibilities.

RICHBOROUGH. The Richborough Transportation Depot and Train Ferry Terminus. Engineer, vol. 127, no. 3291, Jan. 24, 1919, pp. 76-79. 15 figs. The new wharf. Third article.

RICHMOND, VA. A New Passenger Station Completed at Richmond, Va. Ry. Age, vol. 66, no. 7, Feb. 14, 1919, pp. 401-406, 9 figs. Project involves terminal with facilities for two roads and improved main line. Also in Ry. Rev., vol. 64, no. 7, Feb. 15, 1919, pp. 239-242, 9 figs. Description of three-million-dollar structure.

TERMINAL SHEDS. Marine Terminal Shed, H. McL. Harding. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 47-48, 1 fig. Comparison of one-story and two-story sheds in regard to cost and speed of operation.

YARDS, LONDON. Willesden Gravity and Marshalling Yards. Ry. Gaz., vol. 30, no. 1, Jan. 3, 1919, pp. 17-24, 11 figs. and chart. Freight and coal traffic in London district of London & Western Ry.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

POTENTIAL SIGNS. The Sign of Potentials, Oliver P. Watts. Brass World, vol. 15, no. 2, Feb. 1919, pp. 37-39, 1 fig. Argues that sign adopted for potential of a metal is of importance to electrochemistry and urges continuing established use of plus sign for potential of zinc.

ELECTROPHYSICS

AIR FILMS, DIELECTRIC STRENGTH OF. The Dielectric Strength of Air Films Entrapped in Solid Insulation and a Practical Application of the Problem for Alternator Coils and Cables, F. Dubsky. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 2, Feb. 1919, pp. 141-161, 7 figs. It was found from experiments that the dielectric strength of air films between insulations was practically the same as the dielectric strength of air films between conductors. Specific examples are given illustrating application of data to design of armature coils and cables.

AMPLIFICATION OF CURRENTS. Amplification of the Photoelectric Current by Means of the Audian, Carl Eli Pike. Phys. Rev., vol. 13, no. 2, Feb. 1919, pp. 102-108, 8 figs. Experiments, it is reported, have demonstrated that photoelectric currents can be amplified by means of the audion from 1600 to 5000 times.

CURRENT, FLOW OF. Propagation of the Current in an Electric Line (Propagation du courant dans une ligne), J. B. Pomey. Revue Générale de l'Electricité, vol. 5, no. 6, Feb. 8, 1919, pp. 204-209. Demonstration of Heaviside formula and derivation of a relation to cover case when variable electromotive force starts from a given condition of motion.

ELECTRIC CIRCUIT, GENERAL EQUATION OF. The General Equations of the Electric Circuit—III, Charles P. Steinmetz. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 3, Mar. 1919, pp. 249-318, 11 figs. Variation of constants r, L, C, and g, and its effects. Equations of line constants as function of equivalent frequency are derived, and applications thereof made to various problems.

ELECTROMAGNETIC FIELDS. On the Flow of Energy in the Electromagnetic Field Surrounding a Perfectly Reflecting Cylinder, T. K. Chinmayan. Lond., Edinburgh & Dublin Phil. Mag., vol. 37, no. 217, Jan. 1919, pp. 9-33, 8 figs. Positions of maxima and minima of illumination and visibility of fringes when plane light waves are grazingly incident in a direction at right angles to axis of cylinder.

ELECTROMAGNETIC PHENOMENA, MECHANICAL REPRESENTATION OF. Mechanical Representations of Electromagnetic Phenomena (Représentations mécaniques des phénomènes électromagnétiques), Artur Korn. Revue Générale de l'Electricité, vol. 5, no. 4, Jan. 25, 1919, pp. 150-151. Considerations on a mechanical representation of an electron, the electric current and a magnet. From Electrotechnische Zeitschrift, vol. 39, Sept. 12 and 19, 1918, pp. 363-375.

ELECTROMAGNETIC OSCILLATIONS. Productions of Electromagnetic Oscillations (Production d'oscillations électromagnétiques), Ricardo Arnô. Industrie Electrique, vol. 27, no. 635, Dec. 10, 1918, pp. 443-444. Produced directly by alternating currents used in industry. Brief abstract of communication to Institute Lombard des Sciences et des Lettres.

GRID CURRENTS IN VACUUM TUBES. Note on the Effects of Grid Currents in Three-Electrode Ionic Tubes, E. V. Appleton. Lond., Edinburgh & Dublin Phil. Mag., vol. 37, no. 217, Jan. 1919, pp. 129-134, 2 figs. Conductance of grid circuit inside tube is treated as high-resistance leak across condenser of oscillatory circuit connected to grid and filament; effect of this leak in amplifying and oscilation circuits is investigated quantitatively.

INSULATION, ELECTRICAL STRESSES IN. Ionization of Occluded Gases in High-Tension Insulation, G. B. Shanklin and J. J. Matson. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 2, Feb. 1919, pp. 163-210, 21 figs. Determination of safe working stress from measurements of stress at which ionization starts in different types of built-up insulation, such as used in cables and coils. Paper brings out importance of reducing gas spaces to minimum size and using materials of lowest possible permittivity, since the higher the permittivity the greater the stress on the gas spaces.

INSULATORS, RUPTURE OF. Mechanism of the Rupture of Electric Insulators (Le mécanismes de la rupture des isolants électriques). Génie Civil, vol. 74, no. 5, Feb. 1, 1919, pp. 92-93, 3 figs. Factors determining rupture; effect with alternating currents.

IRON LOSSES AT RADIO FREQUENCIES. Note on Losses in Sheet Iron at Radio Frequencies, Marius Latour. Proc. Inst. Radio Engrs., vol. 7, no. 1, pp. 60-71, 1 fig. Calculation of power dissipated separately by Foucault currents and by hysteresis in a sheet of iron, assuming constant angle of lag between magnetic induction in sheet and magnetizing field producing it; thickness of iron sheet which will make total power a minimum; angle of lag between voltage and current in circuit of inductance coil.

Hysteresis and Eddy-Current Losses in Iron at Radio Frequencies, Christian Nusbaum. Proc. Inst. Radio Engrs., vol. 7, no. 1, Feb. 1919, pp. 15-26, 8 figs. Review of literature on heat losses per cycle at various frequencies; comparison calorimetric method whereby losses in soft-iron-wire core of a toroid are measured against similarly wounded toroid without iron core.

MAGNETIC FLUX DENSITY. The Natural Frequency of an Electric Circuit Having an Iron Magnetic Circuit, H. G. Cordes, Proc. Inst. Radio Engrs., vol. 7, no. 1, Feb. 1919, pp. 73-82, 2 figs. Following Steinmetz procedure, magnetic flux density in laminated iron core with a.c. current excitation is found; then expressions and tables for determining natural frequency of circuits containing iron-core inductances are given; results obtained are numerically illustrated.

MAGNETISM, KINETIC THEORY OF. On a Kinetic Theory of Magnetism in General, Kôtarô Honda and Junzo Okubo. Phys. Rev., vol. 13, no. 1, Jan. 1919, pp. 6-26, 4 figs. Modifications in Langevin's theories of para-magnetic and dia-magnetic substances in order to account for observed facts.

RESISTANCE MEASUREMENTS, RADIO FREQUENCY. The Measurement of Radio Frequency Resistance. Phase Difference, and Decrement. J. H. Dellinger. Proc. Inst. Radio Engrs., vol. 7, no. 1, Feb. 1919, pp. 27-59, 9 figs. Relations between resistance, phase difference, sharpness of resonance, and decrement; derivation and classification of methods of measurement. Methods are comprised under resistance-variation and reactance-variation. Special direct-reading methods of measuring reactance.

SHORT-CIRCUIT CURRENT CALCULATION. Calculation of Short-Circuit Currents in Alternating-Current Systems, W. W. Lewis. Gen. Elec. Rev., vol. 22, no. 2, Feb. 1919, pp. 140-145, 8 figs. The author describes the use of a calculating table, for solving complicated problems in the determination of short-circuit currents in large power networks.

SINUSOIDAL CURRENT, ACTION OF. Electrical State of a Line Carrying a Sinusoidal Current (Etat permanent sur une ligne parcourue par un courant sinusoïdal), M. E. Brylinski. Bulletin de la Société Française des Electriciens, vol. 8, no. 75, Dec. 1918, pp. 401-420. Formulæ for electrical quantities determined for various cases.

STEEL CONDUCTORS. Resistance and Reactance of Commercial Steel Conductors, H. B. Dwight. Elec. Jl., vol. 16, no. 1, Jan. 1919, pp. 25-27, 15 figs. Curves showing amperes per wire against ohms per mile for different sizes; graphs drawn from results of tests.

TRANSIENT OSCILLATIONS. Theory of the Transient Oscillations of Electrical Networks and Transmission Systems, John R. Carson. Proc. Inst. Elec. Engrs., vol. 38 no. 3, Mar. 1919, pp. 407-489, 22 figs. Theoretical study with view to developing methods of calculation directly applicable to engineering problems. A formula is derived which expresses current in electric network due to suddenly applied e.m.f. in terms of applied e.m.f. as time function and a characteristic function of constants and connections of system.

FURNACES

MANUFACTURE. Furnace Company Completes New Plant. Blast Furnace, vol. 7, no. 3, Mar. 1919. pp. 152-153, 2 figs. Features of electric furnace manufacturing plant.

Plant of the Electric Furnace Co. Brass World, vol. 15, no. 2, Feb. 1919, pp. 61-63, 10 figs. Plant manufactures Baily furnaces for electrical heat-treating and annealing of steel, and melting of nonferrous metals.

RENNERFELT FURNACE OPERATION. Melting Silver, Nickel and Bronze Alloys by Electricity. Eng. & Min. Jl., vol. 107, no. 7, Feb. 15, 1919, pp. 323-324. Results at Phila. mint with 1000-lb. Rennerfelt electric furnace.

RESISTOR-TYPE EXPERIMENTAL FURNACE. Experimenting with the Electric Furnace. Wirt S. Scott. Jl. Electricity, vol. 42, no. 4, Feb. 15, 1919, pp. 173-174. Experimental work on resistor type furnaces for forging.

STEEL FURNACES. Electric Furnaces as Applied to Steel Making, Henry Lawrence Hess. Mech. Eng., vol. 41, no. 3, Mar. 1919, pp. 245-248, 5 figs. Methods of producing electric steel; Héroult type of furnace; cold method of producing electric steel; method of pouring, rolling and other furnace operations practiced in plant operating two 6-ton and four 7-ton Héroult furnaces.

GENERATING STATIONS

CANADA. Statistical Analysis of the Central Electrical Station Situation of Canada. Elec. News, vol. 28, no. 3, Feb. 1, 1919, pp. 26-30, 7 figs. Synopsis of data prepared by Dominion Water Power Branch of Dept. of Interior, in co-operation with Dominion Bur. of Statistics of Dept. of Trade & Commerce.

DIESEL ENGINES. Electric Generation by Diesel Engine, E. J. Richards. Jl. Electricity, vol. 42, no. 4, Feb. 15, 1919, pp. 167-169, 5 figs. Results obtained at large copper mine.

HYDROELECTRIC PLANTS. Michigan's Largest Hydroelectric Development. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 21-24, 6 figs. Layout; co-ordination of turbines installed to water flow; equipment of 140,000-volt transmission line.

SINGLE-PHASE CURRENT GENERATION. The Supply of Single-Phase Power from Three-Phase Systems, Miles Walker, Jl. Instn. Elec. Engrs., vol. 57, no. 278, Jan. 1919, pp. 109-139 and (discussion) pp. 139-148, 49 figs. Methods of obtaining single-phase power, particularly (1) by taking of single-phase current direct from one of phases of a three-phase supply system and use of balancer for balancing phases, and (2) by a rotating balancing transformer which absorbs balanced three-phase power in one winding and supplies a single-phase load from an independent winding. A calculation of a balancing transformer for feeding a 400-kw. electric furnace is worked out; figures obtained in tests of machine at no load and at full load are given.

GENERATORS AND MOTORS

BRUSHES. Application of Brushes to Electrical Machinery, Warren C. Kal, Power, vol. 49, nos. 7 and 8, Feb. 18, and 25, 1919, pp. 241-243 and 276-278, 9 figs. Feb. 18: Various types of brushes used on electrical machinery, their composition, method of manufacture and field of application. Feb. 25: Discussion of effect of conditions of service upon selection of carbon brushes.

COOLING OF MOTORS. Colling of Electric Motors, with Special Reference to Totally-Enclosed Machines, P. A. Mossay. Tran. Instn. Min. Engrs., vol. 56, part 2, Dec. 1918, pp. 103-115 and (discussion), pp. 115-117, 13 figs. Writer's experience and suggestions in regard to present systems of ventilating motors.

DEMAND FACTORS OF MOTORS. Determination of Demand Factors to Save Copper, Henry C. Horstmann and Victor H. Tousley. Elec. World, vol. 73, no. 7, Feb. 15, 1919, pp. 308-310, 3 figs. Methods by which electrical inspectors can more accurately gauge in advance probable demand factors of different types of motor installations.

INDUCTION MOTORS, SPEED-CONTROL OF. Speed Control of Induction Motors on Cranes and Hoists by means of Solenoid Load Brakes, R. H. McLain and H. H. Vernon. Gen. Elec. Rev., vol. 22, no. 2, Feb. 1919, pp. 117-125, 9 figs. Article covers different applications of solenoid brakes and gives a detailed description of a solenoid load brake.

MECHANICALLY CONNECTED MOTORS. The Operation of Mechanically-Connected Direct-Current Motors Permanently in Series or Permanently in Parallel, H. F. Stratton. Popular Engr., vol. 11, no. 2, Feb. 1919, pp. 10-13, 8 figs. Reasons why preference is given to several mechanically connected motors in preference to a single large motor. (To be continued.)

STANDARDIZATION OF MOTORS. Advantages of Uniform Motor Design. Rotary Apparatus. Elec. Power Club, bul. 6010, Jan. 2, 1919, 6 pp. Views of manufacturers and users concerning standardization of electric motors.

SYNCHRONOUS MOTORS, STARTING. Starting Synchronous Motors, E. E. George. Elec. Wld., vol. 73, no. 9, March 1, 1919, pp. 429-430. How to avoid excessive currents and mechanical strains in synchronous motors started as induction machines.

LIGHTING AND LAMP MANUFACTURE

MUNICIPAL LIGHTING. A Study in Municipal Electric Lighting. Stone & Webster Jl., vol. 24, no. 2, Feb. 1919, pp. 104-112. Comparative data showing results of municipal electric lighting in Massachusetts.

POCKET LAMPS. Pocket Electric Lamps (Les lampes électriques de poche), L. Lindet. Bulletin de la Société d'Encouragement, vol. 130, no. 6, Nov.-Dec. 1918, pp. 398-399. Development of industry in France; details of manufacture.

THEATRES. Electric Lighting of Theatres (L'éclairage électrique au théatre), J. Reyval. Revue Générale de l'Electricité, vol. 5, no. 4, Jan. 25, 1919, pp. 133-145, 11 figs. Brief survey of progress in artificial lighting of theatres; description of electric installation of the Théâtre National de la Comédie Française, Paris.

MEASUREMENTS AND TESTS

KENOTRON. Measurement of the Crest Values of alternating Voltage by the Kenotron, Condenser and Voltmeter, J. R. Craighead. Gen. Elec. Rev., vol. 22, no 2, Feb. 1919, pp. 104-109, 8 figs. Arrangement described embodies in one instrument a combination of qualities said not to be possessed by previous devices for the purpose. The theory and construction of the crest meter is described, test of its accuracy recorded and its advantages and limitations set forth.

POWER APPLICATIONS

CALIFORNIA CAMPAIGN. California Co-operative Campaign Progress. Jl. Electricity, vol. 42, no. 3, Feb. 1, 1919, pp. 108-110. Summary of accomplishments in 1918. Object of campaign is better electric service to public.

ELECTROMETALLURGICAL INDUSTRIES. Electrometallurgical Industries in the Scandinavian Countries (Les industries électrométallurgiques dans les pays Scandinaves). Journal du Four Electrique, vol. 28, no. 3, Feb. 1, 1919, pp. 17-19, Statistical figures and notes on various projects.

FLOUR MILLS. Electrical Equipment of New Pacific Coast Flour Mill. Elec. Rev., vol. 74, no. 8, Feb. 22, 1919, pp. 295-296, 5 figs. Mill at Pasco, Wash., is completely equipped electrically; labor-saving methods promote marked economy.

HEATING. Electric Heating as a Profitable Load, Barry Dibble. Jl. Electricity, vol. 42, no. 3, Feb. 1, 1919, pp. 102-105, 2 figs. Data on cost and revenue of electric, heating on Minidoka project, Idaho.

LABORATORIES. Electrically Equipped Laboratories, C. B. Merrick. Jl. Electricity, vol. 42, no. 4, Feb. 15, 1919, pp. 153-154, 2 figs. Installation at parasitology laboratories of Cal. State Board of Health.

OFFICE BUILDING. Electricity in a Large Office Building. Jl. Electricity, vol. 42, no. 4, Feb. 15, 1919, pp. 150-151, 3 figs. General description of electric equipment in Southern Pacific building, San Francisco.

POTTERIES. Electricity in the Ceramic Arts, J. P. Alexander. Gen. Elec. Rev., vol. 22, no. 2, Feb. 1919, pp. 113-116, 4 figs. Describes various processes employed in the pottery industry and the service afforded by electricity in this field.

SHIPBUILDING. Electricity in the Shipbuilding and Shipping Industries. Shipbuilding & Shipping Rec., vol. 13, no. 1, Jan. 2, 1919, pp. 13-14. Concerning efficient development utilization of power as means to face international competition.

SIGNS. Portland Sign Ordinance. Jl. Electricity, vol. 42, no. 3, Feb. 1, 1919, pp. 114-115. Regulations in Portland and Oregon.

STANDARDS

FUNDAMENTAL UNITS, DEFINITIONS OF. International Electrotechnic Commission (La commision electrotécnica internacionale), German Niebuhr. Boletin de la Asociacion Argentina de Electro-Tecnicos, vol. 4, no. 9, Sept. 1918, pp. 807-815, 2 figs. Definitions adopted for the fundamental units. (Continuation of serial.)

STANDARDIZATION. Standardization of Edison Lamp Bases and Sockets (Projet d'unification des filetages des culots et supports de lampes à vis Edison), C. Zetter. Bulletin de la Société d'Encouragement, vol. 130, no. 6, Nov.-Dec. 1918, pp. 405-410, 2 figs. Report of Union des syndicats de l'Electricité.

TELEGRAPHY AND TELEPHONY

AMATEUR RADIO. Amateur Radiotelegraphy of the Future, Alfred N. Goldsmith. Wireless Age, vol. 6, no. 5, Feb. 1919, pp. 11-13. Advocates operating all amateur radio stations of the future on sustained waves between 100 and 300 meters.

The Fire Underwriters' Rules Applied to Amateur Stations. Wireless Age, vol. 6, no. 6, Mar. 1919, pp. 32-33, 2 figs. Advisability of modifying installation to conform to Underwriters' rules and method of doing so.

AUTOMATIC TELEPHONE, WESTERN ELECTRIC. The Western Electric Company's Automatic Telephone System, B. O. Anson. Instn. Post Office Elec. Engrs., paper on 72, pp. 1-47 and (discussion) pp. 48-61, 23 figs. Operation, details of principal apparatus used, schematic connections of various line exchanges, and records of service.

BAUDOT QUADRUPLEX SYSTEM. Paris-London Quadruplex Baudot Communication (Communication Baudot quadruple Paris-Londres), M. Mercy. Annales des Postes, Télégraphes et Téléphones, vol. 7, no. 4, Dec. 1918, pp. 623-624. Condensation is reported to have been overcome in Anglo-French cable by interpolation of differential transmission between cable and aerial line in France. Device used described in Annales, Mar. 1917, p. 144.

BRITISH COLONIES. The Telegraph and the Telephone in the British Colonies (Le télégraphe et le téléphone dans les Colonies britanniques). Journal Télégraphique, vol. 43, no. 1, Jan. 25, 1919. pp. 3-6. Australia and New Zealand. (Concluded.)

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FRENCH COLONIES. Wireless Telegraphy in the French Colonies (La télégraphie sans fil dans les colonies françaises). Revue Générale de l'Electricité, vol. 5, no. 6, Feb. 8, 1919, pp. 233-234. Present conditions; particulars of the Messimy project. From Economiste français, Jan. 11, 1919.

GOVERNMENT OWNERSHIP. Both Sides of the Government Ownership Question. Wireless Age, vol. 6, no. 6, Mar. 1919, pp. 11-21 and 46, 13 figs. Summary of opposing testimony given in congressional hearing on Alexander bill for Government ownership of wireless.

INTERFERENCE PREVENTION. General Rules Followed in the United States for Protecting Telephone Lines Against Three-Phase Lines (Règles générales suivies aux Etats-Unis pour protéger les lignes téléphoniques contre les lignes triphasées), M. Valensi. Annales des Postes, Télégraphes et Téléphones, vol. 7, no. 4, Dec. 1918, pp. 526-607, 38 figs. Prepared from information obtained in conferences of writer with engineers of Am. Telephone & Telegraph Co. and his perusal of Proc. Am. Inst. Elec. Engrs., notably Interference as a Practical Problem by A. H. Griswold and R. W. Mastick, and the Design and Transposition for Parallel Power and Telephone Circuits by H. S. Osborne.

LLOYD'S SEMAPHORE, RADIO TELEGRAPHY. Wireless Telegraphy and the Safety of Navigation (La télégraphie sans fil et la sécurité de la navigation maritime). Journal Télégraphique, vol. 43, no. 1, Jan. 25, 1919, pp. 6-10. Lloyd's semaphore plan proposed to the Paris International Conference. (To be continued.)

MERCURY-VAPOR RECTIFIERS. Mercury Vapor Rectifiers (Les redresseurs à vapeur de mercure). Revue Générale de l'Electricité, vol. 5, no. 4, Jan. 25, 1919, pp. 146-149, 8 figs. Scheme of connections, efficiency curves and oscillograms of voltages and currents. From Schweizerische Bauzeitung, vol. 72, Sept. 28, 1918, pp. 117-120, 13 figs.

MOLYBDENITE RECTIFIERS. Photoelectric Sensitivity vs. Current Rectification in Molybdenite, W. W. Coblentz and Louise S. McDowell. Phys. Rev., vol. 13, no. 2, Feb. 1919, pp. 154-155. Tests are said to have shown that low-resistance, photoelectrically-insensitive samples of molybdenite are more efficient rectifiers than high-resistance, light-sensitive specimens.

MULTIPLEX TRANSMISSION. Multiplex Telegraphy and Telephony. Wireless Age, vol. 6, no. 6, Mar. 1919, pp. 22-23, 4 figs. Concerning use of radio frequency currents.

Multiplex Telephony and Telegraphy, Frank B. Jewett. Telegraph & Telephone Age, vol. 37, no. 2, Jan. 16, 1919, pp. 45-47, 4 figs. Development and possibilities.

NAVAL RADIO STATIONS. A Brief Technical Description of the New San Diego, Pearl Harbor, and Cavite High Power Naval Radio Stations, Leonard F. Fuller. Proc. Inst. Radio Engrs., vol. 7, no. 1, Feb. 1919, pp. 11-13.

RADIO PROGRESS DURING WAR. Radio Development During the War, Nugent H. Slaughter. Elec. World, vol. 73, no. 7, Feb. 15, 1919, pp. 311-315, 4 figs. Problems with which Signal Corps were confronted when the United States first engaged in conflict; how it placed radio-apparatus production on quantity basis; nature of improvements made.

RESONANCE MEASUREMENTS. Resonance Measurements in Radiotelegraphy with the Oscillating Audion. Proc. Inst. Radio Engrs., vol. 7, no. 1, Feb. 1919, pp. 9-10. The telephone click in an oscillating audion circuit when a coupled circuit is brought into tune with it is utilized to measure quickly and accurately antenna capacity, wave length of distant stations, capacities, inductances and wave lengths.

Rouzet Transmitting System. Rouzet Transmitting System for Increasing Spark Frequencies. Wireless Age, vol. 6, no. 5, Feb. 1919, p. 20, 4 figs. Wiring diagram.

Simultaneous Telegraphy and Telephony. The Van Rysselberghe System of Simultaneous Telegraphy and Telephony, the Marshall Electrical Condenser Etc., Wm. Maver, Jr. Telegraph & Telephone Age, vol. 37, nos. 1 and 4, Jan. 1 and Feb. 16, 1919, pp. 21-23 and 95-97. (Concluded from Sept. 16, 1918.)

Telegraph Lines, Protection Against Lightning. Protection Against Lightning and High Tension Circuits. Telegraph & Telephone Age, vol. 37, no. 2, Jan. 16, 1919, pp. 42-44 Summary of experience of railroad telegraph departments. Presented at convention of Assn. Ry. Telegraph Superintendents. (Concluded.)

Telephone Circuits. Telephone Circuits With Zero Mutual Induction, William W. Crawford. Proc. Am. Inst., Elec. Engrs., vol. 38, no. 3, Mar. 1919, pp. 377-405, 11 figs. Deals with reduction of inductive interference in telephone circuits. Several forms of construction involving various relative positions of two or more circuits, in which mutual inductance is zero, and mutual capacitance unbalance approximately zero, are discussed.

Telephone Relays. Telephone Relays Used by the French Administration. (Les relais téléphoniques employés par l'Administration française). Revue Générale de l'Electricité, vol. 5, no. 4, Jan. 25, 1919, pp. 151-152. 4 figs. Apparatus deviced by Latour. From Annales des Postes, Telégraphes et Téléphones, vol. 7, Sept. 1918, p. 403, 4 figs.

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Telephony, Radio. Magnetic Modulating System for Wireless Telephony. Wireless Age, vol. 6, no. 5, Feb. 1919, pp. 20-21, 3 figs. Modulation effected by subjecting magnetic core to relatively weak and rapidly alternating cross magnetization.
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Tone Frequencies. The Production of Tone Frequencies. Wireless Age, vol. 16, no. 5, Feb. 1919, pp. 18-20, 6 figs. Oscar Roos methods of operating wireless system over wide range of tone frequencies.

Vacuum Tubes. War-Time Development of Vacuum Tubes, Ralph Brown. Elec. World, vol. 73, no. 8, Feb. 22, 1919, pp. 358-363, 9 figs. Most important advance in radio engineering; three stages; determining desirable characteristics; designing tubes having these characteristics and capable of being produced in quantities; specifications and test methods.

Wave-Length Standardization. The Standardization of the Wave Lengths of Electro-Magnetic Waves for Radio-Engineering and the Calibration of Wave Meter (in Japanese), K. Nishizaki. Denki Gakkwai Zasshi, no. 366, Jan. 10, 1919.

Weagant Oscillation Valve. The Weagant Oscillation Valve. Wireless Age, vol. 6, no. 6, Mar. 1919, pp. 24-25, 6 figs. Reported improvement on original Fleming oscillation valve. A plate and a filament are enclosed in a vacuum chamber as usual; a metallic electrostatic control element is placed parallel to electron stream so that its field acts at right angles to latter; this position of control is said to be essential characteristic of tube.

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

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The Essentials of Transformer Practice—XVIII, E. G. Reed. Elec. Jl., vol. 16, no. 1, Jan. 1919, pp. 31-32, 9 figs Transformer connections for phase transformations.

Voltages, Abnormal. Abnormal Voltages Within Transformers, L. F. Blume and A. Boyajian. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 2, Feb. 1919, pp. 211-248, 21 figs. Mathematical analysis of rectangular wave impinging upon a transformer winding and quantitative values of resulting internal voltage stresses in terms of transformer constants; partial applicability of conclusions to abrupt impulses; difference between operating transformer with isolated and grounded neutral; comparison of theoretical results with impulse and high-frequency tests made in laboratory.

TRANSMISSION, DISTRIBUTION, CONTROL

High-Tension Transmission. For High Tension Transmission Service. Power Plant Eng., vol. 23, no. 4, Feb. 15, 1919, pp. 179-183, 5 figs. Description of new Dixon station of Illinois Northern Utilities Co.; modern coal-handling equipment; novel arrangement of intake prevents dirty screens.

Line Tests. Line Tests in Medium-Sized and Small Offices (Essais de lignes dans les bureaux de moyenne et de petite importance), M. Poirier. Annales des Postes, Télégraphes et Téléphones, vol. 7, no. 4, Dec. 1918, pp. 625-627, 2 figs. How to make simple tests by means of voltmeter.

Phase-Displacement and Power Rates. Phase-Displacement and Its Relation to Methods of Charging for Power, H. Bussmann. Elecn., vol. 82, no. 2122, Jan. 17, 1919, pp. 101-102, 3 figs. Abstract of article in Elektrotechnische Zeitschrift, no. 10, 1918.

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Substations. A Well-Lighted and Well-Ventilated Substation, S. H. Granton. Elec. Ry. Jl., vol. 53, no 7, Feb. 15, 1919, pp. 326-327, 4 figs. Descriptiou of new substation of Kansas City Railways.

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Wire Sizes. Calculation and Design of Direct Current Circuits, Terrell Croft. Nat. Engr., vol. 23, no. 2, Feb. 1919, pp. 72-75, 3 figs. Determining sizes of wire for distribution of electrical energy; voltage variations for incandescent lamps; apportionment of voltage drop; wiring calculations.

WIRING

Interior Wiring. Approved Interior Wiring Methods, John H. Mayer. Telegraph & Telephone Age, vol. 37, no. 4, Feb. 16, 1919, pp. 83-84. Suggestions in regard to wiring offices for electric light so work will pass inspection.

ACCOUNTING

Graphical Analysis. Graphical Analysis of Accounting, Walter E. Gaby. Min. & Sci. Press, vol. 118, no. 8, Feb. 22, 1919, p. 260, 1 fig. Proposes scheme of representing in form of flow sheet the elements of double-entry bookkeeping.

EDUCATION

Crippled Workmen. Cut Metal Trade's Disability Costs, Douglas C. McMurtrie. Iron Trade Rev., vol. 64, no. 7, Feb. 13, 1919, pp. 445-446. Work of Red Cross Inst. for reeducation of crippled and disabled men, New York City.
Re-education vs. Disability Compensation, Douglas C. McMurtrie. Am. Mach., vol. 50, no. 9, Feb. 27, 1919, pp. 405-406. A plea for the re-education of the disabled worker rather than the pension and his neglect.

Education and Democracy. Industry, Democracy and Education, C. V. Corless. Bul. Can. Min. Inst., no. 83, Mar. 1919, pp. 257-272. Address at joint session Am. Inst. Min. Engrs. and Can. Min. Inst.

Navy Machinists. How the Navy Trains its Machinists Ashore, Willard Connely. Am. Mach., vol. 50, no. 9, Feb. 27, 1919, pp. 397-400, 6 figs. Training comprises courses in machine work, pattern making, molding, blacksmithing, sheet metal working, oxyacetylene welding, boat building and gasoline-engine construction and repair.

Reeducation of Cripples. Disabled Soldiers and Sailors, Douglas C. McMurtrie, Salt Lake Min. Rev., vol. 20, no. 21, Feb. 15, 1919, pp. 29-30. Work of reeducation at Red Cross Inst. for Crippled and Disabled Men, New York City.
L'Hôtel des Invalides, at Avignon, Jules Veran. Am. Jl. Care for Cripples, vol. 7, no. 2, pp. 139-141. Discusses establishment of institution for war cripples. Translated from Revue Interalliée pour l.Etudes des Questions intéressant les Mutilés de la Guerre, vol. 1, pp. 285-289.
Placement of Disabled American Soldiers and Sailors; Agreement Between Federal Board for Vocational Education and United States Employment Service. Am. Jl. of Care for Cripples, vol. 7, no. 2, 1918, pp. 154-156.
The Problem of the Discharged Disabled Man, H. H. C. Baird. Am. Jl. of Care for Cripples, vol. 7, no. 7, 1918, pp. 117-125. Insufficiency of present means of readaptation; conditions resulting from public indifference. From Outlook.
A Record of Practical Experience in Retraining Crippled Ex-Service Men, A. G. Baker, Am. Jl. of Care for Cripples, vol. 7, no. 7, 1918, pp. 109-111. Notes of the Superintendent, Pavillion Military Hospital, Brighton, England.
Re-Education from the Point of View of the Disabled Soldier, Grace S. Harper, Am. Jl. of Care for Cripples, vol. 7, no. 2, 1918, pp. 85-87. Translated from Revue Interalliée pour l'Etude des Questions intéressant les Mutilés de la Guerre, vol. 1, 1918, pp. 254-258.
Should Disabled Men be Re-Educated in Special Schools? L. Alleman, Am. Jl. of Care for Cripples, vol. 7, no. 7, 1918, pp. 100-104. Translated from French address to Inter-Allied Conference on the After-Care of Disabled Men. (Reports pp. 171-178.)
Social Responsibilities in the Rehabilitation of Disabled Soldiers and Sailors, Douglas C. McMurtrie, Am. Jl. of Care for Cripples, vol. 7, no. 7, 1918, pp. 126-132. Duties of the family, of the employer, and of the general public. From Medical Rev.
So Comes the Sacred Work, John Galsworthy. Am. Jl. of Care for Cripples, vol. 7, no. 7, 1918, pp. 88-91. Extent of reeducation work the nations will have to undertake.
The Training of the Disabled South Africa Soldier and Its Lesson, E. N. Thornton. Am. Jl. of Care for Cripples, vol. 7, no. 7, 1918, pp. 105-108, 4 figs. Paper at Inter-Allied Conference on Disablement Problems Arising out of the war.
The Vocational Rehabilitation Act. Am. Jl. of Care for Cripples, vol. 7, no. 2, 1918, pp. 142-144. Text of measure as signed by Preident Wilson.
The Vocational School for Disabled Soldiers at Nantes, France, Emmanuel Chastand, Am. Jl. of Care for Cripples, vol. 7, no. 7, 1918, pp. 92-99, 8 figs. Claims that experience has shown that reeducational school which comprises shops, classrooms, dormitories, and dining rooms is best agency for refitting for work disabled soldiers; training in private shop is considered as ineffective.

Reeducation of Cripples. What the Employers of America Can Do for the Disabled Soldiers and Sailors. Jl. Acetylene Welding, vol. 2, no. 8, Feb. 1919, pp. 381-384 and 398. Coöperation the oxy-acetylene industry can offer. Vocational rehabilitation series no. 3 of Federal Board for Vocational Education.

Research Work by Students. Reforms in the Technical Engineering Education (Ideas sobre la reforma de la ensenanza tecnica), Ramon Salas Edwards. Anales del Instituto de Ingeniros de Chile, vol. 18, no. 9, Sept. 1918, pp. 388-395. Concerning personal research work by engineering students.

Students in Coal Mining. The Training of Students in Coal Mining, With Special Reference to the Scheme of the Engineering Training Organization, F. W. Hardwick, Tran. Instn. Min. Eugrs., vol. 56, part 2, Dec. 1918, pp. 94-100 and (discussion), pp. 119-126. Lays emphasis on practical training of students at collieries.

Training Department', Aircraft Factory. Installing a Training Department, James W. Russell. Indus. Man., vol. 57, no. 3, March, 1918, pp. 175-182, 10 figs. Descriptive of the school for training 400 women weekly for a variety of positions, including clerical, metal-working, wood-working and drafting occupations at the Buffalo factory of the Curtis Aeroplane & Motor Corporation.

EXPORT

Foreign Plant Construction. Americans Build Foreign Plants, V. G. Iden, Iron Trade Rev., vol. 64, no. 8, Feb. 20, 1919, pp. 509-513. Discusses opportunities for American enterprises and capital.

FACTORY MANAGEMENT

Department Heads. Executive Common Sense in the Workshop, Abe Winters. Can. Machy., vol. 21, no. 7, Feb. 13, 1919, pp. 157-159. Circular letter to department heads of Standard Oil Co. Also in Can. Foundryman, vol. 10, no. 2, Feb. 1919, pp. 46-48.

Employment Management. Handbook on Employment Management in the Shipyard, Bulletin II, Tue Employment Building. U. S. Shipping Board Emergency Fleet Corporation, Employment Management Branch, Oct. 1918, 29 pp., 4 figs. General requirement of employment building; recommended plans for employment buildings.

Hiring Methods. Selecting Employees. Natural Gas & Gasoline Jl., vol. 13, no. 2, Feb. 1919, pp. 65-68. Method of Laclede Gas Light Co. Applicant appears separately before five examiners who test him and draw reports on appearance, mentality, native ability, mental alterness and past record, respectively.

Industrial Laws. Managing for Maximum Production, L. V. Estes. Indus. Man., vol. 57, no. 3, March 1, 1919, pp. 169-175, 5 figs. Principles and laws in industry. First of a series of articles.

Labor Saving. Plant for War and Peace. Times Eng. Supp., year 15, no. 531, Jan. 1919, pp. 2-3. Concerning saving of labor.

Labor-Saving Devices. Labor-Saving Devices, George Frederick Zimmer. Eng. Rev., vol. 32, no. 7, Jan. 15, 1919, pp. 189-191. Relative advantages and possibilities of mechanical means for handling.

Management of Employees. Developing Ambition and Confidence in Employces, George Wehrle. Gas Age, vol. 43, no. 3, Feb. 1, 1919, pp. 129-131. Suggestions to general managers of gas works.

Mental Factors in Tests. Mental Factors in Industrial Organization, Thomas T. Read. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 563-567. Report of chairman of Institute's committee on industrial organization.

Mental Tests in Industry, Robert M. Yerkes. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 405-419, 16 figs. Brief account of methods for measuring intelligence prepared for use in U. S. Army, of typical results, and of their practical applications.

Office-Building Management. Building Manager and Chief Engineer, Edward H. Kearney. Nat. Engr., vol. 23, no. 2, Feb. 1919, pp. 57-59. Incidents in daily routine of managing an office building; importance of engineering and cleaning departments.

Purchasing. Method of Purchase Expediting, Harry M. Sutton. Indus. Man., vol. 57, no. 3, March, 1919, pp. 230-231, 2 figs. Chart intended to eliminate delay.

Standardization of Methods. The Control of Methods, Processes and Materials in a Manufacturing Plant, H. L. Campbell. Proc. Steel Treating Research Soc., vol. 2, no. 2, 1919, pp. 20-31, 2 figs. Way in which a research department assisted in improvement and standardization of methods, processes and material used in a manufacturing plant.

Stock Room. The Storage of Electric Supplies. Jl. Electricity, vol. 42, no. 4, Feb. 15, 1919, pp. 161-162, 3 figs. General description of office and warehouse of wholesale firm.

Tool Room Organization. Modern Tool Room Organization Machinery, vol.1 3,. no. 331, Jan. 30, 1919, pp. 477-479, 7 figs. Scheme for recording and costing jigs and fixtures.

FINANCE AND COST

Cost Accounting. Cost Accounting to Aid Production, G. Charter Harrison. Indus. Man., vol. 57, no. 3, March 1919, pp. 218-224, 3 figs. Importance of deliberation in introducing changes. Sixth article.

Equipment and Maintenance Factors in Cost Accounting During Transition Period, L. W. Alwyn-Schmidt. Am. Mach., vol. 50, no. 8, Feb. 20, 1919, pp. 366-368. Book value of equipment readjustment equipment for new work, revaluation of all equipment recommended; charges for depreciation; how can each job be apportioned?

Fundamentals of a Uniform Cost Accounting System, G. A. Schonlau. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 58-60. General remarks on standardization and discussion of accounting method for manufacturers of concrete pipe and title. From Proc. Am. Concrete Pipe Assn.

Costing. Accurate Costing in Engineering. Eng. Rev., vol. 32, no. 7, Jan. 15, 1919, pp. 187-188. Selection of proper standard of value is given as first step in scheme for preparing standard cost system.

Costing and Labor. The Workers' Interest in Costing, M. Webster Jenkinson. Iron & Coal Trades Rev., vol. 98, no. 2657, Jan. 31, 1919, pp. 127-130. Attainment of efficiency and progress through taking workers in confidence of management. From paper before Conference of Indus. Reconstruction Council.

LABOR

Contract and Bonus Systems. Day Labor, Force Account Work and Bonuses on Highway Construction, Charles M. Upham. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 31-33. Pronounces coutract system more economical, than day labor and discusses advantages of bonus system.

Contract vs. Day Labor. Performing Municipal Construction Work by Day Labor in Flint, Michigan, Ezra C. Showcraft. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 66-67. Volume of day labor; contract vs. day-labor system; opinion as to success.

Construction Projects. City and County Engineers Write of Construction Projects Planned to Provide Buffer Employment for Labor During Readjustment Period. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 37-46. Reports from 57 engineers.

Distribution of Labor. Distribution of Labor. Times Eng. Supp., year 15, 531, Jan. 1919, pp. 3-4. Discussed from viewpoints of work, skill and direction.

Employee Representation. Steel Plant Industrial Relations Studied. Blast Furnace, vol. 7, no. 2, Feb. 1919, pp. 101-104 and 118. Plan developed and in use by a company, whereby elected employee representatives meet and discuss problems of management and welfare.

Hours of Work. The Eight Hour Day Defined. Nat Indus., Conference Board, Research report no. 11, Nov. 1918, 9 pp. Comparison and analysis of different senses in which word is used and of principles on which demands for each type of a so-called 8-hr. day are based. Also in Eng. & Min. Jl., vol. 107, no. 6, Feb. 8, 1919, pp. 271-273.

Hours of Work as Related to Output and Health of Workers. Wool Manufacturing. Nat. Indus. Conference Board, Research Report no. 12, Dec. 1918, 69 pp. Based upon data gathered by means of schedules of inquiries addressed to members of Nat. Assn. Wool Mfrs., and to other wool naumfacturers and by field investigation.

Shorter Hours. Times Eng. Supp., year 15, no. 531, Jan. 1919, pp. 5 and 7, Expected effects on output.

Housing. The Group House—Its Advantages and Possibilities, Richard Henry Dana. Am. Architect, vol. 115, no. 2249, Jan. 29, 1919, pp. 163-165. Address delivered at Annual Conference of Housings in America.

Housing Construction at Craddock. Mun. Jl., vol. 46, no. 4, Jan. 25, 1919, pp. 61-63, 4 figs. Project to provide homes for 5,000 workers. Central concrete plant serving entire project.

Industrial Fatigue. Reducing Industrial Fatigue. Automotive Industries, vol. 40, no. 4, Jan. 23, 1919, pp. 219-221. Suggestions of Divisional Committee on Industrial Fatigue of Division of Scientific Research, U. S. Public Health Service.

Industrial Relations. Improving Relations of Employer and Empolyee, Elec. Wld., vol. 73, no. 9, March 1, 1919, pp. 418-419. Discussion by Richard H. Rice of ways to bring about a closer and better relationship between employees and the industry.

Labor Agreements. The 47-Hour Week and 8-Hour Day. Ry. Gas., vol. 30, no. 2, Jan. 19, 1919, p. 40. Terms of understanding arrived at between representatives of Engineering and Nat. Employers' Federations, Shipbuilding Employers' Federation, and Amalgamated Soc. Engrs. and Unions Affiliated to Eng. and Shipbuilding Trades and Federations.

Labor Conditions in 1917. Labor Conditions in 1917. S. A. Jl. Industries, vol. 1, no. 15, Nov. 1918, pp. 1426-1433. Abstract of annual report for 1917 of superintendent and chief inspector of white labor union of South Africa.

Labor Conditions in 1918. A Review of the Labor Conditions of 1918. Ry. Maintenance Engr., vol. 15, no. 2, Feb. 1919, pp. 63-65. Measures introduced to secure help on account of shortage of employees.

Labor Market. The Labor Market. New York State Indus. Commission Bul., vol. 4, no. 5, Feb. 1919, pp. 98-99. Employment in N. Y. State factories in Jan. 1919; wages and cost of living in Dec. 1918.

Labor Outlook. The Labor Outlook for the Coming Year, Hugh Reid. Ry. Maintenance Engr., vol. 15, no. 2, Feb. 1919, pp. 43-45. Past and present conditions in relation to future prospect; influence of federal supervision.

Outlook for Labor Generally Improved. Ry. Maintenance Engr., vol. 15, no. 2, Feb. 1919, pp. 68-70. Review of situation in various parts of the country during 1918, and discussion of 1919 prospects.

Productivity of Labor. The Principles of Employing Labor, E. H. Fish. Indus. Man., vol. 57, no. 3, March 1919, pp. 203-207. The author points out two ways of increasing the amount of labor effort in industry; bring out labor that has retired; increase the productive work of each individual employed.

Profit Sharing. How Valuable Are Profit-Sharing Plans? Harry Tipper. Automotive Industries, vol. 40, no. 4, Jan. 23, 1919, pp. 209-210. Claims that any system which attempts to satisfy the physical necessities of the worker without increasing his responsibility must fail.

Rest Periods. Rest Periods for Industrial Workers. Safety Eng., vol. 37, no. 2, Feb. 1919, pp. 77-78. Investigation by Nat. Indus. Conference Board.

Social Surrounding of Labor. Social Surrounding Have Important Bearing on All Labor Questions, Harry Tipper. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, pp. 366-367. Points out that comfort and home life of worker will modify extent and acuteness of unrest and migration.

Soldier Apprentices. Soldier Apprentices. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 9. Scheme of state assistance.

Trade Unions. Trade Unions and Production. Times Eng. Supp., year 15, no. 531, Jan. 1919, pp . 4-5. Reports engineers express view that trade unions have not helped production in past and are not likely to help it in future.

Unemployment Statistics. Unemployment Figures Mere Guess. Iron Trade Rev., vol. 64, no. 9, Feb. 27, 1919, pp. 580-584, 1 fig. Claims figures of Federal Employment Service on unemployment are inaccurate.

Wages and Cost of Living. Salaries and the High Cost of Living (Les salaires et la vie chère). Revue Générale de l'Electricité, vol. 5, no. 6. Feb. 8, 1919, pp. 235-236. Proposes increase of salaries on prorata basis of percentage of increase in price of principal commodities. From Moniteur des Intérêts matêreils, Jan. 8, 1919.

Welfare Work. Welfare Work Among Maintenance Men. Ry. Maintenance Engr., vol. 15, no. 2, Feb. 1919, pp. 40-42, 6 figs. Pennsylvania Railroad's educational courses and camps.

Women. Employment of Women Workers in Our Industries. Gas Age, vol. 43, no. 3, Feb. 1, 1919, pp. 123-128, 7 figs. Standards for employment of women issued by U. S. Dept of Labor; costumes in England and Amcrica; experiences of gas companies.

What Women Earn at Work. New York State Indus. Commission Bul., vol. 4, no. 5, Feb. 1919, p. 83. Data and figures complied by Bureau of Statistics.

Women Can Handle Exacting Work, J. Edwards-Schipper. Automotive Industries, vol. 40, no. 5, Jan. 30, 1919, pp. 266-267, 2 figs. Experiences of some manufacturers concerning adaptability of female labor.

Women in Electrical Industry. Safety Eng., vol. 37, no. 2, Feb. 1919, pp. 67-73, 12 figs. Working conditions at Westinghouse plant where 4000 women are employed.

Organization and Management. Women in Industry, Their Work and Their Health, Samuel Semple. Safety Eng., vol. 37, no. 1, Jan. 1919, pp. 17-19. Social effects of employment of women. From Proc. Seventh Annual Safety Congress.

Working Conditions. Works Life. Times Eng. Supp', year 15, no. 531, Jan. 1919, pp. 7-8. Discusses influences affecting workers personally.

Workmen's Compensation. Workmen's Compensation Legislation of the United States and Foreign Countries, 1917 and 1918. U. S. Dept. of Labor, Bur. of Labor Statistics, Workmen's Insurance and Compensation Series, no. 243, Sept. 1918, 477 pp. Enactments, new and amendatory, made by the State legislatures during 1917 and up to July 1918. Some changes in foreign legislation are also noted.

LEGAL

Compensation Acts. The "Coverage" of the Compensation Acts. Chesla C. Sherlock, Am. Mach., vol. 50, nos. 7 and 8, Feb. 13 and Feb. 20, 1919, pp. 319-321 and pp. 354-356. Second and third article. Second article establishes who are employees and when they are entitled to compensation, with an incursion into question of dependents and when they come under protection of compensation laws. Third article makes distinction between accidents occurring "out of" and "in course of" employment and at other times technically construed by citations from American and English courts.

Joint Sales Agencies. Legality of Joint Sales Agencies, A. L. H. Street. Coal Age, vol. 15, no. 9, Feb. 27, 1919, pp. 404-405. Court decisions concerning propriety of forming a pool for sale of members' products. Coal and fuel companies have been involved in cases quoted.

Tools, Laws on Use of. The Law Relating to the Use of Tools, Chesla C. Sherlock. Iron Age, vol. 103, no. 7, Feb. 13, 1919, pp. 427-428. Rule of simple tool and its application; employer's duty of inspection limited; important exceptions.

LIGHTING

Economic Aspects. Economic Aspects of Industrial Lighting, C. E. Clewell. Elec. World, vol. 73, no. 8, Feb. 22, 1919, pp. 371-374, 7 figs. Cost vs. wages; increased production and greater accuracy in workmanship; less eye stain; stimulating effect; comfort of workmen; more neatness.

Office. Modern Office Lighting, A. L. Powell. Elec. World, vol. 73, no. 7, Feb. 15, 1919, pp. 316-320, 4 figs. Lighting system for new office building of Edison Lamp Works was designed by illuminating engineers in advance of construction period; extensive tests indicate importance of careful maintenance of fixture and walls.

PUBLIC REGULATION

Price Regulation. Gas Coke Price Escapes Regulation in Germany. Gas Age, vol. 43, no. 3, Feb. 1, 1919, pp. 140-142. Upon profiteering under war-time conditions. From Journal für Gasbeleuchtung.

Railways, Electric. The Trend of Regulation. Area, vol. 7, no. 7, Feb. 1919, pp. 677-684. Discussions and opinions of courts and commissions concerning electric railways.

Rates. Rate Adjustment, Valuations, and Some of the Problems Incident Theroto, G. M. Garland. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 74-76. Situation likely to arise in operation and management of public utilities by reason of general opinion.

Utility Valuation. Need of a Revised Principle of Utility Valuation, Robert L. Hale. Gas Age, vol. 43, no. 3, Feb. 1, 1919, pp. 137-139. Discusses decisions of Wis. R. R. Commission.

Water Power, Canada. Water-Power Administration in Canada. H. W. Grunsky. Can. Engr., vol. 36, no. 7, Feb. 13, 1919, pp. 209-211 Summary of existing laws, regulations and practices in Quebec, Ontario, Prairies Provinces and Territories, and British Columbia.

RECONSTRUCTION

Automotive Industry, England. European Expansion Under War Pressure—I and II, David Beecroft. Automotive Industries, vol. 40, nos. 7 and 8, Feb. 13 and Feb. 20, 1919, pp. 345-348 and 403-406. Developments in factory enlargement, features of electric starting and lighting. Problem of reorganization of industry on peace basis.

British Views. The Return to Civil Industry. Problems of Engineering Production. Times Eng. Supp., year 15, no. 531, Jan. 1919, pp. 1-2. Views of leading manufacturers.

Canadian Organization. Canada Organizing for Vast Trade. Iron Trade Rev., vol. 64, no. 7, Feb. 13, 1919, p. 453. List of commodities for which there is an immediate market in Belgium, prepared by Can. Mfrs.' Assn.

Co-operation. Co-operation Vital in Reconstruction. Iron Trade Rev., vol. 64, no. 6, Feb. 6, 1919, pp. 381-382. British business leaders declared at London meeting held jointly with American business paper editors, that new tasks cannot be accomplished unless capital and labor continue teamwork as during war.

Peace Problems Demand Cooperation, G. W. Thompson. Chem. Engr., vol. 27, no. 2, Feb. 1919. pp. 43-44 and 48. Suggests that chemical industries, by means of Webb law, open price associations and through greater cooperation prepare themselves to meet foreign competition and internal conditions.

Engineering Forecast. Engineering and Industrial Forecast, W. T. Christine. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 55-57. Writer's opinion concerning opportunities for profitable business.

France. Economic Organization of the Country After the War (L'organisation économique du pays après la guerre). Echo des Mines et de la Métallurgie, vol. 47, no. 2613, Feb. 16, 1919, pp. 108-110. Report of commission appointed by French senate.

Engineering conditions in France. Mech. Eng., vol. 41, no. 3, Mar. 1919, pp 262-264. Expressions from American engineer-delegates to conference with French engineers on reconstruction problems.

The Rebuilding of Devastated France, John V. Schaefer. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 36-38. Exposition of suggestions that have been offered in regard to the co-operation of U. S. Government with French Government.

Government Sales Plan. Government's Sales Plan Outlined. Iron Trade Rev., vol. 64, no. 6, Feb. 6, 1919, p. 389. Disposal of surplus war products to be effected through co-operation between War Dept's sales division and U. S. Chamber of Commerce

Philadelphia. Reconstruction in Philadelphia After the War, Albert N. Hogg. Jl. Enger.' Club Phila., vol. 35-12, no. 169, Dec. 1918, pp. 553-554. Declares need for a better knowledge of business methods on the part of engineers.

Public Utilities. Maintenance of Public Utility Plants, Robert J. Thomas. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 14-15. Effect of war conditions.

Selling Prices. Business Dividend on Redfield Plan. Iron Trade Rev., vol. 64, no. 8, Feb. 20, 1919, pp. 495-496. Opinions concerning practicability of plans suggesting prices for basic commodities.

Proper Joint Plan to Lower Prices. Iron Trades Rev., vol. 64, no. 7, Feb. 13, 1919, pp. 456-457. Secretary Redfield's plan to determine fair selling prices in basic industries without lowering wages.

SAFETY ENGINEERING

Co-operation in Accident Prevention. Pull Together to Decrease Accidents, E. B. Van Doren. Elec. World, vol. 73, no. 8, Feb. 22, 1919, pp. 368-369, 3 figs. Co-operation between employer and employee to increase production and efficiency and reduce accidents; safety welfare committees should encourage suggestions.

Education of Workers. Foundry Management from Standpoint of Accident Prevention, G. A. Hart, Safety Eng., vol. 37, no. 1, Jan. 1919, pp. 12-13. Remarks on education of workers concerning safety methods and precautions. From Proc. Seventh Annual Safety Congress.

Employment. Scientific Employment and Its Relation to Accident Prevention, R. W. Inmel. Safety Eng., vol. 37, no. 2, Feb. 1919, pp. 75-76. Suggests character analysis and allocation of individuals to work which they can adequately and safely perform.

Fire-Alarm Systems. Central Fire Alarm Station of San Francisco. Elec. Rev., vol. 74, no. 8, Feb. 22, 1919, pp. 201-204, 7 figs. Unusually complete equipment; special provision to insure reliability of power supply and interchangeability of circuits; method of operating.

Fire Prevention and Fighting. Extinguishing and Preventing Oil and Gas Fires, C. P. Bowie. Dept. of Interior, Bur. of Mines, bul. 170, Petroleum Technology 48, 50 pp., 4 figs. Points out what has been done by operators in the past, and describes various fire-prevention methods and fire-fighting apparatus.

Safety Organization. Safety, Sanitation and Welfare. Safety Eng., vol. 37, no. 2, Feb. 1919, pp. 53-58, 2 figs. Safety organization of U. S. Steel Corporation.

Shipyard Sanitation. Sanitation in Emergency Shipyards, W. L. Stevenson, vol. 6, no. 1, Jan. 1919, pp. 1-18, 8 figs. Work of Department of Health and Sanitation of U. S. Shipping Board.

SALVAGE

Creamery Wastes. Treatment and Disposal of Creamery Wastes, Earle B. Phelps. Mun. Jl., vol. 46, no. 4, Jan. 25, 1919, pp. 68-70, 1 fig. Settling tank and sand bed designed and tested by U. S. Public Health Service. From Public Health Reports.

Metal Waste Reclamation. Reclamation of Waste to Be Extended. Iron Trade Rev., vol. 44, no. 3, Jan. 16, 1919, pp. 220-221. Estimates on reclamation of metals by new division of Dept. of Commerce on waste reclamation service.

SALVAGE ORGANIZATION. Scientific Salvage, H. N. Sessions. Jl. Electricity, vol. 42, no. 3, Feb. 1, 1919, pp. 105-107, 2 figs. How the Southern Cal. Edison Co. directs its salvage work.

SCRAP BUSINESS. Huge Loss of Steel Brings Problem, G. H. Manlove. Iron Trade, Rev., vol. 64, no. 6, Feb. 6, 1919, pp. 371-375, 6 figs. Claims that obliteration of millions of tons of American material on foreign battlefields disrupts normal cycle of scrap recovery.

WASTE PREVENTION. Conservation of Material by the Store Department, J. G. Stuart. Ry. Age, vol. 66, no. 9, Feb. 1919, pp. 497-500. Care in ordering and handling to prevent waste; systematic methods needed in reclamation. From a paper before the Railway Storekeepers' Association. January, 1919.

WASTE UTILIZATION. Instructive Examples of Utilizing Industrial Wastes, H. E. Howe. Indus. Man., vol. 57, no. 3, March, 1919, pp. 225-229. To illustrate the importance of reclaiming and utilizing wastes in industries article quotes a number of examples.

Salvaging Miscellaneous Wastes, W. R. Conover. Gen. Elec. Rev., vol. 22, no. 2, Feb. 1919, pp. 127-133. Deals with such wastes as cables, slings, belting, paper, lumber by-products, oils, power, heat and light.

TRANSPORTATION

COAL TRANSPORTATION, INDIA. The Carriage of Coal by Rail in India, H. Kelway-Bamber. Jl. Royal Soc. of Arts, vol. 67, no. 3454, Jan. 1919, pp. 150-161 and (discussion), pp. 161-164, 6 figs Review of past development in the Indian coal output; forecast of future coal consumption; suggestions for reducing cost of coal transportation.

TRANSATLANTIC RATES. West Blocked on Orient Shipments. Iron Trade Rev., vol. 64, no. 7, Feb. 13, 1919, p. 455. Claims that transatlantic rail rates leave advantage with Atlantic ports by canal route.

VARIA

ECONOMIC DUTIES OF ENGINEERS. The Economic Duties of the Engineer, W. R. Ingalls. Eng. & Contracting, vol. 51, no. 8, Feb. 19, 1919, pp. 193-194. From presidential address before Mining and Metallurgical Soc. of America, Jan. 1919.

FILING SYSTEMS. Uniform Filing System, C. C. Hogan. Jl. Electricity, vol. 42, no. 4, Feb. 15, 1919, pp. 170-172. Based on Dewey decimal system.

HAND FOR CRIPPLES. A Compressed Air Actuated Hand for Crippled Soldiers (Die Pressluft-Hand fuer Kriegsbeschaedigte Industrie Arbeiter), W. Dahlheim. Zeitschrift fuer Komprimierte und Fluessige Gase, vol. 19, no. 2, 1917, pp. 18-19, 1 fig. Togglejoint actuated by compressed air piston, to replace the natural hand, enabling the workman to perform practically all machine shop operations, including filing. Light, simple, inexpensive.

LAND SETTLEMENT. The Present Status of Land Settlement Activities for Ex-Service Men in Great Britain, Hilda A. Fox. Am. Jl. of Care for Cripples, vol 7, no. 2, 1918, pp 133-138. List and activities of a number of organizations, voluntary and otherwise, working for this object.

OCCUPATIONAL THERAPY. Occupational Therapy in Military Hospitals, James E. Russell. Am. Jl. of Care for Cripples, vol. 7, no. 7, 1918, pp. 112-116. Situation at War Department. Address before Nat. Soc. for Promotion of Occupational Therapy.

TELEPHONE CREDIT-CHECK SYSTEM. Telephone System of Credit Checks, Clotilde Grunski. Jl. Electricity, vol. 42, no. 4, Feb. 15, 1919, pp. 152-153, 2 figs. Department-store credit system; uses a central telephone exchange and various stations in different parts of store.

METALLURGY

ALUMINUM

ALUMINUM ALLOYS. Aluminum and Its Alloys (L'aluminium et ses alliages), Walter Rosenhain. Metallurgie, vol. 50, no. 52, Dec. 25, 1918, pp. 1877 and 1879. Their future after the war. Résumé of conference before Roy. Soc at Exposition of British Scientific Products.

BLAST FURNACES

BOSH TUYERES. A Few Notes on Bosh Tuyeres, J. Hollings. Iron & Steel Can., vol. 2, no. 1, Feb. 1919, pp. 11-13, 2 figs. Writer's experience use of bosh tuyeres. Table and sketch illustrate English practice in number, size and position. Paper presented before Iron & Steel Inst.

BLAST-FURNACE PRODUCTION. Ferromanganese in Blast Furnace, P. H. Royster. Iron Trade Rev., vol. 64, nos. 6 and 7, Feb. 6 and 13, 1919, pp. 405-407 and 439-443, 3 figs. From Bur. of Mines' report on investigation of 18 blast furnaces producing ferromanganese.

UNG Furnace Bung Distributes Blast Evenly. Iron Trade Rev., vol. 64, no. 7, Feb. 13, 1919, pp. 446-447, 2 figs. Bung frame is provided with an air cylinder that is cast the full length of the top of the bung; cylinder is closed entirely at one end, but at opposite end an opening is provided for air blast.

DESIGN. Progress in Blast Furnace Design, J. G. West. Iron Trade Rev., vol. 64, no. 8, Feb. 20, 1919, pp. 499-505, 12 figs. Changes in adaptation of mechanical construction; modifications in detail of blast-furnace lines. Abstract of paper presented before Am. Iron & Steel Inst.

SLAG ACTION. Influence of Temperance Upon the Action of Slag Upon Refractory Materials, Raymond M. Howe. Chem. & Metallurgical Eng., vol. 20, no. 4, Feb. 15, 1919, pp. 167-168. Experimental data.

COPPER

BRONZE. Manganese Bronze, P. E. McKinney. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 421-425. Possibilities of producing manganese bronze without resorting to use of high-grade virgin materials.

COPPER-ALUMINUM ALLOYS. Constitution and Hardness of Copper-Aluminum Alloys Having High Percentage of Copper (Constitution et dureté des alliages cuivre-aluminium riches en cuivre). Metallurgie, vol. 50, no. 52, Dec. 25, 1918, p. 1881, 1 fig. General type of graphs showing percentage of aluminum against Brinell hardness. (Continuation of serial.)

COPPER MELTING. Volatilization of Cuprous Chloride on Melting Copper Containing Chlorine, S. Skowrenski and K. W. McComas. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 169-179, 1 fig. Experiments are said to have proved that volatilization of cuprous chloride on melting cathode copper takes place almost in its molecular ratio, and that under present copper-refining practice any cuprous chloride present in or on the cathode can be considered for all practical purposes as completely volatilized on melting, and may be the cause of a serious metallurgical loss of copper.

LEACHING. First Year of Leaching by the New Cornelia Copper Co., Henry A. Tobelmann and James A. Potter. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 449-495, 7 figs. Process adopted consisted of leaching crushed ore 8 days by counter-current system and upward circulation, using sulphuric acid and ferric sulphate; reduction by sulphur-dioxide gas of ferric iron in neutral solutions from leaching tanks; electrolytic deposition of copper from reduced solution; and recovery of copper from discharged neutral solution as cement copper precipitated on iron. Numerical results are quoted.

LEAD IN BRASS. Notes on the Rapid Estimation of Lead in Brass and Alloys, G. H. Hodgson. Chem. News, vol. 118, no. 3067, Jan. 24, 1919, pp. 37-38. Two methods are given, one gravimetric and volumetric.

FERROALLOYS

FERROALLOYS. Ferro-Metallic Alloys (Les alliages ferro-métalliques), Jean Escard. Revue Générale des Sciences, vol. 29, no. 23, Dec. 15, 1918, pp. 673-680, 3 figs. Manufacture of ferrochromium, ferrosilicon and ferromanganese. (To be continued.)

Production of Ferromanganese in the Blast Furnace, P. H. Royster. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 367-378, 3 figs. Operating data in ferromanganese practice; average practice for ferromanganese furnace and for iron furnace; calculated slag loss; stack loss. From report of research under joint auspices of U. S. Bur. of Mines and Nat. Research Council.

FLOTATION

GALENA. The Flotation of Galena at the Central Mine, Broken Hill, R. J. Harvey. Min. & Sci. Press, vol. 118, no. 5, Feb. 1, 1919, pp. 149-154, 7 figs. Selective flotation of complex silver-lead-zinc sulphide associated in the main with quartz, rhodonite, rhodochrosite, and some garnet-sandstone. Paper before Instn. Min. & Metallurgy.

LEAD ORES. Flotation of Oxidized Ores of Lead, Glenn L. Allen. Chem. & Metallurgical Eng., vol. 20, no. 4, Feb. 15, 1919, pp. 169-175, 1 fig. Process of sulphidizing ores such as cerussite, wulfenite and cerargyrite.

IRON AND STEEL

AGING BREAK. A Volute Aging Break, Henry M. Howe and Edward C. Groesbeck. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 181-182, 2 figs. Views of volute which developed spontaneously in a hardened and tempered steel helmet between 19 and 38 days after it had been tested ballistically.

BESSEMER PROCESS, ACID. Present American Acid Bessemer Process, Richard S. McCaffery. Blast Furnace, vol. 7, no. 3, Mar. 1919, pp. 140-142. Reversibility of manganese oxidation reaction; eliminating " spitting " by temperature control during blow.

BLUING STEEL. Bluing Steel, W. B. Greenleaf. Mech. Wrold, vol. 64, no. 1668, Dec. 20, 1918, pp. 291-292, 2 figs. Saltpeter process.

CONVERTER CASTING. Converter Steel Casting Practice, Charles M. Campbell. Proc. Steel Treating Research Soc., vol. 1, no. 10, July 1918, pp. 7-20, 15 figs. Description of steel foundry equipped with two cupolas, three 2-ton converters and producing an average of 12 heats per day. Suggestions in regard to molding, casting annealing and heat-treating.

ELECTRIC SMELTING. Electric Smelting of Iron Ores in British Columbia. Alfred Standfield. Iron & Steel Can., vol. 2, no. 1, Feb. 1919, pp. 4-10. Report of investigation to determine commercial possibility. Swedish type of furnace is recommended as most economical for permanent plant, and open pit furnace is suggested as best for temporary plant.

Dr. Standfield's Report on Electric Smelting of B. C. Iron Ores. Can. Min. Jl., vol. 40, no. 4, Jan. 29, 1919, pp. 54-56. Finds that while process is metallurgically feasible, nevertheless, under present conditions and prices for electric energy, its application would not be practical.

Electric Smelting of Domestic Manganese Ores, H. W. Gillet and C. E. Williams. Dept. of Interior, Bur. of Mines, War Minerals Investigations Series, no. 10, Dec. 1918, 48 pp. Tests to investigate whether electric smelting of manganiferous slags and low-grade domestic ores is likely to be profitable at times of normal costs and prices are said to have demonstrated that such smelting is metallurgically possible but practicable only in times of high prices.

ELECTRIC STEEL. Making Electric Steel for Ball Bearings, Arthur V. Farr. Iron Trade Rev., vol. 44, no. 3, Jan. 16, 1919, pp. 211-215, 12 figs. Reviews method of manufacture and calls attention to qualities of steel produced in electric furnace.

The Metallurgy of Electric Furnace Steel Processes, L. B. Lindemuth. Jl. Engrs. Club, Phila., vol. 35-12, no. 169, Dec. 1918, pp. 544-549. History; crucible process; open hearth; electric furnace; duplex and triplex processes; comparison between metallurgical features of electric-furnace process and those of the open-hearth and crucible processes.

FLAKY STEEL. Microstructural Features of Flaky Steel, Henry S. Rawdon, Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 183-201, 27 figs. Summarizes characteristic features of defective steel of flaky type as found from laboratory study of numerous specimens, and aims to show conditions within metal that are favorable to occurrence of this type of defect.

Ingot-Production Statistics. Production of Ingots and Rolled Products. Iron Age, vol. 103, no. 8, Feb. 20, 1919, pp. 497-500. Statistics prepared by American Iron and Steel Institute show new record for steel and some finished forms in 1917.

Iron and Steel Trades. Iron and Steel. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 17. How iron and steel trades have emerged from war.
Production of Steel Ingots and Castings. Finished Rolled Iron and Steel in 1917. Iron Trade Rev., vol. 64, no. 8, Feb. 20, 1919, pp. 520-521. Statistical tables.
The Production of Iron and Steel in Canada During the Calendar Year 1917, John McLeish. Can. Dept. of Mines, no. 498, 32 pp. Report of Chief of Division of Mineral Resources and Statistics.

Iron-Carbon-Chromium Alloys. On the Structure of Iron-Carbon-Chromium Alloys, Takejirô Murakami. Sci. Reports Tôhoku Imperial Univ., First Series, vol. 7, no. 3, Dec. 1918, pp. 217-276, 124 figs. Report of experimental investigation of alloys containing different amounts of iron, carbon, and chromium with particular reference to structural constitution, changes during heating and cooling, and self-hardening properties. Materials tested were Swedish iron, four different steels, white cast rion, ferrochromium and metallic chromium.

Japanese Iron Industry. The Japanese Iron & Steel Industry. Blast Furnace, vol. 7, no. 2, Feb. 1919, pp. 89-95. Report upon conditions in Manchuria and Korea and upon possibility of Japanese future independence in production of iron and steel

Manganese Alloys. Manganese Alloys in Open Hearth Practice, Samuel L. Hoyt. Blast Furnace, vol. 7, no. 3, Mar. 1919, pp. 142-146. Recommendations for utilization of domestic alloys; molten spiegel mixture practice; use of manganese-silicon alloys in acid practice; electric furnace practice.

Open-Hearth Furnaces. Principles of Open Hearth Furnace Design—III. Charles H. F. Bagley. Blast Furnace, vol. 7, no. 2, Feb. 1919, pp. 11-113, 1 fig. Further considerations of furnace dimensions based on gas port area and hearth area per ton of steel capacity.
Use of Manganese Alloys in Open-Hearth Practice, Samuel L. Hoyt. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 277-289. It is advanced that there are three practices for utilizing our domestic alloys in open-hearth practice: Use of molten spiegel mixture for deoxidation and recarburation; practice of melting and refining steel bath so as to secure 0.3 per cent manganese alloys containing silicon; use of manganese alloys containing silicon. From report of research under joint auspices of U. S. Bur. of Mines and Nat. Research Council.
Water-Cooled Equipment for Open-Hearth Steel Furnaces, Wm. C. Coffin. Bul. Am. Inst. Min. Engrs., No. 146, Feb. 1919, pp. 497-515, 12 figs. Suggests that water-cooling devices for open-hearth steel furnaces should follow lines used in iron blast furnaces; several devices are illustrated.

Tool Steel. New Tool Steel Developed by Research. Iron Trade Rev., vol. 64, no. 9, Feb. 27, 1919, pp. 576-577, 4 figs. Made of alloys and arranged within critical zones in order to make martensite predominant structure. Said not to diminish in efficiency by overheating.

Transformations in Steel. Effect of Rate of Temperature Change on Transformations in an Alloy Steel, H. Scott. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 157-167, 7 figs. Previous investigators have laid particular stress on variation of maximum temperature, rate remaining constant, while variation of rate, maximum temperature remaining constant has received little attention. Writer has applied latter method to investigation of an alloy steel and attempts to correlate result of that method with those of the former and to establish relations of several phonomena observed.

NON-FERROUS METALS

Non-Ferrous Metals. Non-Ferrous Metals. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 18. Advances made in their manufacture during recent years.

OCCLUDED GASES

Steel. Investigation of Gases Occluded in Steel Thomas Baker. Blast Furance, vol. 7, no. 3, Mar. 1919, pp. 156-157 and 163. Experiments to determine composition and volume of occluded gases and their effect upon physical properties of metal, relation between temperature at evolution of gas and electrical point.

ZINC, LEAD AND TIN

Conservation. Metallurgical Work of Bureau of Standards, G. K. Burgess. Blast Furnace, vol. 7, no. 3, Mar. 1919, pp. 130-131, 2 figs. Review of research work concerning welding and tin conservation. (To be continued).

Electric Furnace for Tin. Electrometallurgy of Tin in Electric Furnace (L'électrométallurgie de l'étain au four électrique), Jean Escard. Industrie Electrique, vol. 27, no. 635, Dec. 10, 1918, pp. 444-448. Treatment of minerals; furnaces; recovery of lead; extraction of tin from industrial waste.

Zinc. Zinc Smelting in India, T. R. Wynne. Eng. & Min. Jl., vol. 107, no. 8, Feb. 22, 1919, pp. 356-358. Possibilities of zinc smelting in India; investigation of Burma ores; industrial development in India. Report of chairman at general meeting of Burma Corporation.

HYDROMETALLURGY

Terminology. Defining "Tailings" and "Residues," A. W. Allen. Eng. & Min. Jl., vol. 107, no. 7, Feb. 15, 1919, p. 317. Submits definitions. Third article of series on standardization of terms used in hydrometallurgical operations.

MARINE ENGINEERING

AUXILIARY MACHINERY

Lifting Gear. Marine Steam Turbine Lifting Gear. Mech. World, vol. 65, nos. 1671 and 1673, Jan. 10 and 24, 1919, pp. 18-19 and 43, 5 figs. Brief outline and discussion of various types, giving general method of calculating proportions of principal parts. First and second installments. (To be continued).

Oil Filter. An Efficient Oil Filter for Marine Installations. Pacific Marine Rev., vol. 16, no. 1, Jan. 1919, pp. 130-131, 3 figs. Combination batch and continous oil filter of Paterson marine type.

SHIPS

American Types. American Shipbuilding Practice. Shipbuilding & Shipping Rec., vol. 13, no. 3, Jan. 16, 1919, pp. 63-66, 2 figs. Types of vessels adopted by Submarine Boat Corporation; organization and operation of Hog Island and arrangement of the yards.

American Shipbuilding. The Early History of American Shipbuilding, W. A. Dobson. Jl. Engrs. Club Phila., vol. 35-10, no. 167, Oct. 1918, pp. 455-466, 9 figs. Review of history and practice of shipbuilding in U. S. prior to 1880 as compiled from memoirs of C. M. Cramp, the report by Henry Hall, and the writer's personal experience.

Concrete Ships. Concrete Ships VI. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 38. Notes on yards at Thornaby-on-Tees, Amble, Whitby, Sunderland, Granton and Faversham, where concrete ships are being built.
A Composite System of Reinforced Concrete Ship Construction, A. S. Holmes. Pacific Marine Rev., vol. 16, no. 1, Jan. 1919, pp. 116-117, 2 figs. System employs a combination of timber, concrete and reinforcing metal.
Ireland's First Concrete Ship. Shipbuilding & Shipping Rec., vol. 13, no. 2, Jan. 9, 1919, p. 42, 1 fig. Account of her launching; general dimensions.

Efficiency. The Economic Efficiency of Merchant Ships, Alexander Urwin. Shipbuilding & Shipping Rec., vol. 13, no. 3, Jan. 16, 1919, pp. 72-74. Table showing factors in a deadweight cargo carrier which operate upon each other and decide efficiency of vessel.

European Shipbuilding. European Marine Notes. Pacific Marine Rev., vol. 16; no. 1, Jan. 1919, pp. 114-115. Model British fabricated ship; concrete barges, German shipping in the war.

Fabricated Vessels. The "N" or Fabricated Vessels, Engineering, vol. 107, no. 2768, Jan. 17, 1919, pp. 69-71, 6 figs. Discussion of "National" standard vessels built according to "d'Eyncourt-Graham" system.

Ford Methods. Ford Methods in Ship Manufacture, Fred E. Rogers. Indus. Man., vol. 57, no. 3, March 1919, pp. 190-197, 10 figs. Division and subdivision of the erecting operations. Third article.

Freighter. SS. "Westerner." Shipbuilding & Shipping Rec., vol. 13, no. 1, Jan. 2, 1919, pp. 8-9, 2 figs. Principal dimensions, plans and details of cargo steamer of 8800 tons d.w. on 24 ft. 1 in. draft. Built by Emergency Fleet Corporation.

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Splendid Record of Wooden Motorship. Pacific Marine Rev., vol. 16, no. 1, Jan. 1919, pp. 94-95, 2 figs. Account of travel of "Libby Maine" in voyage through arctic waters.

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Stresses. Stresses in Ships, Sydney V. James. Jl. Western Soc. Engrs., pp. 356-376, 8 figs. Discussion of kinds of stresses, and of methods of determining principal longitudinal stresses; results of application of such methods to study of Ships of well-known type; question of shearing stresses and of situation relative to transverse-stress calculations.

Terminology. Displacement Deadweight gross and Tonnage, T. H. Fenner. Mar. Eng. Can., vol. 8, no. 12, Dec. 1918, pp. 303-304, 4 figs. Definitions of terms. used in ship's measurements.

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The English Channel Train Ferry. Ry. Age, vol. 66, no. 9, Feb. 28, 1919, pp. 509-510, 3 figs. Brief notice of the Richborough ferry.

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WATER BALLAST. Improvements in Construction of Ships, E. F. Spanner. Shipbuilding & Shipping Rec., vol. 13, no. 2, Jan. 9, 1919, pp. 44-46, 3 figs. System of dealing with water ballast by means of a duct keel. Abstract of paper before Instn. Engrs. & Shipbuilders in Scotland.

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Welding as a process in Ship Construction, S. V. Goodall. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 3, Mar. 1919, pp. 329-335. Review of what has been done in substituting welding for riveting in shipbuilding. Writer's opinion concerning general adoption of welding.

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ALCOHOL. Future and Sources of Industrial Alcohol, Can. Foundryman, vol. 10, no. 2, Feb. 1919, pp. 41-42. Manufacture from grain and potatoes; synthetic processes: utilization of wood waste; comparative yields.

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The Condition of Arsenic in Glass and Its Role in Glass-Making, E. T. Allen and E. G. Zies. Jl. Am. Ceramic Soc., vol. 1, no. 11, Nov. 1918, pp. 787-790. Writers claim that in all glasses they have tested, both plate and optical glasses, major part of arsenic present exists in pentavalent state and a portion in trivalent state.

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The Production of Nitrogen Compounds, Jack P. Montgomery. Chem. Engr., vol. 27, no. 2, Feb. 1919, pp. 35-39. Review of sources of nitrogen compounds and processes of utilizing them with special reference to methods employed to meet waste of nitrogenous material.

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MUNITIONS AND MILITARY ENGINEERING

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Depth-Bomb Throwers. Thornycroft Depth Charge Throwers. Engineer, vol. 127, no. 2391, Jan. 24, 1919, pp. 86-88, 5 figs. Description.

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Submarines. The Submarine Situation, C. H. Clandy. Sci. Am., vol. 120, no. 9, Mar. 1, 1919, pp. 198-199, 5 figs. British types of submarines, one 340 ft. in length mounting three 4-in. guns and one mounting a 12-in. 50-ton gun.

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Canada. Coal Production in Canada—Its National Significancce, F. W. Gray. Can. Min. Jl., vol. 40, no. 5, Feb. 5, 1919, pp. 73-74. Urges that mining industry be represented in federal parliament.
The Production of Coal and Coke in Canada During the Calendar Year 1917, John McLeish. Can. Dept. of Mines, no. 501, 39 pp. Report of chief of Division of Mineral Resources and Statistics.

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Lens—The Coal Field of France, Frank Haas. Coal Age, vol. 15, no. 9, Feb. 27, 1919, pp. 392-394, 11 figs. How French coal mining at Lens was conducted before German invasion.

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Franklin-Orleans Bridge. The Franklin-Orleans Bridge. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 16-18, 7 figs. Plans and details of double-leaf trunnion bascule structure over Chicago river.

Howe Truss Spans. Strengthening Howe Truss Spans. Ry. Maintenance Engr., vol. 15, no. 2, Feb. 1919, pp. 45-46, 3 figs. Designs prepared by Northern Pacific.

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The New Architectural Education. Am. Architect, vol 115; no.2249, Jan. 29, 1919, pp. 157-160. Report of Sub-Committee on Education of Reconstruction Committee of Illinois Chapter. Am. Inst. Architects and Ill. Soc. Architects.

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Flat-Slab Construction. Design of Exterior Panels in Flat Slab Construction, Albert M. Wolf. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 27-30, 2 figs. Survey of requirements and rulings by various institutions.

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Roof Construction for Factories with Excessive Moisture, Frederick J. Hoxie. Am. Architect, vol. 115, no. 2249, Jan. 29, 1919, pp. 181-187, 20 figs. Varieties of wood-destroying fungi; examples of rot formation and destruction of beams; reduction of relative humidity by designing for increased temperature, putting more heating pipes near roof or preventing escape of heat through poorly insulated roof planks.

School Buildings. Construction and Equipment of Portable School Buildings, John Howatt and Samuel R. Lewis. Heat & Ventilating Mag., vol. 16, no. 2, February, 1919, pp. 24-32, 7 figs. Experiences with the use of this type of building with suggestions for its heating and ventilating.

Tanks Tank Construction Ernest G. Beck. Mech. World, vol. 65, no. 1671, Jan. 10, 1919, pp. 18-19, 6 figs. Side walls of rectangular tanks. Twenty-fourth installment. (Continuation of serial).

Trestles. Reinforced Concrete Trestles at North Toronto. Ry. Gaz., vol. 30, no. 1, Jan. 3, 1919, pp. 15-16, 3 figs. Details of structure involving 13,500 cu. yd. of concrete and 670 tons of reinforcing steel.

Viaducts. Design and Construction of Reinforced Concrete Viaducts, at Mileages 0.9 and 1.8 North Toronto Subdivision, of the Canadian Pacific Railway, B. O. Eriksen and H. S. Deubelbeiss. Jl. Eng. Inst. Can., vol. 2, no. 2, Feb. 1919, pp. 93-101, 20 figs. Slabs 36 ft. long were premolded and bulk of concrete cast in forms on the ground.

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Wharves. Construction of the St. Louis Municipal Wharf Ry. Rev., vol. 64, no. 8, Feb. 22, 1919, pp. 275-279, 8 figs. Description of engineering features of construction, with drawings and photographs of details of work in progress.

CEMENT AND CONCRETE

Cement Production. The Production of Cement, Lime, Clay Products, Stone, and Other Structural Materials in Canada During the Calendar Year 1917. Can. Dept. of Mines, no. 500, 44 pp. Report of Chief of Mineral Resources and Statistics.

Gravity Concreting. Placing Concrete by Gravity in Block Frames (La mise en place du béton par gravité dans les chantiers de constructilns civiles ou de travaux publics). Génie Civil, vol. 74, no. 2, Jan. 11, 1919, pp. 21-24, 13 figs. Details of falsework and auxiliary machinery. Schemes of various American builders.

Pneumatic Concreting. The Pneumatic Method of Concreting, H. B. Kirkland. Jl. Western Soc. Engrs., vol. 23, no. 5, May 1918, pp. 319-349 and (discussion) pp. 349-355, 27 figs. Method consists in blowing batches of concrete through a pipe from a central point of supplies to their place in concrete forms; materials for a batch of concrete (1-2 cu. yd.) are proportioned in a measuring device and dropped into the pneumatic mixer without previous mixture.

Progress in 1918. Concrete and Cement. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 27. New applications given to concrete and reinforced concrete in 1918.

Slag Concrete. Blast Furnace Slag in Concrete and Reinforced Concrete, J. E. Stead. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 36-38. Laboratory tests to determine whether blast-furnace slag has any corrosive action on iron and steel placed in contact with it. (To be continued). From Lond. Eng.

Solubility of Cement. The Solubility of Portland Cement and Its Relation to Theories of Hydration, J. C. Witt and F. D. Reyes. Philippine Jl. Sci., vol. 13, sec. A, no. 4, July 1918, pp. 147-161, 1 fig. It is reported as result of experiments that when cement is shaken with water in a closed vessel large amounts of calcium with relatively small amounts of most other elements present go into solution, and that the factors that effect results are (1) absence of carbon dioxide, (2) method of agitation, (3) fineness of grain, (4) volume of water, and (5) time.

Wasteful Construction. Useless Waste in Concrete Construction Due to Legal Requirements, W. Stuart Tait. Am. Architect, vol. 115, no. 2249, Jan. 29, 1919, pp. 187-189, 1 fig. Criticism of basing design methods on strength for 1-2-4 concrete at 28 days of 2,000 lb. per sq. in. (Continuation of serial).

HARBORS

Seattle. Seattle Starts Large Expansion of Her Public Port Facilities, Frank Carleton Teck. Marine News, vol. 5, no. 9, Feb. 1919, pp. 98-99, 1 fig. Type and equipment of proposed additional pier 2,700 ft. long.

The Port of Seattle, W. A. Scott. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 61-63, 4 figs. Freight-handling equipment.

Shore Protection. Coastal and Shore Protection, H. Colin Campbell. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 11-17, 7 figs. Breakwaters, sea walls, and revetment work in various locations and under various conditions.

MUNICIPAL ENGINEERING

Town Planning. Town Planning, Thomas Adams. Can. Engr., vol. 36, no. 7, Feb. 13, 1919, pp. 215-216. Concerning town development in Quebec. From South Shore Board of Trade Rev.

ROADS AND PAVEMENTS

Brick Paving. Latest Seattle Specifications for Brick Paving Are for the Monolithic Type, W. H. Tiedeman. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 13-14. Writer prefers cement-grout filler and believes sand-cement "cushion" fails.

The Brick Highways of Ashtabula County, Ohio, Ray N. Case. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 53-57, 17 figs. County engineer believes slag bed desirable to give stability and gives account of developments and results.

Canada. Federal Aid for Highways, J. D. Reid. Can. Engr., vol. 36, no. 7, Feb. 13, 1919, pp. 223-224. Plans of the Dominion Government.

Good Roads in Lanark County, C. J. Foy. Contract Rec., vol 33, no. 7, Feb. 12, 1919, pp. 141-144, 2 figs. Account of developments. Before convention of Eastern Ontario Good Roads Assn.

Construction. Arching an Underground Roadway With Concrete Blocks, W. Ross Iron & Coal Trades Rev., vol. 98, no. 2657, Jan. 31, 1919, p. 141, 4 figs. Method to conduct excavating and building simultaneously, the packing being done as material is produced at face.

Road Contractor Successfully Employs Portable Charging Bins to Eliminate Dumping and Wheeling on Subgrade in Concrete Road Construction, George A. Burley. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 11-12, 2 figs. Comparison of bin method and dumping on subgrade.

Utilizing More Mechanical Devices on Road Construction, Frank F. Rogers. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 18-20. Reports of various county engineers of Michigan.

Earth Roads. Can Earth Roads Be Made Satisfactory? H. S. Carpenter. Jl. Eng. Inst. Can., vol. 2, no. 2, Feb. 1919, pp. 102-104. Suggestions in regard to selection of material, placing it on roadbed and estimates of cost of earth, sand clay, gravel and macadam roads.

Financing. How the Successful Campaign for the $60,000,000 Good Roads Bond Issue was Conducted in Illinois, S. E. Bradt. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 3-5, 1 fig. Organization chart of workers.

Florida. Lessons Taught by Road Building Experience in Florida, G. Robert Ramsey. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 73-74. Influence of distance from manufacturing centers, productive area, assessed valuations, etc.

Foundations. Engineers Must Study Road Foundations. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 31-35 Suggests that foundations be constructed with a view to bearing the greatest possible load under all conditions.

Good-Roads Movement. National Highways and Good Roads, J. A. Duchastel de Montrouge. Jl. Eng. Inst. Can., vol. 2, no. 2, Feb. 1919, pp. 91-92. Comparison of situations in U. S. and Canada with reference to act, passed by U. S. Congress, destined to aid several states in road construction.

The Federal Aid Road Law; Experience to Date and Suggestions for Better Co-operation, Logan Waller, Page. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 20-23, 10 figs. Various federal aid road projects; amendments to law. Written for presentation before Am. Assn. State Highway Officials.

Twenty-Five State Highway Engineers Report Their Plans for 1919. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 46-51. Letters state funds available and plans in detail.

Highway Pavements. City Pavements for State Highway in Connecticut, Charles J. Bennett. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 62-63, Sheet asphalt on concrete base.

New Yory. Highway Work in Four New York Boroughs, Good Roads, vol. 17, no. 8, Feb. 22, 1919, pp. 69-71 and 84, 4 figs. Résumé of outstanding features of road and street work in Brooklyn, Bronx, Queens and Richmond.

Roads of New York, E. A. Bonney. Good Roads, vol. 17, no. 8, Feb. 22, 1919, pp. 73-76 and 84, 8 figs. Historical sketch of development of N. Y. State Highway Department with review of its organization and accomplishments.

Street Work in Manhattan. Good Roads, vol. 17, no. 8, Feb. 22, 1919, pp. 67-68 and 78, 3 figs. Historical sketch of development of highway operations.

Sand-Clay Roads. Experience with Sand Clay Road Surfacing in Nebraska, George E. Johnson. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 9-11, 3 figs. Location of materials and their properties.

Snow Removal. Snow Removal from New York State Highways, Edwin Duffey. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 23-24. Concerning snow-removal legislation.

Wood-Block Paving, Base for. Method Employed in Minneapolis in Constructing Smooth Surfaced Concrete Base for Wood Block Paving, Ellis R. Dutton. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 51-52, 2 figs. Concrete surface smoothed over with small roller on templets.

SANITARY ENGINEERS

Drain Pipe. Aligning Drain Pipe, Harry Gardner. Eng Wrold, vol. 14, no. 4, Feb. 15, 1919, pp. 45-46, 1 fig. Method of giving grade and line for pipe sewer construction.

Latrines. A Mine Latrine, William W. Cort. Min. & Sci. Press, vol. 118, no. 5, Feb. 1, 1919, pp. 155-157, 3 figs. Details of latrine and sanitary arrangements connected with it. From bul. 28 of Cal. State Board of Health. Sanitation in Mines for the Prevention and Eradication of Hookworm.

Sanitation. Sanitation in Emergency Shipyards, W. L. Stevenson. Mun. & County Eng., vol. 56, no 2, Feb. 1919, pp. 70-71, 2 figs. Methods of distributing drinking water; collection and disposal of wastes; fly and mosquito extermination.

Sewage Disposal. Sewage Disposal in Kansas, F. M. Veatch, H. P. Evans and L. E. Jackson. Bul. Univ. Kan., vol. 18, no. 18, Dec. 1, 1917, 40 figs. Discussion of practice in certain municipalities, together with instructions to plant operators.

Sewage Disposal at Manchester, Can. Engr., vol. 36, no. 7, Feb. 13, 1919, pp. 222-223. Results of operation and activitated sludge investigations at Withington and Davyhulme works. From Surveyor, London.

Sewage Disposal Works in Reconstruction Period, Harrison P. Eddy. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 60-62. Data relating to cost of certain sewage disposal projects built under ante-war conditions, and proportion of budget likely to be required to meet annual charges.

Sewers. Some Design and Constructional Features of the Rideau River Intercepting Sewer, Ottawa, Canada, L. McLaren Hunter. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 63-65, 4 figs. Sewer is 17,900 ft. long with 400-ft. tunnel section under railway tracks.

The Selection of the Value of the Factor "n" in Sewer Design, Paul E. Green. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 52-53. Attempt to demonstrate that n (in Kutter formula) has wrongly been recommended by experimenters as varying between 0,013 and 0.015 for vitrified-tile pipe sewers. Writer believes construction conditions determine value of n.

Swimming Pools. Keeping Swimming Pools Pure and Wholesome—IV. Metal Worker, vol. 91, no. 3, Jan. 17, 1919, pp. 86-87, 1 fig. Installation of ozoning apparatus. (Concluded.)

SURVEYING

Chains. Metallic Chains Used in Geodic Surveys (Fili e nastri metallici nella misura delle basi geodetiche), G. Cicconetti. Il Nuovo Cimento, vol. 15, nos. 5-6, May-June, 1918, pp. 180-190. Remarks on Jädering's method for obtaining accurate base measurements.

WATER SUPPLY

Conservancy. Water Works Conservancy, Arthur A. Reimer. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 24-29. Economical utilization and salvaging undertakings.

Electrical Control. Automatic Electrical Control at the Deer Trail, L. Brandenburger. Salt Lake Min. Rev., vol. 20, no. 21, Feb. 15, 1919, pp. 25-26, 3 figs. Diagrammatical sketch. Plant supplies 30,000 gal. water per day to flottation and cyanide mill.

Filter Plant. Need of Certain Investigations for Increasing the Efficiency of Water Filter Plant Design and Operation, James W. Armstrong. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 5-6. Most efficient mix with least loss of head; time and intensity of agitating; coagulation-basin design.

Hardness. Advantages and Disadvantages of Hard City Water. (Vorteile und Nachteile der Wasserhaerte) Dr. Carl Opitz. Journal fuer Gasbeleuchtung und Wasser-Versorgung, vol. 61, no. 41, Oct. 12, 1918, pp. 482-485. Reviews the relative effects of the water supplied upon the physical condition of 87,617 school children in 158 towns in Germany and finds that the harder the water, the better preserved are the teeth, nervousness and other ills are also diminished.

Purification. Features of Present-Day Water Purification Practice, Milton F. Stein. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 57-60, 1 figs. Non-technical review written for municipal officials.
Notes on Chlorine Treatment of London, England, Water Supply, A. C. Houston. Mun. & Coun. Eng., vol. 56, no. 1, Jan. 1919, pp. 29-30. From report of Director of Water Examination.
Chlorination of Chicago's Water Supply, John Ericson. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 68, 2 figs. Diagram indicating operation of Miller aeriostat.

Reservoir. The Water Supply for Montevideo. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 23-26, 16 figs. Design and construction of concrete reservoir at Uruguay capital.
An Interesting Nile Scheme. Elec. Times, vol. 55, no. 1122, Jan. 16, 1919, pp. 35-37, 1 fig. Reservoir project in Sudd region, Paper before Sultanieh Geographical Soc., Cairo.
Waterworks Operation Reservoir Maintenance. Mun. Jl., vol. 46, no. 4, Jan. 25, 1919, pp. 65-67. Methods costs, figures and results.

Water-Works Operation. Effect of War Conditions on the Operation and Maintenance of Water Works. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 16-17. Cost of principal materials and supplies. 1911-1918: unskilled labor prices per hour.

WATERWAYS

Hudson River. Government Work on Hudson River. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 11-15, 7 figs. Removal of old works and construction work involved in erection of dam in N. Y. State barge canal at Troy.

Niagara. Mapping Niagara at the Brink. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 39-40, 2 figs. Apparatus used in sounding river just above fall.

Saone River. The Navigable System of the Saona River (Le réseau navigable de la Saone). Génie Civil, vol. 73, no. 24, Dec. 14, 1918, pp. 466-468, 1 fig. System consists of five routes disposed in fan shape. Data are given on organization, arrangement and operation.

IRRIGATION AND RECLAMATION

Arid Lands. Post-War Reclamation of Arid Lands, S. O. Andros. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 19-22, 8 figs. Butte project, other Government projects and private projects.

Irrigation Project. Preliminary Project for Irrigating the Chancay Pampas (Proyecto preliminar de irrigacion de las pampas de Chancay), Carlos W. Sutton and Juan N. Portocarrero y C. Boletin del Cuerpo de Ingenieros de Minas del Peru, no. 94, 1918, 21 pp., 2 figs. Involves irrigation of 15,000 hectares.

Irrigation Prospects. Some Financial, Agricultural and Engineering Aspects of Irrigation. Charles Kirby Fox. Mun. & County Eng., vol. 56, no. 1, Jan. 1919, pp. 30-31. Statistics in United States; question of transportation: outlook of future developments.

Preliminary Work. Preparing Six Hundred Acres of Land for Irrigation. F. W. Herron. Eng. News-Rec., vol. 82, no. 7, Feb. 13, 1919, pp. 337-339, 2 figs. Soil studies, surveys, supply and drainage ditches; land levelling and ditch construction operations.

Swamp Lands. Reclamation of Swamp Lands in Dane County. Wisconsin, W. G. Kirchoffer. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 65-66. Work in straightening and deepening main drainage line of marsh and in providing a main outlet; 129,349 acres drained since 1908.

GENERAL SCIENCE

CHEMISTRY

Antimony Analysis. A Bibliography on the Analysis of Antimony, Elton R. Darling. Chem. Engr., vol. 27, no. 1, Jan. 1919, pp. 11-12 and 21. Articles which have appeared in scientific periodicals arranged alphabetically by authors' names. (Part I, from A to Ke).

Argon. Specific Weight of Argon (Ueber das specifische Gewicht des Argons), Dr. Hugo Schaltze. Zeitschrift fuer Kompruinerte und fluessige Gase, vol. 19, no. 1, 1917, pp. 1-3. Mean specific weight for the pure gas. 0.00178371 at 735 m.m. mercury, or 0,001783 at 760 m.m. Coefficient of compressibility between 0 and 760 m.m., 0.00091 at 0 deg. C. Molecular weight referred to 32 for oxygen—39.945. Communication from the Physikalisch-Technische Reichsanstalt.

Colloids. Metals and Alloys from a Colloid-Chemical Viewpoint, Jerome Alexander. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 127-130. Regards them as sponge-like structures, the viscosity or stiffness of which at ordinary temperatures is exceedingly great.

Crucibles, Corrosion of. Action of Alkalies on Crucibles of Platinum and Gold Alloys (Action des alcalis sur les creusets en alliages de platine et d'or), Paul Nielardot and Claude Chatelot. Bulletin de la Société Chimique de France, vols. 25-26, no. 1, Jan. 1919, pp. 4-9. Experiments to determine influence of age on resistance of platinum to alkaline attack, also effect of presence of iridium and similar other metals; tests were extended to gold, silver and palladium alloys.

Glass Analysis. A Contribution to the Methods of Glass Analysis, with Special Reference to Boric Acid and the two Oxides of Arsenic, E. T. Allen and E. G. Zies. Jl. Am. Ceramic Soc., vol. 1, no. 11, Nov. 1918. pp. 739-786, 1 fig. Separation of trivalent and pentavalent arsenic in glasses depends on volatilization of trivial arsenic as As_3F_3 when glass is heated with hydrofluoric and sulphuric acids, while pentavalent arsenic remains in residue. For determination of boric acid Chapin's method is recommended as reliable and accurate.

Radiation. Ionization and Excitation of Radiation by Electron Impact in Nitrogen, Bergen Davis and F. S. Goucher. Phys. Rev., vol. 13, no. 1, Jan. 1919, pp. 1-5, 5 figs. From experiments it is found that radiation can be stimulated in nitrogen molecules by electron bombardment without ionizing them up to about 18 volts when ionization sets in.

Structure of Matter. The Conception of the Chemical Element as Enlarged by the Study of Radio-Active Change. Jl. Soc. Chem. Indus., vol. 38, no. 2, Jan. 31, 1919, pp. 19R-20R. Significance of disintegration and the discovery of elements which differ in their radioactive properties but are chemically identical.

Ultra-Violet Light. Ultra Violet Light in the Chemical Arts, Carleton Ellis and A. A. Wells. Chem. Engr., vol. 27, no. 1, Jan. 1919, pp. 19-20 and 11 ad. Conclusions regarding absorption spectra of some aromatic compounds; conflicting views concerning spectra of nitro compounds. (Continuation of serial).

Valence. Valence, William Albert Noyes. Science, vol. 44, no. 1260, Feb. 21, 1919, pp. 175-182. Presidential address before Am. Assn. for Advancement of Science.

MATHEMATICS

Algebraic Surfaces. On Surfaces Containing a System of Cubics that do not Constitute a Pencil, C. H. Sisam. Am. Jl. Math., vol. 41, no. 1, Jan. 1919, pp. 49-59. Classifies types of algebraic surfaces generated by an algebraic system of r of $oo1$ cubic curves so that two generic curves of given system intersect in v z variable points.
The Classification of Plane Iuvolutions of Order (3), Anna Mamye Howe. Am. Jl. Math., vol. 41, no. 1, Jan. 1919, pp. 25-48. Discusses the different algebraic (1.3) point correspondences between two planes.
On plane Algebraic Curves with a Given System of Foci, Arnold Emch. Bul. Am. Math. Soc., vol. 25, no. 4, Jan. 1919, pp. 157-161. Suggests method for finding foci of an n-ic and illustrates it by applying it to a circular cubic.

Continuous Functions. Continuous Sets that Have No Continuous Sets of Condensation, R. L. Moore. Bul. Am. Math. Soc., vol. 25, no. 4, Jan. 1919, pp. 174-176. Establishes theorem; every bounded continuous set of points that has no continuous set of condensation is a continuous curve.
Derivitiveless Continuous Functions, M. B. Porter. Bul. Am. Math. Soc., vol. 25, no. 4, Jan. 1919, pp. 176-180. Proposes simplification of treatment of Weirstrass's and similar functions.

Isoperimetric Problem. An Ipsomeric Problem with Variable End-Points, Archibald Shepard Merrill. Am. Jl. Math., vol. 41, no. 1, Jan. 1919, pp. 60-78, 3 figs. Discusses necessary and sufficient conditions for a maximum (minimum) for a type of problems in the calculus of variations which are related to usual isoperimetric problems and in which both end-points are allowed to vary along a given fixed curve.

Non-Euclidean Geometry. Quadratic Systems of Circles in Non-Euclidean Geometry, D. M. Y. Sommerville. Bul. Am. Math. Soc., vol. 25, no. 4, Jan. 1919, pp. 161-173.

Parabolic Arcs. Comparison of Formulas for Computing Parabolic Arcs, Robert C. Strachan. Eng. News-Rec., vol. 82, no. 7, Feb. 13, 1919, pp. 25-326, 2 figs. Studies limit of applicability of common formula.

Poincare Surfaces. On Poincaré Surfaces of the Sixth Order (Sur les surfaces de Poincaré d'ordre 6), Pierre Humbert. Comptes rendus des Séances de l'Académie des Sciences, vol. 167, no. 22, Nov. 25, 1918, pp. 776-778. Comment on Liapounov's researches on possible number of Poincaré surfaces in vicinity of critical Jacobian.

Spectral Determination of Functions. Spectral Determination of Functions (Détermination spectrale de fonctions), Michael Petrovitch. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 22, Nov. 25, 1918, pp. 771-776. Determination of f (z) a region of Z-plane by one numerial datum.

Volterra's Functions. On Function of Lines and a Set of Curves, Soichi Kakaeya. Sci. Reports Tôhoku Imperial Univ., First Series, vol. 7, no. 3, Dec. 1918, pp. 177-196.

Weierstrass Formula. On the Evaluation of the Elliptic Transcendents η_2 and η_2, Harris Hancock. Bul. Am. Math. Soc., vol. 25, no. 4, Jan. 1919, pp. 150-157. Discusses value of Weierstrassian formulæ when applications of general theory are involve or whenever any kind of numerical computation is derived.

PHYSICS

Air. Some Recent Contributions to the Physics of the Air, W. T. Humphreys. Science, vol. 44, no. 1259 and 1260, Feb. 14 and 21, 1919, pp. 155-163 and 182-188, 6 figs. Feb. 14; Temperatures of air at different elevations; isothermal state of upper air; relation of temperatures to barometric pressures both in summer and in winter; law of wind increase with elevation. Feb. 21: Barometric fluctuations; atmospheric electrical phenemona.

Black Body. A New Experimental Determination of the Brightness of a Black Body, and of the Mechanical Equivalent of Light, Edward P. Hyde, W. E. Forsythe and F. E. Cady. Phys. Rev., vol. 13, no. 1, Jan. 1919, pp. 45-48, 4 figs. Set of values of brightness of black body from 1,700 to 2,600 deg,

Corbino Effect. Double Induction Balance to Study the Corbino Effect (Doppia bilancia di induzione per lo studio dell' effetto Corbino), Luizi Puccianti. Il Nuovo Cimento, vol. 15, nos. 5-6, May-June 1918, pp. 249-257, 1 fig. Suggests explanation for electro-magnetic effect in a magnetic field.

Crystals. An Apparatus for Growing Crystals under Controlled Conditions, J. C. Hastetter. Jl. Wash. Acad. Sci., vol. 9, no. 4, Feb. 19, 1919, pp. 85-94, 2 figs. Consists essentially of two thermostats,— saturator and crystallizer; saturator is maintained at a temperature slightly higher than crystallizer and is about one-third filled with crystals which keep solution saturated: liquid is pumped from saturator into crystallizer where excess material is deposited into crystals, after which solution is returned to saturator.

CYCLONES. Prevention of Columnar Crystallization by Rotation During Solidification, Henry M. Howe and E. C. Groesbeck. Bul. Am. Inst. Min. Engrs., vo. 146, Feb. 1919, pp. 361-365, 6 figs. Theory of mechanism of solidification; experiments with strong hot solution of ammonia alum both with quiescent and with rotating solidification.

Reply to Dr. Fulton's Discussion of the Assignment of Crystals to Symmetry Classes, Edgar T. Wherry. Jl. Wash. Acad. Sci., vol. 9, no. 4, Feb. 19, 1919, pp. 99-102.

Sulfur Crystal, F. Russell Bichowsky. Jl. Wash. Acad. Sci., vol. 9, no. 5, March 4, 1919, pp. 126-131, 2 figs. Obtained by mixing a hot alcoholic solution of ammonium polysulfide with a mixture of bonzonitrile, hydroxylamine hydrochloride and ether.

X-Ray Analysis and the Assignment of Crystals to Symmetry Classes, Alfred E. H. Tutton. Jl. Wash. Acad. Sci., vol. 9, no. 4, Feb. 19, 1919, pp. 94-99. Criticism of Edgar T. Wherry's memoir on above subject in Jl. Wash. Acad. Sci., vol. 8, 1918, p. 480.

CYCLONES. On Travelling Atmospheric Disturbances, Harold Jeffreys. Lond., Edinburgh & Dublin Phil. Mag., vol. 37, no 217, Jan. 1919, pp. 1-8. Mathematical study of propagation of a cyclone and specially of the conditions which produce the circularity of its isobars.

DIFFRACTING APERTURES. On the Radiation of Light from the Boundaries of Diffracting Apertures, Sudhansukumar Banerji. Lond., Edinburg & Dublin Phil. Mag., vol. 37, no. 217, Jan. 1919, pp. 112-128, 6 figs. Experimental and theoretical analysis of problem. Finds that in all cases in which apertures in focal plane through which rays pass are symmetrically disposed about center of field, this latter being excluded, image of boundary of diffracting surface appears as a perfectly black line surrounded on either side by luminous bands.

On the Theory of Superposed Diffraction—Fringes, Chandi Prasad. Phys. Rev., vol. 13, no. 1, Jan. 1919, pp. 27-33, 4 figs. Shows how principle of superposition suggested by C. F. Brush (Proc. Am. Phil. Soc., 1913, pp. 276-282) may be formulated mathematically and its validity tested in experiment.

DOPPLER EFFECT. Experimental Demonstration of the Constancy of Velocity of the Light Emitted by a Moving Source, Q. Majorana. Lond., Edinburgh & Dublin Phil. Mag., vol. 37, no. 217, Jan. 1919, pp. 145-150, 1 fig. Experimental verification of Doppler effect with artificial movement of common luminous source.

ELASTIC SOLIDS. Deformation Resulting from the Contact of Two Elastic Solids (Sulla deformazione conseguente al contatto di due solidi elastici), Elena Mannei. Il. Nuovo Cimento, vol. 15, nos. 5-6, May-June 1918, pp. 171-179. Study of Hertz' discussion of problem. (Gesammeldte Werke, vol. 1, pp. 154-169).

ELASTOSTATICS. A Problem in the Elastostatics of a Semi-Infinite Solid, Kwan-ichi Terazawa. Sci. Reports Tohoku Imperial Univ, First Series, vol. 7, no. 3, Dec. 1918, pp. 205-215, 7 figs. Distribution of normal pressure on boundary of a semi-infinte elastic solid.

ELECTROMOTIVE FORCES. Reciprocal Relations Following from Kirchhoff's Laws (Relations de réciprocité découlant des lois de Kirchoff), J. B. Pomey. Revue Générale de l'Electricité, vol. 5, no. 3, Jan. 18, 1919, pp. 83-87, 4 figs. Mathematical equations establishing relations between electrical, mechanical and kinetic magnitudes in network of conductors. Derived for various arrangements and distributions. Supplementary to writer's study of electromotive forces in branches of network. (See R. G. E. vol. 4, Aug. 3, 1918, pp. 131-132.)

ELECTRONS. On the Mechanical and Electrodynamical Properties of the Electron, Megh Nad Saha. Phys. Rev., vol. 13, no. 1, Jan. 1919, pp. 34-44. Investigation if scalor and vector potentials of moving electron, electric and magnetic fields due to a moving electron, Maxwell's stresses, law of attraction between two moving electrons and equations of motion of the electron, by Minkowski's method of fourdimensional analysis.

GAS EQUATIONS. Molecular Attraction and Attration of Mass, and Some New Gas Equations, James Kam. Lond., Edinburgh & Dublin Phil. Mag., vol. 37, no. 217, Jan. 1919, pp. 65-97, 2 figs. Deviations from gaseous laws lead to establishing that cohesive forces are proportional to the square of molecular weight and obey inverse square law; thus an analytical value is derived for the tensile strength of iron which is of same order as experimental value.

The Laws of Perfect Gases in Relation to the Theory of Heat (Sulle leggi die gas perfetti in relazione alla teoria del calore), M. Ascoli. Il Nuovo Cimentol vol. 15, nos. 5-6, May-June 1918, pp. 212-220, 1 fig. Derivation of general differential of thermodynamic changes from the gas equation and also from the first thermodynamic law.

HYDRODYNAMICS. Integral Invariant of Hydrodynamics and Its Application to the Theory of General Relativity (Sur un invariant intégral de l'Hydrodynamique et sur son application à la théorie de la relativité générale), E. Vessiot. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 27, Dec. 30, 1919, pp. 1065-1068. Concerning Einstein's hypothesis on nature of fluids.

INDUCTION COILS. The Optimum Secondary Capacity of an Induction Coil, E. Taylor Jones. Elec., vol. 82, no. 2122, Jan. 17, 1919, pp. 99-101. A mathematical article.

INTERFERENTIAL CONTACT LEVER. Interferential Contact Lever Experiments Relating to the Elastics of Small Bodies, Carl Barus. Proc. Nat. Acad. Sci., vol. 5, no. 2, Feb. 1919, pp. 44-49, 9 figs. Apparatus designed by writer in which interferential contact lever measures strain corresponding to stress imparted by pushing springs.

MERCURY-VAPOR LIGHT. The Light From Mercury Vapor, C. D. Child. Lond., Edinburgh & Dublin Phil. Mag., vol. 37, no. 217, Jan. 1919, pp. 61-64, 1 fig. Comparison of writer's experiments with similar experiments by Strutt (Proc. Roy. Soc., 1917, A. 94, p. 88) on the luminous vapor coming from discharge through gases at low pressure.

THERMAL CONDUCTIVITIES. Thermal Conductivity of Various Materials, T. S. Taylor. Phys. Rev., vol. 13, no. 2, Feb. 1919, pp. 150-151. Table of values for hard rubber, white fiber, various species of wood, solid and powdered graphite and lamp black.

TUNING FORKS. A Method of Comparing Tuning Forks of Low Frequency and of Determining their Damping Decrements, Albert Campbell. Proc. Phys. Soc., Lond., vol. 31, part 2, Feb. 15, 1919, pp. 87-89. Method consists in putting windings of maintaining magnets in series with each other and with a sensitive vibration galvanometer: beats are shown by pulsations of band of light on scale.

WELSBACH MANTLE. Physical Study of the Welsbach Mantle. Engineer, vol. 107, no. 2769, Jan. 24, 1919, pp. 100-103. Develops the physical theory of the Welsbach mantle.

X-RAYS. Energy of the Characteristic X-Ray Emission from Molybdenum and Palladium as a Function of Applied Voltage, Benhamin Allen Wooten. Phys. Rev., vol. 13, no. 1, Jan. 1919, pp. 71-86, 5 figs. It was found that in molybdenum ∞ and B radiation appeared at 19.2 kv. and in palladium at 24 kv.; ratio of intensity of ∞ line to that of B line was found to become constant as voltage increased for each metal; absorption coefficients for wave lengths of ∞ and B lines of molybdenum and palladium in glass and in molybdenum and palladium respectively were determined.

MECHANICAL ENGINEERING

MECHANICAL PROCESSES

BAKELITE PRODUCTS. Making Moulded Bakelite Products. Machinery, vol. 13, no. 331, Jan. 30, 1919, pp. 481-485, 9 figs Concerning design and manufacture of dies with provision for heating with steam.

BOILERS. How to Design and Lay Out a Boiler—IV, William C. Strott. Boiler Maker, vol. 19, no. 2, Feb. 1919, pp. 46-47, 2 figs. Size of rivets; efficiency of joint. (Continuation of serial).

BRIQUETTES. Notes on the Manufacture of Briquettes, E. H. Robertson. Colliery Guardian, vol. 117, no. 3029, Jan. 17, 1919, pp. 136-137, 3 figs. Rolls for briquetting; cohesion testing machine and arrangement of bars. From Tran. Min. Geol. Inst. India.

COPPER DRIVING BANDS. The Manufacture of Copper Driving Bands, Wm. J. Reardon. Metal Industry, vol. 17, no. 2, Feb. 1919, pp. 63-68, 6 figs. How wartime needs developed way to produce pure copper castings in large quantities.

CRUSHING. Fine Crushing in Ball-Mills, E. W. Davis. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 111-156, 17 figs. Theoretical mechanics of fine crushing, ball-wear formulæ and operating tests on siliceous rock comprising 35 per cent magnetite, the remainder being chiefly quartzite and iron silicates.

PRESSES. Manufacturing the Whitlock Pony Press, Robert Mawson. Can. Machy., vol. 21, no. 7, Feb. 13, 1919, pp. 159-161, 9 figs. Jigs and fixtures intended to simplify machining operations.

ROLLING MILLS. Builds Huge Plate Mill for Japan. Iron Trade Rev., vol. 64, no. 6, Feb. 1919, pp. 387-388, 1 fig. 180-in. plate mill recently built by Morgan Eng. Co., Alliance, Ohio.

Novel Plate Turnover for Tandem Mill. Blast Furnace, vol. 7, no. 3, Mar. 1919, pp. 128-129, 2 figs. Arrangement at Youngstown Sheet & Tube Co.'s plate mill.

The Strip Mills of Trumbull Steel Co. Iron Age, vol. 103, no. 8, Feb. 20, 1919, pp. 475-479, 5 figs. Hot mill of wide range of speeds; interesting arrangement of finishing stands; motor speed control a feature.

TRACTORS. Manufacturing the Caterpillar Tractor, Frank A. Stanley, Am. Mach., vol. 50, no. 7, Feb. 13, 1919, pp. 299-302, 7 figs. Cylinders, pistons and crankshafts. Sixth article.

WHEELS, CAR. Slick Machines for Rolling Car Wheels at Johnstown Mill of Cambria Steel Company (Le taminage des roues de wagons par les machines Slick, aux usines de la Cambria Steel Co. à Johnstown, Pensylvanie, E.-U.), P. Calfas. Génie Civil, vol. 73, no. 24, Dec. 14, 1918, pp. 461-466, 18 figs. Description of a process of making car wheels in which they are formed directly from large rolled bars by a rolling-forging process as applied at the Cambria Steel Works.

ABRASIVES

MICROSTRUCTURE. The Microstructure of Abrasives, J. Scott. Mech. World, vol. 64, no. 1666, Dec. 6, 1918, pp. 266-267, 2 figs. Remarks on physical and chemical phenomena in polishing, grinding and sharpening; photomicrographs of emery cloth and tripoli powder.

AIR MACHINERY

BLOWERS. Snow Gas Engine Blower at Parkgate Works. Iron & Coal Trades Rev., vol. 98, no. 2657, Jan. 31, 1919, pp. 132-133, 2 figs. Arrangement of twin-tandem gas-driven blowing engine at Parkgate Iron & Steel Works, Rotherdam.

COMPRESSED-AIR APPLICATION. Compressed-Air in a Shell Plant, R. E. C. Martin and S. B. King. Am. Mach., vol. 50, no. 9, Feb. 27, 1919, pp. 395-396, 3 figs. Illustrates convenience, adaptability and economy of air power for industrial and manufacturing purposes.

COMPRESSORS. Hydraulic Air Compressors. (Hydrokom-pressoren). Engineer Heinrich. Zeitschr, fuel komprimierte und fluessige Gase, vol. 19, no. 5, June 26, 1918, pp. 45-49, 4 figs. Part II. Conclusion to follow. Describes C. H. Taylor's compressor, German types, Pohle's air-lift pump. Gives the theory of hydro-compressors and their efficiency curves derived from tests. Part I in vol. 18, page 33.

FANS. Influence of Blade Inclination in the Power of a Centrifugal Fan (Influence de l'inclinaison des aubes sur la puissance des ventilateurs), M. Karrer. Génie Civil, vol. 73, no. 25, Dec. 21, 1919, pp. 486-489, 6 figs. Mathematical formula for the pressure exerted by blade and graps showing volume against pressure for various inclinations of the blades.

LUBRICATION. Lubrication of Air Compressors, H. V. Conrad. Power Plant Eng., vol 23, no. 5, Mar. 1, 1919, pp. 247-249, and Elec. Ry. Jl., vol. 53, no. 9, Mar. 1, 1919, p. 424. Difficulties encountered; suitable oils; proper quantities.

PNEUMATIC DELIVERY. Pneumatic Postal Delivery Systems. (Die Verwendung der Pressluft in der Verkehrstechnik mit besonderer Beruexksichtigung der Robr-post Anlagen), Baurat Kasten. Zeitschrift fuer Komprinierte und fluessige Gase, vol. 19, no. 3, 1917-1918, part 2, pp. 25-29, 8 figs. Compares the systems in use in the various large cities of the world, and claims more efficient performance for the systems in use in Berlin and Munich. Gives diagrams of air pressure fluctuations and switchboards. (To be continued)

CASE-HARDENING

Shimer's Process. Shimer Case-Hardening Process, Joseph W. Richards. Iron Trade Rev., vol. 64, no. 7, Feb. 13, 1919, pp. 437-438, and Bul. Am. Inst. Min Engrs., no. 146, Feb. 1919, pp. 431-433. Process employes bath of easily fusible non-case-hardening salts (usually a mixture of sodium chloride, calcium chloride, and barium chloride in equal preportions by weight) and fresh calcium cyanide, which latter imparts case-hardening properties.

CORROSION

Rustproofing. Rust-Proofing of Iron and Steel, Elmer S. Whittier. Metal Industry, vol. 17, no. 2, Feb. 1919, pp. 79-82. Description of Parker process.

FORGING

Hollow Forging. Improved Methods of Hollow Forging S. A. Hand. Am. Mach., vol. 50, no. 9, Feb. 27, 1919, pp. 377-382, 20 figs. Methods described were used in France for making the 75-mm. shell. They have been adapted to American practice and it is asserted that they have been found more economical than former methods.

Smithing. The Engineer's Smithy. Joseph Horner, Mech. World, vol. 65, no. 1673, Jan. 24, 1919, pp. 42-43, 6 figs. Drawing-down process in anvil forging. Tenth installment. (Continuation of serial).

FOUNDRIES

Brass Foundry Practice. Materials and Chemicals Used in Brass Foundry Practice, Charles Vickers. Brass World, vol. 15, no. 2, Feb. 1919, pp. 35-37, 1 fig. History, properties, appearance, physiological action and commercial use. Feathered tin; phosphor tin; phosphor copper. Third article.

Cores. Core Mixtures for Large Marine Engine Cylinder Cores, John F. Kellogg. Pacific Marine Rev., vol. 16, no. 1, Jan. 1919, pp. 128-129, 2 figs. Practices followed at various foundries.

Die Casting. Die Castings and Their Application to the War Program, Charles Pack. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 239-248, 9 figs. Survey of developments in manufacture of metal castings by forcing molten metal, under pressure, into a metallic mold or die, with brief descriptions of several casting machines and of methods used to avoid blowholes.

Ferrosilicon. Ferrosilicon as an Aid to the Iron Foundry, W. F. Sutherland. Can. Foundryman, vol. 10, no. 2, Feb. 1919, p. 39. Manufacture and properties of ferrosilicon.

Foundry Design. Foundry and Shops of Striking Design, Charles Lundberg. Iron Iron Age, vol. 103, no. 7, Feb. 13, 1919, pp. 417-422, 11 figs.Result of studious effort to attain ideal in Michigan plant; storage building contains bins for all materials used.

Manganese-Steel Castings. Manufacture of Manganese-Steel Castings, B. S. Carr, Mech. World, vol. 65, no. 1674, Jan. 31, 1919, pp. 56-57. Physical characteristics; heat treatment; cleaning and machining. From Armour Engr.

Pattern Making. Contraction and Expansion, G. W. Lynes. Mech. World, vol. 65, no. 1673, Jan. 24, 1919, pp. 43-44, 4 figs. As affecting patternmaker. Paper before Sheffield Branch British Foundrymen's Assn.

Substitutes. Meeting the Situation with Substitute Formulæ, R. R. Clarke. Brass World, vol. 15, no. 2, Feb. 1919, pp. 47-48. Conditions in foundry industry.

Tool Casting. New Way to Cast High Speed Tools, J. E. Johnson. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 353-360, 6 figs., and Iron Trade Rev., vol. 64, no. 7, Feb. 13, 1919, pp. 435-437, 7 figs. Also Iron Age, vol. 103, no. 8, Feb. 20, 1919, pp. 481-483, 5 figs. The Davidson process and its advantages over method of shaping tools from forgings; the structure and its effect.

Waste. Modern Method Applied to the Foundry, W. R. Dean. Metal Industry, vol. 17, no. 2, Feb. 1919, pp. 69-70, 4 figs. Causes of waste; classification and prevention of losses. Second article.

FUELS AND FIRING

Anthracite. Burning Steam Sizes of Anthracite With or Without Admixture of Soft Coal. U. S. Fuel Administration, eng. bul. 5, 8 pp., 1 fig. Furnace equipment required for burning various percentages of steam anthracite and soft coal.

Ash. The Relation Between the Calorific Values and the Ash-Yields of Coal-Samples from the Same Seam, Thomas James Drakeley. Tran. Instn. Min. Engrs., vol. 56, part 2, Dec. 1918, pp. 45-56 and (discussion) pp. 56-60, 3 figs. From experiments and graphs the following formula is suggested, $y = C\ (I\text{-}X)\ S$, where C is a factor for the seam and stands for calorific value of mineral-free coal: S the percentage of ash yielded by impurities; y the required calorific value of sample, and X the percentage of ash yielded by sample.

Blending. The "Sandwich" System of Fuel Blending, E. W. L. Nicol. Colliery Guardian, vol. 117, no. 3030, Jan. 24, 1919, pp. 192-193, 3 figs. Apparatus for mixing various grades of solid fuel as they are fed to burners.

Fuel Blending, E. W. L. Nicol. Times Eng. Supp., year 15, no. 531, Jan. 1919, pp. 40-41. 3 figs. Arrangement of "sandwich" system designed to cause blending of various grades of solid fuels as they are fed to furnace. Working results are given.

Briquetting. Economy of Briquetting Small Coal, J. A. Yeadon. Mech. World, vol. 64, no. 1668, Dec. 20, 1918, pp. 293. Abstract of paper before Min. Inst. Scotland.

Combustion Control. Combustion and Flue Gas Analysis. U. S. Fuel Administration, eng. bul. 4, 12 pp., 5 figs. Combustion-control apparatus; necessity of instructions to firemen.

Control of Combustible and Air in Burning Powdered Coal, W. G. Wilcox. Power Plant Eng., vol. 23, no. 5, Mar. 1, 1919, pp. 237-239. From a paper before the Western New York Section of the American Chemical Society.

Fuel Conservation. Fuel Conservation. Southern & Southwestern Ry. Club, vol. 14, no. 12, Nov. 1918, pp. 10-20 and (discussion), pp. 20-38. Discusses necessity of locomotive maintenance, constant education of enginemen and firemen, co-operation and necessity of complete understanding of importance of fuel conservation by operating officials.

Fuel Utilization. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 24. Reviews of efforts in coal conservation. particularly pulverizing coal and oil production and gas works.

Methods for More Efficiently Utilizing Our Fuel Resources, C. G. Gilbert and J. E. Pogue, Gen. Elec. Rev., vol. 22, no. 2, Feb. 1919, pp. 149-151. Part 25. The need for a constructive economic policy in developing the coal products Industry. Extract from U. S. Nation Museum Bulletin 102, Part 5; "Power: Its Significance and Needs," 1918.

Worcester's Fuel Saving Campaign, S. E. Balcome. Power Plant Eng., vol. 23, no. 5, Mar. 1, 1919, pp. 236-237, 2 figs. First article of a series on the organization, work of committees and results obtained in industrial plants.

Conservation of Fuel, D. C. Randolph. Proc. Central Ry. Club, vol. 27, no. 1, Jan. 1919, pp. 529-536 and (discussion), pp. 536-554. Contrasts what are termed good and bad railway fuel practices in locomotives, shops, roundhouses, yards and on the road.

Low-Grade Fuels. On the Utilization of Low-Grade Fuels at the Montrambert Collieries (Note sur l'utilisation des combustibles pauvres par la société des houillères de Montrambert. Bulletin de la Société d'Encouragement, vol. 130, no. 6, Nov.-Dec. 1918, pp. 376-378. Materials tested contain 42 to 50 per cent ash and 18 to 20 per cent volatile matter.

Motor-Car Fuel. Gas as Automobile Fuel (l'emploi du gaz dans les automobiles), A. Grebel. Génie Civil, vol. 74, no. 5, Feb. 1, 1919, pp. 81-84, 11 figs. Applications in France and in England; experiments of the Société du Gaz, Paris.

Fuel. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, pp. 356-357. Possibilities of benzol, alcohol and shale distillate as substitutes for gasoline.

An Interpretation of the Engine-Fuel Situation, Joseph E. Rogue. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, pp. 357-361, 3 figs. Believes that lesser gasoline output, which writer considers as inevitable, can be met only by modifying engine design so as to secure higher thermal efficiency and to use less specified fuel.

Pacific Coast Problems. Fuel Problems of the Pacific Coast. Mech. Eng., vol. 41, no. 3, Mar. 1919, pp. 264-269 and 292. Possibilities of fuel-oil conservation through its economic utilization and development of hydraulic power.

Peat. Possibilities of Peat, C. C. Osborne. Jl. Am. Peat Soc., vol. 12, no. 1, Jan. 1919, pp. 7-16 and 17-47. General conditions in industry; production in U. S., 1908-1917; manufacture of peat products; occurrence properties and uses; comparative calorific value of peat and other fuels; methods of preparation; peat industry in principal foreign countries. From U. S. Geol. Survey.

Powdered Coal. A Review on the Use of Powdered Coal, W. O. Renkin. Blast Furnace, vol. 7, no. 2, Feb. 1919, pp. 114-116 and 119, 3 figs. Graph showing comparative value and advantages of different fuels; comparison of installation and operating costs of producer gas, natural gas and hand-fired coal; early uses of powdered coal.

Powdered coal as a Substitute for Fuel-Oil. Min. & Sci. Press, vol. 118, no. 7, Feb. 15, 1919, pp. 235-236, 1 fig. Layout of experimental plant using Buell-Sautmyer system.

Pulverized Coal and Its Utilization, H. G. Barnhurst. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 45-46. Developments in pulverized-coal burning; plants using pulverized coal.

Pulverized Coal in an Industrial Plant, C. A. Dille. Power Plant Eng., vol. 23, no. 4, Feb. 15, 1919, pp. 188-189, 1 fig. Its parepration and method of application at plant of Mansfield Sheet and Tin Plate Co.

Characteristics of Powdered Coal, W. G. Wilcox. Brick & Clay Rec., vol. 54, no. 2, Jan. 28, 1919, pp. 127-131. Essentials of good combustion; flame length and air control; mixing coal with air; velocity of combustion.

U. S. Fuel Administration. Distribution of Coal Under U. S. Fuel Administration, J. D. A. Morrow. Bul. Am. Inst. Min. Engrs., no. 147, Mar. 1919, pp. 585-589. Method of controlling directing distrietuion.

Work of National Production Committee of U. S. Fuel Administration, James B. Neale. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 439-444. Method adopted for increasing production; need of stimulating ambition in workmen; industrial obligations of employers to men.

Wet Coal. Birds-Nesting of Boiler Tubes, James Scott, Nat. Engr., vol. 23, no. 2, Feb. 1919, pp. 66-67, 3 figs. Suggests avoidance of wet coal highly impregnated with sulphur; also suppression of very high temperatures until sulphur has volatilized away. From Practical Engr.

FURNACES

Annealing Furnaces. Heating Furnaces and Annealing Furnaces—II and III, W. Trinks. Blast Furnace, vol. 7, nos. 2 and 3, Feb. 1919, and Mar. 1919, pp. 98-101, 9 figs., and pp. 134-137, 7 figs. Speed of heat transmission and required brick surface; curves showing rate of heat abstraction from exterior of furnace.

Heating Furnaces. Practical Pointers on Heating Furnaces, George J. Hagan. Blast Furnace, vol. 7, no. 3, Mar. 1919, pp. 153-155 and 163. Changes in hearth areas capacities and walls to improve product and reduce losses. Paper before Engrs.' Soc. Western Pa.

Kilns. Ovens and Kilns With a High Thermal Efficiency, A. Bigot. Engineering, vol. 107, no. 2768, Jan. 17, 1919, pp. 80-82, 6 figs. Paper before Refractory Materials Section of Ceramic Soc.

Open-Hearth Furnaces. Open-Flame Furnaces at Government Gun Plant Accomplish Results That Munitions Specialist Believed Possible Only with Muffled Furnace or Electric. Am. Gas Eng. Jl., vol. 110, no. 5, Feb. 1, 1919, pp. 91-94, 4 figs. Large units measuring 37 ft. in depth and 9.5 fit. outside diameter are used to heat-treat big guns.

HANDLING OF MATERIALS

Coaling Station. Coaling Stations of the Philadelphia & Reading Railway. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 47-49, 6 figs. $270,000 locomotive coaling plant arranged to handle both anthracite and bituminous coal.

Coal Yard. An Efficient Chicago Coal Yard. Black Diamond, vol. 62, no. 4, Jan. 25, 1919, p. 65, 3 figs. Operates auto-crane in place of having elevated tracks.

Paper Mill. Handling Material in a Paper Mill, Henry J. Edsall. Indus. Man., vol. 57, no. 3, Mar. 1919, pp. 183-189, 18 figs. Boilerhouse machinery, conveyors for wet and dry pulp, machinery for handling black ash: track hauler, monorails and cranes. (Concluded.)

Steel Works. Handling Fuel and Materials in Iron and Steel Works, Frank Somers Colliery Guardian, vol. 117, no. 3029, Jan. 17, 1919, p. 141. Concerning avoidance of passing materials backwards. Paper before Staffordshire Iron & Steel Inst.

GAGES

Limit Gages. Limit Gages, W. E. Wilson. Mech. World, vol. 65, no. 1672. Jan. 17, 1919, p. 27. Correction of gages for wear. First instalment. (To be continued.) From Commonwealth Engr.

HEAT-TREATING

Critical Points. Critical Points. Proc. Steel Treating Research Soc., vol. 2, no. 2, 1919, pp. 32-40, 1 fig. Discussions held before Detroit section on shrinkage and warpage in hardening steel parts and on development of soft spots in case-hardened parts.

Low-Carbon Steel. Heat Treatment of Low-Carbon Steel, W. M. Wilkie. Mech. Eng., vol. 41, no. 3, Mar. 1919, pp. 239-244, 12 figs. Photomicrographs showing change in grain structure caused by annealing to various temperatures; effect of these structures on quality of steel.

Mass, Effect of. Effect of Mass on Heat Treatment, E. F. Law. Proc. Steel Treating Research Soc., vol. 2, no. 2, 1919, pp. 11-18 and (discussion), pp. 18-19 and 31, 3 figs. Chemical analyses, heating and cooling curves, and mechanical tests of cubes taken from 25-in. square ingot 10 ft. long after it was cogged down to 18 in. square. Paper before Iron & Steel Inst.

Springs. Manufacture, Heat Treatment and Physical Tests of Automobile Springs, N. E. Hendrickson. Proc. Steel Treating Research Soc., vol. 1, no. 10, July 1918, pp. 39-42 and (discussion), pp. 42-44. Calls attention to inconsistency of combining high-grade material with poor workmanship or heat treatment.

Steel Selection. The Composition and Properties of Steels, Howard Ensaw. Mech. World, vol. 65, no. 1671, Jan. 10, 1919, pp. 15-17. Suggests selection of few types of steel in order to avoid error in hardening and tempering. Tests of physical and chemical properties of steel.

Tempering. Phases on Tempering, E. W. Upham. Iron & Steel Can., vol. 2, no. 1, Feb. 1919, pp. 25-27. Discussion of methods of treatment and temperature control. Paper before Steel Treating Research Soc.

HEATING AND VENTILATION

Economics. Engineering Economics of Heating, M. William Ehrlich. Heat. & Ventilating Mag., vol. 16, no. 2, February 1919, pp. 17-23, 6 figs. Containing also a method of predetermining coal requirements for steam and hot water heating systems. Abstract of a paper presented at the annual meeting of the American Society of Heating and Ventilating Engineers, New York, January 1919.

Electricity. Heating Our Homes with Electricity. Elec. News, vol. 28, no. 3, Feb. 1, 1919, pp 23-25 and 30, 7 figs. Pioneer installation in Toronto said to prove that electric heating is practical.

Heating Plants. The Enormous Heating Plant at the Great Lakes Naval Training Station, J. C. Foster. Domestic Eng., vol. 86, no. 7, Feb. 15, 1919, pp. 299-300. Plant supplies heat to 950 buildings covering area of 1210 acres.

Low-Pressure System. Saving Steam in Industrial Heating Systems. U. S. Fuel Administration, eng. bul. 6, 14 pp., 9 figs. Suggests utilization of exhaust steam and discusses chief requirements for a good low-pressure heating system.

HOISTING AND CONVEYING

Conveyors. Conveyors in Relation to Engineering Works, W. W. Atherton. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 27-30, 4 figs. Illustrations showing various types of conveyors.

Floating Cranes. Floating Crane of 75-Ton Capacity. Eng. World, vol. 14, no. 2, Jan. 15, 1919, pp. 63-64, 1 fig. Dimensions and arrangement of auxiliary parts.

Grain Elevators. Some Modern German Grain Elevators (Neuzeitlicher deutscher Getreidespeicherbau), Prof. M. Buhle. Zeitschrift fuer Baumwesen, vol. 68, no. 7 to 9, 1918, pp. 3195-314, 19 figs. Gives views and details of mechanical equipments of a number of grain elevators erected in Germany, Austria, Russia and Holland.

Wall Cranes. Wall Cranes, Ernest G. Beck. Mech. World, vols. 64 and 65, nos. 1669 and 1674, Dec. 27, 1918, and Jan. 31, 1919, pp. 306-307 and 54. Computation of stresses in members. Twentieth and twenty-first installments. (Concluded.)

HYDRAULIC MACHINERY

China. Age-Long Engineering Works of China, Middleton Smith. Engineer, vol. 127, no. 3291, Jan. 24, 1919, pp. 72. A description of some of the ancient hydraulic works in China.

Gates. Automatic Gates a Factor in Safety of Spillway Dams, Robert H. Moulton. Safety Eng., vol. 37, no. 2, Feb. 1919, pp. 58-60, 4 figs. Gates are operated by the water pressure.

INTERNAL-COMBUSTION ENGINES

Diesel Engine. The Diesel Engine on Shipboard, Bruce Lloyd. Jl. Electricity, vol. 42, no. 3, Feb. 1, 1919, pp. 116-119, 5 figs. Discussions of results obtained in trials on vessels built in Pacific Coast. Writer's opinion concerning marine acceptance of Diesel engine. Paper before San Francisco Section, Am. Soc. Mech. Engrs.

The Diesel Engine—I, Herbert Hans. South-Engr., vol. 30, no. 6, Feb. 1919, pp. 48-50, 4 figs. Three general types of liquid-fuel engines; explosion engines having four-stroke cycle; engines having two-stroke cycle.

Junkers Engine. The Junkers Engine, Philip Lane Scott. Pacific Marine Rev., vol. 16, no. 1, Jan. 1919, pp. 112-114, 4 figs. Operation of engine (Diessel type) having two pistons in one cylinder.

Semi-Diesel Engine. Combustion Engines and Their Applications (Les moteurs à combustion et leurs applications), M. Drocsne. Revue Générale des Sciences, vol. 29, no. 23, Dec. 15, 1918, pp. 666-673, 1 fig. Origin and development of semi-Diesel engines; survey of results obtained in France and elsewhere in the construction of Diesel engines of various types.

The Leading Features of Semi-Diesel Oil Engine, James Richardson. Mar. Eng. Can., vol. 8, no. 12, Dec. 1918, pp. 295-300, 10 figs. Definition; nomenclature; classification; compression pressure; effect of compression; cycle of operation.

LUBRICATION

Grinding Lubricants. Proper Care of Grinding Lubricants, Howard W. Dunbar. Iron Trade Rev., vol. 64, no. 6, Feb. 6, 1919, p. 375. Contends that a tank for each machine is best way to handle grinding compounds and lubricants.

Lubricating Oils. Lubricating Oils, G. R. Rowland. Nat. Engr., vol. 23, no. 2, Feb. 1919, pp. 68-71, 1 fig. Physical characteristics and application; selection of oil most suitable for work required; distillation.

MACHINE ELEMENTS AND DESIGN

Bearings, Thrust. Single-Collar vs. Multi-Collar Thrust Bearings for Propeller Shafts, H. G. Reist. Gen. Elec. Rev., vol. 22, no. 2, Feb. 1919, pp. 133-137, 3 figs. From data available author assumes that substituting of single for multi-collar thrust bearings on average merchant ship would result in saving about one-half of one per cent of the total power, coal and size of boilers.

Flywheels. How Much Should a Flywheel Weigh? Rufus T. Strohm. Power, vol. 49, no. 8, Feb. 25, 1919, pp. 269-273, 7 figs. Simple method of calculating approximately weight of flywheel.

Gears. The Properties of Worm Axle Gears. Machinery, vol. 13, no. 331, Jan. 30, 1919, pp. 479-480. Formulæ and calculations.

Springs. Calculation of Helical Springs. (Berechnung zylindrischer Schraubenfedern unter Verwendung von Schaulinien.) Richard Seeman, Dinglers Polytechnisches Journal, vol. 333, no. 11, June 1. 1918, pp. 91-96, 11 figs., 5 tables. Concluded in no 12, June 15, 1918, pp. 99-101. Large diagrams for solving all usual problems occurring with helical compression and tension springs. The second part contains typical examples, considering also the element of time, as in the closing of valves.

MACHINE SHOP

Boring and Lining. War-Time Repairs in the Navy, Frank A. Stanley. Am. Mach., vol. 50, no. 9, Feb. 27, 1919, pp. 383-387, 14 figs. Boring and lining operations. Fifth article.

Control of Tools. The Control of Electrically Operated Machine Tools, F. Ashton. Mech. World, vols. 64 and 65, nos. 1663, 1665, 1668, 1669, 1671 and 1672, Nov. 15, 29, Dec. 20, 27, 1918, Jan. 10 and 17, 1919, pp. 236-237, 259-260, 292-293, 304-305, 20-21 and 28-29, 17 figs. Description of various types in use; remarks on their operation; methods of starting; dangers from overloads.

Drive. Industrial Motor Installation, W. H. Wakeman. Southern Engr., vol. 30, no. 6, Feb. 1919, pp. 56-59, 10 figs. Detail of construction work in changing from belt drive to electric drive.

Grinding. Grinding as a Machine Operation. Ry. Gaz., vol. 30, no. 1, Jan. 3, 1919, pp. 25-27, 3 figs. Suggestions in regard to designing and operating grinding machines.

Grouting of Bases. Grouting Electrical Machinery Bases—I, Terrell Croft. Southern Engr., vol. 30, no. 6, Feb. 1919, pp. 52-55, 3 figs. Function of grouting; mixing the grout; various materials for grout; preparing a machine bedplate for grout.

Hammering. Handier Hammering. Sci. Am., vol. 120, no. 9, Mar. 1, 1919, p. 208, 2 figs. Hammer provided with device to hold nail.

Shaft Pressing. Recent Developments in Shaft Pressing at Destination. N. L. Rea. Gen. Elec. Rev., vol. 22, no. 2, Feb. 1919, pp. 138-140, 3 figs. Description of methods that have been found successful in pressing on shafts at destination.

MACHINERY, METAL-WORKING

Drills. A New Method of Gang Drilling. Iron Age, vol. 103, no. 8, Feb. 20, 1919, pp. 489-492, 7 figs. Radical design based on detachable drill heads and chain drive; cutting cycle automatic; application in boiler shop.

Lathe, Roll. Japan to Have Massive Roll Lathe. Iron Trade Rev., vol. 64, no. 7, Feb. 13, 1919, pp. 451-452, 1 fig. Tool is motor-driven and is provided with several spindle speeds; bed is made in sections to facilitate transportation; total weight, 275,000 lb.

Lathe, Screw-Cutting. High-Precision Screw-Cutting Lathe. Mech. World, vol. 64, no. 1667, Dec. 13, 1918, p. 282, 1 fig. Machine built by Commission of Machine Tool Dept., Ministry of Munitions. Among other features "live" center is "dead," drive being obtained by catchplate revolving about spindle extension.

Milling Machine. Double-Spindle Milling Machine for Wrench Slot in Detonator Socket. Machinery, vol. 13, no. 331, Jan. 30, 1919, p. 495, 2 figs. Described as permitting manufacture of 4000 to 5000 fuse parts per day.

Trimmer. Bliss Flat-Edge Trimmer for Sheet Metal. Am. Mach., vol. 50, no. 9, Feb. 27, 1919, pp. 412-414, 4 figs. Description of a machine that will trim the scrap from metal stampings and leave a smooth, flat edge suitable for soldering, welding, brazing or other operations.

MACHINERY, SPECIAL

Evaporators. Industrial Vacuum Evaporators, Frank Coxon. Mech. World, vol. 65, nos. 1670 and 1673. Jan. 3 and 24, 1919, pp. 5 and 40, 7 figs. Classification and description. First and second installments. (To be continued.)

Reserving Machine. Reversing Value of Water-Sealed Type. Iron Trade Rev., vol. 64, no. 7, Feb. 13, 1919, pp. 452 and 467, 1 fig. Reversal of 36-in. hand-operated furnace valve is accomplished by a balanced hood and counterweights.

Trench-Digging Machine. German Excavating Machine for Tunnels and Mine Galleries (Machine allemande pour le creusement des tunnels et des galeries de mines), Francis Schmitt. Génie Civil, vol. 73, no. 22, Nov. 30, 1918, pp. 421-423, 10 figs. Details of excavator and of shaft with spiral blade for automatic removal of material.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

Alternating Stresses. Effect of Cold-Working and Rest on Resistance of Steel to Fatigue Under Reversed Stress, H. F. More and W. J. Putnam. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 391-404, 9 figs. Report of research under auspices of Nat. Research Council.

Cast Iron. Cast Iron in Bending: Variation in Beam Strength, J. Harland Billings. Can. Machy., vol. 21, no. 7, Feb. 13, 1919, pp. 162-163, 2 figs. Tests to determine effect of varying cross section upon strength of beams in bending.

Glass. Strength Tests of Plain and Protective Sheet Glass, T. L. Sorey. Jl. Am. Ceramic Soc., vol. 1, no. 11, Nov. 1918, pp. 801-808, 4 figs. Claims that in both impact and cross-bend tests blown window glass was stronger than plate glass.

Toughness. Static, Dynamic, and Notch Toughness, Samuel L. Hoyt. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 339-351, 10 figs. Considers toughness as an independent property and proposes quantitative determinations of toughness by notched-bar impact tests (Charpy tests).

MEASUREMENTS AND MEASURING APPARATUS

Dynamometers. Commercial Dynamometers, P. Field Foster. Mech. World, vol. 65, no. 1670, Jan. 3, 1919, pp. 6-7, 2 figs. "Transmission" types. Eighth installment. (Continuation of serial.)

Screw Measurements. A Machine for Measuring Screws, P. E. Shaw. Engineering, vol. 107, no. 2769, Jan. 24, 1919, pp. 104-108, 16 figs. Methods described depend upon a simple point contact in all cases. The machine used deals with the diameters and the pitch and is of a simple type, easy to use.

Spherometers. Mechanical Measure of a Spherical Surface. Spherometers. Mesure mécanique d'une aire sphérique. Les sphérimètres). Paul Vanet. Génie Civil vol. 74, no. 5, Feb. 1919, p. 96, 6 figs. Principle of planimeter applied to measurement of area of closed figure drawn on a spherical surface.

Temperature Measurements. Measuring Gas Temperatures in Boiler Settings. Engineering, vol. 107, no. 2768, Jan. 17, 1919, pp. 75, 1 fig. Abstract of Bulletin 145, U. S. Bureau of Mines, by Messrs. Kreisinger and Barkley.

New Method of Measuring High Temperatures by the Coloration of the Light Emitted by an Incandescent Body (Sur une nouvelle méthode de mesure des températures élevées d'après le coloration de la lumière émise par le corps incandescent). A Boutaric. Revue Générale de l'Electricité, vol. 5, no. 6, Feb. 8, 1919, pp. 210-217, 7 figs. Based principally on researches by Paterson and Dudding. (Phil. Mag., vol. 30, July 1915, p. 34.)

On the Lags of Thermometers with Spherical and Cylindrical Bulbs in a Medium Whose Temperature is Changing at a Constant Rate, A. R. McLeod. Lond., Edinburgh & Dublin Phil. Mag., vol. 37, no. 217, Jan. 1919, pp. 134-144. Gives expressions for steady values of lags when surface conductivity is finite, and for lags at any instant when surface conductivity is infinite. Expression for surface conductivity $h=0.0000515\ V$, where V is miles per hour, is suggested for thermometers moving through air at aeroplane speeds.

MECHANICS

Beams. Theory of the Hyperstatic Beam Théorie de la Poutre Hyperstatique), D. Wolkowitsch. Génie Civil, vol. 74, no. 5, Feb. 1, 1919, pp. 84-89, 7 figs. Simple beam supported at one end and fixed at the other; continuous beams on supports at same level. (Concluded.)

Ropes, Wire, Stresses in. Stresses in Wire Rope, Shortridge Hardesty. Mech. Eng., vol. 41, no. 3, Mar. 1919, pp. 257-260, 4 figs. Development of new formula for determination of bending stresses.

Shafts, Critical Velocity of. On the Critical Velocity of Shafts. Dunkerley's Formula (Note sur la vitesse critique des arbres. Formule de Dunkerley), E. Hahn. Revue Générale de l'Electricité, vol. 5, no. 4, Jan. 25, 1919, pp. 123-130, 3 figs. Demonstration of Dunkerley's formula and calculation of its accuracy.

Struts. Critical Distributed Loads for Long Struts. Arthur Morley and F. F. P. Bisacre. Engineering, vol. 107, no. 2769, Jan. 24, 1919, pp. 99-100, 2 figs. Deals mainly with the compression flange or member of cantilevers or masts, developing a general formula applicable to a wide variety of distributed loads.

MOTOR-CAR ENGINEERING

Axles. Parker Silent Internal Gear Axle. Automotive Industries, vol. 40, no. 6, Feb. 6, 1919, pp. 305-306, 3 figs. Gear is completely enclosed and runs in oil bath.

Carburetors. New Sunderman Carburetor Uses Floating Venturi. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, p. 377, 5 figs. Employs mushroom jet and air bypass for regulating depression at nozzle.

Design. Effect of Airplane Construction on the Automobile, O. E. Hunt. Eng. World, vol. 14, no. 4, Feb. 15, 1919, pp. 53-55. Claims that most important contribution has been the stimulus to thought of industry.

Possible Effect of Aircraft Experience on Automobile Practice, Howard C. Marmon, O. E. Hunt and Henry M. Crane. Automotive Industries, vol. 40, no. 6, Feb. 6, 1919, pp. 317-322. Comparison of plane and automobile engines; applicability to automobile manufacture of experience gained in producing light-weight results; development of alloy pistons. Paper before Soc. Automotive Engrs.

Engines. Motor Transport Under Difficulties, J. A. L. Gallard. Min. Mag., vol. 20, no. 2, Feb. 1919, pp. 90-91. Service given by sleeve-valve engine under stresses of war conditions.

Continental Adaptation of Class B War Truck Engine. Automotive Industries, vol. 40, no. 4. Jan. 23, 1919, pp. 211-213, 8 figs. Engine has aluminum crankcase and bell housing; designed originally for military use.

Gray Victory Four-Cylinder Engine. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, pp. 370-371, 5 figs. Block-cast engine of 3½-in. bore by 5-in. stroke, of valve-in-head type. Intended for passenger cars, trucks and tractors.

Récardo Engine "Made Good" in Tanks. Automotive Industries, vol. 40, no. 8, Feb. 20, 1919, pp. 407-410, 7 figs. Piston design; means for cooling piston, for preheating carburetor air, and for preventing unvaporized fuel getting into crank chamber.

Fans. Radiator Cooling Fans, Louis Schwitzer. Automotive Industries, vol. 40, no. 4, Jan. 23, 1919, pp. 202-205. Fan design, mounting and drive; location of fan relative to housing.

Governors. Truck and Tractor Engine Governors, R. B. Shoop. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, pp. 374-375 and 392, 8 figs. Classification of various types; factors affecting design; adaptation of marine type.

Hotchkiss Drive. An Analysis of the Hotchkiss Drive, Otto M. Burkhardt. Automotive Industries, vol. 40, no. 4, Jan. 23, 1919, pp. 206-208, 5 figs. Resultant of weight carried and torque or brake reaction; effect of torque on spring.

Motorcycles. Harley-Davidson Co. Brings Out Sport Model. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, pp. 362-364, 6 figs. Design having a two-cylinder opposed engine, multiple-disk clutch and three-speed transmission.

Standards. S. A. E. Discusses Truck Subjects, B. B. Bachman, Cornelius T. Myers and G. E. Randles. Automotive Industries, vol. 40, no. 7, Feb. 13, 1919, pp. 349-351. Pneumatic tires for trucks; recommended inflation pressures.

Tractors. Case 15-27 Hp. Tractor, P. M. Heldt. Automotive Industries, vol. 40, no. 5, Jan. 30, 1919, pp. 256-261, 9 figs. Features of construction. Main frame is single iron casting designed to serve as main part of transmission case, crank-case and rear-axle housing.

Operating a Traction Engine, Thomas G. Thurston. Nat. Engr., vol. 23, no. 2, Feb. 1919, pp. 60-63, 2 figs. What is included in field operations; skill required in making repairs from scant and unsuitable materials.

Principles of the Wheeled Farm Tractor, Edward R. Hewitt. Automotive Industries, vol. 40, no. 6, Feb. 6, 1919, pp. 312-315, 3 figs. Factors determining maximum traction obtainable; results of experiments to ascertain rolling resistance. Paper before Soc. Automotive Engrs.

Valves. Small In let Valves Satisfactory in Overhead Valve Design—I, L. H. Pomeroy. Automotive Industries, vol. 40, nó. 8, Feb. 20, 1919, pp. 432-435, 6 figs. Report of tests made with two engines of approximately same size, one a valve-in-head design and the other an L-head valves side by side in valve pocket. Paper before Instn. Automobile Engrs.

Windshields. A New Windshield for Closed Bodies, George J. Mercer. Automotive Industries, vol. 40, no. 8, Feb. 20, 1919, pp. 416-417, 3 figs. Upper and lower parts in inclined planes cutting each other in line of vision.

PIPE

Standards. Pipe Standards and Their Application to Commercial Work, A. M. Houser and C. C. Bartlett. Power Plant Eng., vol. 23, no. 5, March 1, 1919, pp. 250-252, 8 figs. Theoretical standards; Briggs standard gage; making tight joints'

POWER GENERATION

Argentina. Utilization of Waterfalls (Aprovechamiento de la caídas de aqua), A. Di Ciô. Boletin de la Asociacion Argentina de Electro-Ténicos, vol. 4, no. 9, Sept. 1918, pp. 816-820. Popular discussion of economical aspect of problem.

France. Hydraulic Energy in the Central Group of France (L'énergie hydraulique dans le Massif Central de la France), P. Morin. Revue Générale de l'Electricité, vol. 5, no. 6, Feb. 8, 1919, pp. 219-227, 4 figs. Geographical conditions and study of the water courses which are susceptible of immediate utilization.

Maine. Cost of Hydroelectric Development. Elec. Wld., vol. 73, no. 9, March 1, 1919, pp. 413-417. From a report based on the study of Maine water powers by H. K. Barrows to the Maine Public Utilities Commission. Effect of load factor; costs of water rights, power transmission lines, storage reservoirs; comparative utility of hydraulic and steam power.

Tennessee. The Larger Undeveloped Water-Powers of Tennessee, J. A. Switzer. Tennessee Geol. Survey, bul. 20, 1918, 35 pp., 30 figs. Report of field and office work; general scheme of development. Paper before Am. Electrochem Soc.

United States. Water Powers, O. B. Wilcox. Nat. Elec. Light Assn. Bul., vol. 6, no 2, Feb. 1919, pp. 55-56. Estimate of available water power in U. S. From report of chairman of Committee on Public Service Securities, Investment Bankers' Assn. Am.

POWER PLANTS

Boiler Design. Modern Boiler Practice, F. A. Combe. Jl. Eng. Inst. Can., vol. 2, no. 2, Feb. 1919, pp. 109-119, 9 figs. Outline of principles governing boiler and furnace design, with review of present knowledge of laws related thereto, and trend of modern practice, together with general notes regarding boiler installation and operation.

Boiler Testing. Boiler and Furnace Testing. Rufus T. Strohm. U. S. Fuel Administration, Bur. of Conservation, eng. bul. 1, 20 pp., 3 figs. Suggests tests to be made everyday and apparatus required for making them.

Boilers, Uptakes for. How to Lay Out a Large Uptake for Stationary Boilers, Phil Nesser. Boiler Maker, vol. 19, no. 2, Feb. 1919, pp. 42-45, 7 figs. Method saves job of shearing.

Condensers. Condenser Engineering Practice, D. D. Pendleton. Mech. World, vols. 64 and 65, nos. 1669 and 1673, Dec. 27, 1918, and Jan. 24, 1919, pp. 309-310 and 41. Hotwell of low-type jet machine; air in surface condensers; heat transfer in surface condensers. Abstract of paper presented to Assn. Iron & Steel Elec. Engrs.

Vacuum Trouble in Turbine Condensers. James Brakes, Jr. Power, vol. 49, no. 8, Feb. 25, 1919, pp. 287-288, 4 figs. Discussion of an article " Keeping Up Condenser Performance," Power, Dec. 17, 1919.

Cost. Power Plant Costs Committee. Nat. Engr., vol. 23, no. 2, Feb. 1919, pp. 90-95, 4 figs. N.A.S.E. committee cost and production sheets.

Draft. Mechanical Draft, Charles L. Hubbard. Southern Engr., vol. 30, no. 6, Feb. 1919, pp. 40-43, 2 figs. Rates of combustion; draft pressure; air requirements; diagram of water-tube boiler equipped with mechanical draft.

Feedwater Softening. Boiler Water Treatment, U. S. Fuel Administration, eng. bul. 3, 8 pp. Examples of economies effected by softening water.

Water Softeners, C. E. Stromeyer. Colliery Guardian, vol. 117, no. 3031, Jan. 31, 1919, pp. 248-249, 2 figs. Abstracted from memorandum of chief engineer to Manchester Steem Users' Assn.

Firebox. New Type of Firebox Construction. Boiler Maker, vol. 19, no. 2, Feb. 1919, pp. 33-37 and 61, 4 figs. Customary arch tubes are repalced by "thermic syphons" or tubular sections extending from lower part of throat sheet up to rear end of crown sheet; upper part of tubular section is extended in form of flat plates, spaced 4 in. apart up to crown sheet for nearly entire length of firebox.

Heat Losses. Fuel Economy in the Boiler House—I, John B. C. Kershaw, Chem. & Metallurgical Eng., vol. 20, no. 4, Feb. 15, 1919, pp. 176-178, 3 figs. Study of heat losses and their control.

High Steam Pressures. Use of Higher Steam Pressures and Temperatures in Power Plants, J. H. Shaw. Elec. Rev., vol. 74, no. 7, Feb. 15, 1919, pp. 252-256, 5 figs. Practical and theoretical considerations involved; their effect upon turbine efficiency, design and plant layout. Abstract of paper before the Am. Inst. of Elec. Engrs.

The Use of High-Pressure and High-Temperature Steam in Large Power Stations, J. H. Shaw. Jl. Instn. Elec. Engrs., vol. 57, no. 278, Jan. 1919, pp. 73-82 and (discussion), pp. 82-108, 5 figs. Discussion of economical aspect of question; quotes data of various stations and suggests a schedule showing coal consumption, cost of coal, and amount of capital that can be expended to absorb estimated saving.

Isolated Plant. Saving Coal in Steam Power Plants. U. S. Fuel Administration, eng. bul. 2, 8 pp., 4 figs. Isolated plant vs. central-station power; typical distribution of heat in medium-sized hand-fired plant, chief losses in boiler-plant operation.

Oil Elimination. Oil Elimination, Charles L. Hubbard. Nat. Engr., vol. 23, no. 2, Feb. 19, 1919, pp. 75-79, 16 figs. Discussion of various methods used to eliminate oil from exhaust steam and condensation and their principles of operation; exhaust steam separators; purpose of baffle plates and corrugations; steam filtration; purifying condensate.

Operation. Improving Factory Steam Plants, H. A. Wilcox. Power Plant Eng., vol. 23, no. 4, Feb. 15, 1919, pp. 184-187, 1 fig. Case IV. Putting old plant into condition to finish its years of service efficiently. Sixth article.

Outline of Factors Governing Economical Boiler Operation, Robert June. Elec. Rev., vol. 74, no. 7, Feb. 15, 1919, pp. 257-260, 2 figs. Combustion, loss due to excess air and losses in burning coal; accounted-for and unaccounted-for losses. Second article.

Power Plants. New Philadelphia Power Plant, Walter C. Edge. Nat. Engr., vol. 23, no. 2, Feb. 1919, pp. 53-57, 6 figs. Designed to eliminate three old plants and to provide ample heat for process work from exhaust steam of engines and auxiliaries.

Safety. Placing Valves in Unsafe Positions, V. R. Hughes. Power, vol. 49, no. 9, Feb. 25, 1919, pp. 266-268, 17 figs. Examples of safe and unsafe arrangements.

Service Records. Memoranda of Office Records, Allan W. Cuddeback. Can. Engr., vol. 36, no. 7, Feb. 13, 1919, pp. 217-218, 2 figs. Records of location of service pipes, valves, hydrants and distribution mains of Passaic Water Co.

Stokers. New Travelling Grate Stoker for Forced Draft. Power Plant Eng., vol. 23, no. 5, March 1, 1919, pp. 262-263, 3 figs. Illustrated description of the Harrington stoker.

Design and Construction of Mechanical Chain Grate Stokers, W. H. Grantham. Mech. World, vol. 64, nos. 1668 and 1669, Dec. 20 and 27, 1918, pp. 294 and 307, 7 figs. Laclide-Christie design. Sixth and seventh installments. (Concluded.)

Turbines. Reliable Performance of Large Turbines, Blast Furnace, vol. 7, no. 3, Mar. 1919, pp. 147-148, 3 figs. Turbine generator of 35,000 kw. installed in Commonwealth Edison Co., Chicago.

Steam Turbine Operation, J. B. Wilson. Power Plant Eng., vol. 23, no.5, Mar. 1, 1919, pp. 227-231, 5 figs. Points to be watched and conditions to be sought for best economy.

Waste Heat. The Utilization of Waste Heat from Open-Hearth Furnaces for the Generation of Steam, Thomas B. Mackenzie. Iron & Steel Can., vol. 2, no. 1, Feb. 1919, pp. 14-24, 3 figs. Data obtained from experiments with acid-lined furnaces or ordinary construction. Paper before Iron & Steel Inst.

POWER TRANSMISSION

Mill Drive. Geared Versus Direct-Couple Motors, R. W. Davis. Blast Furnace, vol. 7, no. 3, Mar. 1919, pp. 138-139, 3 figs. Example of 2000-hp., 81-r.p.m., 6600-volt, 3-phase, 25-cycle motor built with direct-coupled tandem plate mill drive.

PRODUCER GAS

Blast Furnace. The Blast Furnace as a Gas Producer, Blast Furnace, vol. 7, no. 3, Mar. 1919, p.127. Concerning German blast furnace practice. From Stahl und Eisen.

PUMPS

Water-Works Pumps. Economic Value of Electrically Driven Pumps for Small Water Works, D. D. Ewing. Mun. & County Eng., vol. 56, no. 2, Feb. 1919, pp. 68-70. Illustrative examples. Figures are of pre-war type.

Electrically Driven Pumps in Small Water-works, D. D. Ewing. Engineering and Concracting, vol. 51, no. 7, Feb. 12, 1919, pp. 170-171. Energy required by electrically driven pumps; power requirements; concrete illustration of motor-application principle;cost of changing to electrically driven pumps. From paper before Indiana Eng. Soc., 1919.

REFRACTORIES

Basic-Refractories. Basic Refractories for the Open Hearth, J. Spotts McDowell and Raymond M. Howe. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 292-309, 7 figs. Report of laboratory tests, Low-line magnesite showed less tendency to slake, higher refractoriness and greater resistance to attack by firebrick and silica brick than high-lime magnesite; dolomitic materials highest in impurities and lowest in lime were most resistant to slaking; magnesites were more resistant than dolomites to slaking and to action of corrosive Fe_3P. Fe_2O_3 fireclay and silica.

Firebrick. How Slag Temperatures Affect Firebrick, Raymond M. Howe. Brick & Clay Rec., vol. 54, no. 2, Jan. 28, 1919, pp. 143-144. Results of tests indicating effects on life of brick. From Iron Trade Rev.

Great Britain. Refractories. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 19 Empire sources of supply; possibilities in manufacturing reforms.

REFRIGERATION

Marine Refrigeration. Developments in Marine Refrigeration and Details of Brunswick Apparatus, W. O. Whitney. Jl. Am. Soc. Marine Draftsmen, vol. 6, no. 3, Oct. 1918, pp. 30-40, 6 figs. Features of the various types of refrigerating plants; discussion of their respective applicability.

Meat Industry. The Efficiency of the Frozen-Meat Industry, G. L. D. James New Zealand Jl. Sci. & Technology, vol. 1, no. 6, Nov. 1918, pp. 341-345. Loss of dead weight in railing and droving, freesing and transport.

RESEARCH

Gas Industry. The Place of Research in the Gas Industry S. W. Parr Gas Age, vol. 43, no. 3, Feb. 1, 1919, pp. 135-136. Points out fields of investigation, From paper before Western Soc. Engrs.

Great Britain. Research Progress. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 31. Work done by Dept. of Sci. & Indus. Research, Great Britain.

United States. American Engineering Research, W. R. Whitney. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 2, Feb. 1919, pp. 115-127. Calls attention to our national condition in relation to engineering research and expresses convenience of crystallizing research work into an acceptable form.

Research in America After the War, R. A. Millikan. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 2, Feb. 1919, pp. 129-140. Suggestions in regard to concerted action between similar committees of the various scientific societies.

STANDARDS AND STANDARDIZATION

Brass and Bronze Foundries. Standards for Brass and Bronze Foundries and Metal-Finishing Processes, Lillian Eskine. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 263-275. Study of approved practices and equipment to safeguard health of workers.

German Machinery. Standardization in German Machine Building (Vereinheitlichung in deutchen Maschinenbau). Zeitschrift der Deutscher Gesellschaft fuer Mechanik und Optik, nos. 1 and 2, Jan. 15, 1918, pp. 1-6. Standardization to meet competition after the war. This installment contains the first five standard tables intended to be followed by " German Machine Industrie," including sizes of drawings, German standardization, etc.; also list of members throughout Germany engaged in this work. Effective since Feb. 15, 1918. From Zeitschrift ver d. Ing., vol. 61, p. 985, 1917.

Lengths. Industrial Length Standards (Les calibres industriels de longueur), Ch.-Ed. Guillaume. Bulletin de la Société Française des Electriciens, vol. 8, no. 75, Dec. 1918, pp. 383-400, 5 figs. Development of present principles of gaging; comparison of various standards; gaging machines of the Société Génevoise. Writer believes advisability of ascertaining from manufacturers their experience with the various metals used in manufacture of gages and deciding from study of reports on a standard which will satisfy all requirements.

Motor-Car Parts. Standards Committee Acts on Division Reports. Automotive Industries, vol. 40, no. 6, Feb. 6, 1919, pp. 307-311, 8 figs. Ball-bearing electrical, engine, spring, tire and rim S.A.E. recommended standards.

Steel. British Adopt Twenty Standard Steel Specifications. Automotive Industries, vol. 40, no. 8, Feb. 20, 1919, pp. 418-419. Gives chemical and physical properties, together with definitions of terms used.

STEAM ENGINEERING

Boilers. Water Circulation in Boilers, A. D. Williams, Power, vol. 49, no. 8, Feb .25, 1919, pp. 285-286. Notes on water circulation in water-tube boilers. Description of simple experiments by which observer can obtain an idea of flow of steam in tubes of varying pitch.

The Principles of Heat Absorption, Robert June. Brick & Clay Rec., vol. 54, no. 2, Jan. 28, 1919, pp. 133-136, 6 figs. Importance of maintaining clean surfaces inn. boiler.

Turbines. Notes on Large Steam Turbine Design, J. F. Johnson. Elec. Jl., vol. 16, no. 1, Jan. 1919, pp. 33-38, 4 figs. Operating records; load capacities; graph of relative steam consumption of large-capacity turbines; principles of turbine design. Paper before Phila. Section, Am. Soc. Mech. Engrs.

The Assembly and Adjustment of Steam Turbines, J. Humphrey. Machinery, vol. 13, no. 331, Jan. 30, 1919, pp. 486-492. 14 figs. Turbines considered are those working on Parsons principle and having a large number of fixed and moving blades, caulked into casing and on periphery of rotor.

High-Power Steam Turbines (Les turbines à vapeur de grandes puissances), Jean Guerner, Revue Générale de l'Electricité, vol. 5, no. 6, Feb. 8, 1919, pp. 227-230, 3 figs. Development of steam turbines, with reference to American models; economical comparison of the various types, from data obtained in American practice.

WELDING

Acetylene Welding. A Missing Link in Welding Equipment, Arthur W. Dohmen. Jl. Acetylene Welding, vol. 2, no. 8, Feb. 1919, pp. 388 and 392-393, 4 figs. Instrument which indicates flow of gases being used by welder.

Improvements in Guides for Oxy-Acetylene Blowpipes. Acetylene & Welding Jl., vol. 15, no. 183, Dec. 1918, p. 226, 3 figs. Guide consists of rotating plate having eccentrically mounted tube; supporting base for plate is provided with ball race.

Oxy-Acetylene Welding and Cutting. Eng. & Min. Jl., vol. 107, no. 6, Feb. 8, 1919, pp. 268-269. Abstract of bul. 11 of Federal Board for Vocational Education.

Oxy-Acetylene Welding Problems, W. L. Bean. Ry. Mech. Eng., vol. 93, no. 2, Feb. 1919, pp. 97-100, 3 figs. Discussion of flame structure and methods of handling; careful training of operators necessary. From paper before New England Ry. Club.

Oxy-Acetylene Welding. Power Plant Eng., vol. 23, no. 5, Mar. 1, 1919, pp. 244-246, 2 figs. Hints for beginners and pointers on power plant repair jobs. Second article.

Boiler Welding. Boiler Welding, P. F. Willis. Jl. Acetylene Welding, vol. 2, no. 8, Feb. 1919, pp. 393-398, 29 figs. Welding of a half side sheet in a locomotive firebox; welding of simple crack; welding half door sheets. From book on Oxy-Acetylene Welding and Cutting. To be continued.

Cast Iron. Welding Cracked Cast Iron Radiators, David Baxter. Metal Worker, vol. 91, no. 3, Jan. 17, 1919, pp. 83-85, 3 figs. Particulars of work and skill required for job. From Jl. Acetylene Welding.

Covered Electrode Welding. The Covered Electrode Process, E. G. Rigby. Jl. Engrs. Club Phila., vol. 35-10, no. 167, Oct. 1918, pp. 472-482, 6 figs. Its adoption in English shipyards; equipment; conditions required for good welding; its application to ship's deck structures, bulkhead structures, etc. Fourth discussion under auspices of U. S. Shipping Board Emergency Fleet Corporation.

Electric Welding. Electric Welding—A New Industry, H. A. Hornor. Jl. Engrs. Soc. Phila., vol. 35-12, no. 169, Dec. 1918, pp. 537-543, 12 figs. and Elecn., vol. 82, no. 2122, Feb. 17, 1919, pp. 96-97. Present status; review of suggestions offered to develop scientific system of testing; methods of electric welding.

Electric Welding Practice, Comfort A. Adams. Jl. Enger. Club Phila., vol. 35-12, no. 169, Dec. 1918, pp. 531-536, 7 figs. Testing; research; training; ship design and costs; shipyards committee. Seventh discussion under auspices of U. S. Shipping Board, Emergency Fleet Corporation.

Fusion in Arc Welding. Fusion in Arc Welding, O. H. Escholz. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 3, Mar. 1919, pp. 319-327, 16 figs. Characteristics of metallic electrode arc welding, and effect of arc length, welding procedure, electrode material, arc current and electrode diameter upon these characteristics.

Inspection. Inspection of Metallic-Electrode Arc-Welds, O. S. Escholz. Min. & Sci. Press, vol. 118, no. 8, Feb. 22, 1919, p. 26, 7 figs. Methods for indicating fusion, slag content, porosity, and crystal structure.

Mild Steel. Welding Mild Steel, H. M. Hobart. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 517-561, 17 figs. Investigation undertaken by welding research sub-committee of welding committee of the Emergency Fleet Corporation. Object was to extend use of welding in construction of merchant ships and to provide basis for obtaining the best ecomony and efficiency in employing welding in place of riveting in construction of hulls.

Pressure in Weld. Difficulties Encountered in Welding Steel ,B. K. Smith. Boiler Maker, vol. 19, no. 2, Feb. 1919, pp. 39-40. Pressure of iron oxide in the weld; problems of expansion and contraction.

Pressure Vessels. Oxy-Acetylene Welding as Applied to Pressure Vessels. Acetylene & Welding Jl., vol. 15, no. 183, Dec. 1918, pp. 220-221, 1 fig. Example of welded gas containers. From Revue de la Soudure Autogène.

Radiograph. Radiograph Proves Successful "Jack-of-All-Operations." Jl. Acetylene Welding, vol. 2, no. 8, Feb. 1919, pp. 385-387, 6 figs. Account of exbibition of Davis-Bournonville apparatus.

Ruptures in Welds. Path of Rupture in Steel Fusion Welds, S. W. Miller. Bul. Am. Inst. Min. Engrs., no. 146, Feb. 1919, pp. 311-338, 82 figs. Report of research under joint auspices of Nat. Research Council and Emergency Fleet Corporation.

Thermit Welding. Modern Welding and Cutting Ethan Viall. Am. Mach., vol. 50, nos. 7, 8 and 9, Feb. 13, 20 and 27, 1919, pp. 283-291, 20 figs., pp. 341-346, 10 figs., pp. 389-394, 16 figs. Thermit welding of crankshafts, mill pinions, etc. Second, third and fourth articles.

WOOD AND TIMBER

Veneer Manufacture. The Manufacture of Veneer and Plywood, B. C. Boulton. Aerial Age, vol. 8, no. 25, Mar. 3, 1919, pp. 1240-1241, 1272 and 1285, 7 figs. Methods of cutting preparation of logs for sawing and slicing; slicer cutting; veneer sawing and drying.

VARIA

Engineering Societies. Address at the Annual Meeting, Arthur N. Talbot. Proc. Am. Soc. Civil Engrs., Papers & Discussions, vol. 45, no. 2, Feb. 1919, pp. 29-51. Review of activities of the year and discussion of outlook of Society.

Engineer's Part in Reconstruction. The Engineer's Part in After-the-War Problems, F. H. Newell. Sci. Monthly, vol. 8, no. 3, Mar. 1919, pp. 239-246. How the engineer and organizations of engineers, both individually and collectively, can perform their largest service.

Hotels. Mechanical Equipment of a Modern Hotel. Power, vol. 49, no. 7, Feb. 18, 1919, pp. 230-233, 9 figs. First of series describing mecbanical equipment of Hotel Pennsylvania, New York City.

Latin-American Engineering Conditions. Relation Between Engineering and Agriculture in Latin America, A. M. Shaw. La. Planter & Sugar Mfg., vol. 62, no. 7, Feb. 15, 1919, pp. 106-107. Present conditions in Latin America; opportunities these nations offer.

Licensing of Engineers. The Registration of Professional Engineers. Jl. Electricity, vol. 42, no. 3, Feb. 1, 1919, pp. 125-127. Act for licensing of engineers, prepared by San Francisco local sections of engineering societies.

Nomenclature, Scientific. Note on the Linguistic Nomenclature of Scientific Writers, Albert Campbell. Proc. Phys. Soc. London, vol. 31, part 2, Feb. 15, 1919, pp. 80-81 and (discussion) pp. 81-83. Comments on anglicizing terms from Latin and Greek introduced in the language.

State's Part in Industries. Engineers and the State. Times Eng. Supp., year 15, no. 531, Jan. 1919, p. 8. Opinions concerning part Government should take in problems confronting industry.

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Design of Hydro-Electric Plants for Combatting Ice Troubles *

By R. M. Wilson, M.E.I.C.

Nature has provided our fair country with an abundant supply of natural resources; and one, of the many which have only been partly made use of, is its "white fuel." Canada's water powers are of world fame and most of those which have been developed played an important part in the world war of the last four and a quarter years, in that they supplied power for the manufacture of munitions for Great Britain and her Allies.

One of the most difficult problems to be solved in the development of our water powers is the trouble encountered through ice in one or all of its several forms, viz:—sheet ice, frazil, and anchor ice.

When water is sufficiently cooled, it loses its fluidity and becomes filled with thousands of needle-like crystals, which interlace, until the whole mass becomes solidified. The formation of sheet ice begins at the shores, upon reefs, boulders or other obstructions; and with continued cold weather, builds outward and thickens. Unless broken by the wind, or prevented by high water velocity from forming, it gradually covers the whole surface of our rivers or power canals. Where ice forms in bays, around stones, and along the shores of rivers it is known under the name of "Bordage Ice."

Frazil.

Frazil, which is a French-Canadian term, comes from the French for "forge cinders," which it is supposed to resemble. The temperature of the air has only to be lowered a few degrees below the freezing point when the river water is at, or nearly down to, 32°F, to form large quantities upon the surface of open water. With a temperature of 17°F, or even higher, and sufficient wind to create surface agitation, large quantities of this troublesome ice will be formed. Frazil found under these conditions is of a very sticky nature, and, when the same comes in contact with metal exposed to the influence of the outside air, adheres to the metal; from which it cannot be removed unless the temperature of the air is raised two or three degrees, and the water or metal a fraction of a degree above the freezing point.

Frazil that flows down under surface ice does not have the same sticky quality. It is liable, however, to cause just as much trouble for, where the volume is great, it blocks up the openings in the racks and entrance to wheels unless the design of the plant is such as to overcome this trouble.

It will be found that, where frazil has accumulated and consolidated under the surface ice, it will in time raise this surface ice several feet above the elevation of the water surface in the river or power canals. In deep water channels, ice covered, where frazil is attached to the under side of the surface ice in depths varying from 1 to 14 or 15 feet, free from sheet ice, and not consolidated, it has been found that the suspended mass is of a spongy nature and passes a fair volume of water. When this condition exists, a raise of air temperature to 33° or 34°F, lasting two or three days, resulting in the raising of the water temperature between one and two hundredths of a degree F, will cause the greater portion of this suspended mass to disappear.

A great many are under the impression that frazil floats in open water entirely on the surface; this is not true for it will be found floating at depths several feet below the surface.

*Read at Ottawa Professional Meeting, February 12th, 1919; and at the Montreal Branch, February 27th, 1919.

Frazil suspended from the surface ice can be removed by use of electric current. The small quantity of heat generated by the passage of electric current between electrodes, inserted through the surface ice, disintegrates the suspended spongy ice mass very quickly. 2,750 kilowatts will free an area of approximately 4000 sq. ft. of this spongy ice, having an average depth of 7 feet, in about 30 minutes. The voltage required with a spacing between electrodes of 32 feet is 6000 volts.

Anchor Ice.

This form of ice, as its name implies, is attached or anchored to the rough stony bottoms of rivers and rarely forms under a layer of surface ice. The action of the sun's rays, or a rise in the temperature of the water in the river a fraction of a degree, loosens it, when it will rise to the surface. It is very easily distinguished from any other kind of slush ice, as it is usually very much darker in color and floats very high in the water. Where rivers are shallow and the water velocity high, preventing the formation of surface ice, large quantities of anchor ice will be found. From careful observations, we have never found anchor ice forming in water deeper than 16 to 18 feet, even in the very coldest weather and with ideal conditions for its formation.

Anchor ice is very much more dangerous than frazil to a plant for the reason that besides forming, with frazil, under-hung dams under surface ice, it also, when running, carries with it all sorts of water-logged timber, including stumps of trees, as well as large stones.

It has been observed that when the water in rivers in and around Montreal is high during the winter season, greater ice troubles are liable to be experienced. From the middle of December to the end of January is usually the time frazil trouble is at its worst, and from the beginning of February to the middle of March anchor ice is the most troublesome.

Hydro-electric plants in northern climates are more or less affected by ice troubles; and those of early design, in a great many cases, are either completely shut down for short periods during each ice season or their output reduced by a considerable amount. In some cases, the reduction of output lasts for the whole ice season.

Through the knowledge which has been gained by experience and with the improvements in the design of hydraulic equipment, plants can now be designed which will be practically immune from ice troubles; with the possible exception of those whose water supply is obtained through canals running across country where means cannot be provided to mitigate or eliminate the ice difficulty.

Ice troubles may be classified under two heads:—Those which cause trouble and damage to the outside portion of the development, such as erosion of river banks, flooding, damage to dams and other outside structures, and back water; and those which cause trouble to the hydraulic equipment by blocking the racks, wheel chambers and wheels.

To provide against trouble from ice, great care should be exercised in the selection of the site and the design of head and tail race channels. Where the development is one which only makes use of a portion of the flow of a river, and the conditions obtaining during the winter season above and below the plant are such that swift water or rapids exist, resulting in the river not being ice covered care should be taken to ascertain the prevailing wind conditions, for the reason that, with the open water above the plant, frazil and anchor ice will be formed; and, with the prevailing wind direction towards the intake channel, large quantities of this troublesome ice will be forced into the channel, even if the water in the main channel outside of the power canal has a velocity of 5 to 8 ft. per sec., and is almost at right angles to the same. By properly locating the development the trouble from wind conditions can be greatly reduced. A power canal that is narrow and deep is much preferable to one wide and shallow. In any case the average velocity at the entrance should be very low.

When investigating a power site a careful survey of river conditions above the entrance to the power canal should be made to ascertain the presence of reefs, large boulders, or other obstructions; for, with open water conditions, these will become coated with anchor ice to such an extent as possibly to divert the water from the entrance of the power canal sufficiently to cause the lowering of the head by several feet.

The source of another trouble from ice, and one which should be guarded against, is the lowering of the water level in the power canal, due to the temporary blockage of the river above the plant, caused by little ice dams in the open water during extreme cold weather conditions. This is a very important matter and is liable to seriously affect the plant's operation.

An impression seems to exist that, if a large pond can be created by constructing a power canal, ice trouble can be avoided or reduced to a minimum. This is a very wrong impression, where large developments are to be made of the low or medium head class. It is usually assumed that with water velocities in the power canal or headrace as low as 1 to 1½ feet per second surface velocity, surface ice will form as soon as the water temperature has reached the freezing point and the air temperature somewhere between zero and 20°F. This condition may be suitable for the formation of surface ice on the canal in some cases, but not in every case. With conditions such as exist on the St. Lawrence it does not form. What does happen is that sheet ice is formed in the shallow waters and the bays along the shores. The wind breaks up this formation and, with the frazil formed at the same time, the whole mass starts moving, is carried down, and with the aid of the wind enters the power canal coating the whole surface of the same with this conglomerate mass in a very short time. Once the surface of the canal has become coated, the sheet ice is deflected down the main channel, but the frazil, to which has been massed small pieces of sheet ice formed on stones and other obstructions, continues to build under the surface ice on the canal, forming na under-hung dam. This is a very serious condition and unless properly handled will ultimately shut the plant down.

Where rapids exist below the plant care should be taken to see that a suitable wing dam, protecting the tailrace discharge, can be constructed to prevent back water trouble, caused by the formation of anchor ice in the main river channel.

If the development is one involving the damming of the whole of a river with a power house and an overflow dam, a large pond is usually created backing the water upstream for a considerable distance. With a development of this nature, surface ice will undoubtedly form, at times of light load, on the pond. Should there be rapids further up the river which have not been extinguished, considerable trouble will be experienced, for frazil and anchor ice will form and flow down under the surface ice on the pond, cling to its lower side, and form an under-hung dam, contracting the free water area and reducing the capacity of the plant.

The reduction in the capacity of the plant may be serious, if the development is one where the water backed up by the under-hung dam can find another outlet.

When a development has a water storage above its power house and dam, sufficient to carry the plant's peak load over a period of from 1½ to 2 hours daily with a reduction in storage of from 3 to 4 feet or even less, and where the storage water used is built up quickly after the peak load goes off, it will usually be found that the water will rise at such a speed as to over-run the surface ice along the shores and in the immediate vicinity of the dam and power house. This condition results in the surface ice becoming very thick at the locations mentioned, and by the end of the winter season it may be found to be from two to three and a half times as thick as the surface ice in the centre of the river or power canal.

When the spring break-up occurs, more or less damage is liable to be suffered from erosion and scouring of the river banks unless proper means have been provided to take care of same, such as the facing of the river banks with concrete, timber facing, or, where possible, stone rip rap. The ice is liable to be shoved down into the headrace, if the break-up is accompanied by heavy spring freshets, and carried over the dam in layers having a total thickness of as much as 90 inches; and if the overflow is not properly protected, as well as the front portion of the power house raised sufficiently above extreme high water to prevent the ice being carried against the same, considerable damage will be done.

To provide against damage to the apron side of dams and the scouring action to the rear of the apron, tumble ponds will be found very useful, if the design cannot be made to allow the ice to discharge in its normal plane and not on end.

The other troubles from ice are those affecting the operation of the hydraulic equipment, and have been very difficult to overcome with plants of the multi-runner type of design.

The development of high specific speed runners, permitting higher rotational speeds, and the successful results obtained with modern designs of thrust bearings have resulted in the passing away of the multi-runner type of turbine installation, in favor of the vertical shaft, single runner unit.

The majority of developments up to 1912 of low and medium heads consisted of horizontal installations of the multi-runner type, with two, four, six and sometimes more runners on a shaft.

The first plant of the vertical shaft single runner type of unit, to be placed in operation in Canada, was the plant of the Cedars Rapids Mfg. & Power Company, Cedars, Que. The result of four years operation has proved that it is possible to eliminate the ice troubles which have been a bugbear of the multi-runner type of plant.

At the time this plant was designed, careful attention was given to the ice problem, for it was well known that the St. Lawrence River above and below the plant remained open the whole of the winter season, and consequently the ice conditions encountered would be most severe.

Experience gained in the operation of other hydro plants was used to great benefit in this design, to effectively overcome the operating difficulties due to ice, e.g.:— enclosing of the gate house so that the hot air of the generator room enters it, the placing of the screens or racks in such a manner and position as to keep the cold outside air from them, the dividing of the racks into six sections for each unit, the installation of an electric crane for handling them quickly, motor-driven head gates for each unit, and a set of emergency gates permitting the cutting off of the water completely so as to examine racks and motor-driven head gates; have all worked out very efficiently.

Some minor changes have been made in the top rack sections. The original spacing between rack bars was 2½ inches, but this spacing was found too close and every other bar was removed, leaving the spacings 5 inches.

Each of the main units is supplied through three openings of 12′-8″ x 28′-0″. The water enters the openings at approximately 3 feet per sec. and passes to the wheel through spiral concrete casing, entering the wheel at a velocity of approximately 7¼ feet per second.

It has been found that when frazil and anchor ice are running, there is generally mixed with them a certain amount of fine sheet ice, as well as debris of all kinds. When this ice gets on to the racks it coats them so that it blocks off the water from the wheels. By working ordinary rakes up and down the rack bars the ice can be worked through. The procedure, however, is to raise the top section of the racks and hit them a slight blow with a wodden maul when the whole ice coating, which may be from 2 to 3 feet thick, will fall away and go through the wheels. Should the ice show any tendency not to enter the spiral casing by manipulating the head gates, then by changing the velocity of entrance, this trouble may be overcome. This method of operating is only adopted when anchor ice is running heavily. Under ordinary ice conditions the top sections of the racks are allowed to remain up.

Four years of operating with severe winter conditions have demonstracted that no matter how much anchor ice and frazil comes down to the plant, whether before or after the surface of the canal is coated with surface ice, no ice choke takes place in the guide vanes, gates or wheels. The explanation offered for this condition is that the metal parts of the wheel installation are maintained at a temperature just above freezing, thus causing the ice crystals to slip. The difference measured on the thermometric scale is infinitesimal, though the physical results are enormous.

The metal parts are maintained at the slightly higher temperature due, we think, to the following causes:—

1. Power losses in turbine confined to small area.
2. Conduction of heat from steel concrete scroll casing.

3. Conduction of heat along shaft cover plate and gate mechanism.

Operating with the top sections of the racks up when anchor ice has been running heavily has caused some little operating difficulties. Considerable amount of debris has been carried into the runners such as timber, water-logged railroad ties, stumps of trees, stones, etc. One of the stones removed from one of the runners weighed between 600 and 700 pounds. It is estimated that the volume of anchor ice to support the large stone mentioned above, would be between 80 and 90 cubic feet. With this large volume of ice no blocking occurred and the only indication that something was in the runner was a broken gate arm, the unit continuing to develop its power with this large stone in one of its buckets.

The operation of this plant has demonstrated that no trouble from ice shut-downs will be experienced in plants adopting the single runner units and with openings in the guides, gates and wheels as large as the Cedars wheels.

After it had been satisfactorily demonstrated that no matter how large a volume of floating spongy ice entered the power house, it could be put through the wheels, attention was then turned to the headrace. The head-race is slightly over two miles long, at the present time, and about 800 feet wide on the surface of the water.

We found there was a considerable decrease in flow in the canal, due to the ice covering and the reduction of free water area on account of the under-hung dams formed by frazil, anchor ice and sheet ice getting under the surface ice, more particularly at the entrance to the canal. This would be a most serious condition for the plant when the full number of units is installed.

We have, therefore, studied the conditions very carefully and have adopted the method of completely removing approximately half the ice surface from the whole length of the canal, thus operating with open water during the whole of the winter. With this method of operation we have found the sluices, which were originally installed with 16 foot openings for handling ice, were the source of considerable trouble, as they would not handle the large sheets of shore ice 26 to 40 inches in thickness, which are liable to enter the canal when it is kept open.

Last summer we reconstructed our west end sluice-way, erecting two openings of 44 feet each, with from 5 to 6 feet of water flowing over the crest; and, it is our intention to rebuild during the coming summer the sluice-way next to the power house, installing two openings each 60 feet in width.

To close these large openings after the ice season is over, a special stop-log dam has been designed with openings for logs approximately 15½ feet in length. The steel work is lowered into place and the logs inserted after it is in position.

It may be of interest to describe some of the experimental work that was carried out before we found that the only way to operate the plant was to keep open water in the canal the whole year round.

It was thought possible that floating ice could be diverted from the canal by means of a suitable boom stretched at a proper angle from the most westerly sluice-way to the north shore of the canal, but this was found not to be the case. The ice entered the canal in such large volumes that lighter ice, such as frazil and anchor ice, went under the boom and the large sheet ice ultimately broke the boom.

The next method we experimented with was to erect a timber ice deflector at a point about 1500 to 1800 feet above the entrance proper to the canal, the idea being to deflect the large surface ice which breaks away from the shores out into the main channel, as well as frazil and anchor ice.

It was found that this method of protection was not very efficient when the wind conditions were such as to hold all of the ice, floating in the river above the diversion dam, towards the north shore. It was also found that, during extreme cold weather conditions, the reefs in the river channel outside the entrance to the power canal would become heavily coated with anchor ice, and that with these dams and the diversion dam ice coated, the amount of water permitted to enter the canal would only be a small part of what would ultimately be required. We, therefore, removed our experimental diversion dam and are now taking care of whatever ice enters the power canal.

We are still making improvements in our canal entrance in the way of increasing the channels of supply to the power canal by removing some of the reefs, which have been a source of trouble during the ice season, and by the time the remaining units are installed, our canal will be in proper shape at the entrance.

We are thoroughly satisfied, from the experience gained in the plant's operation during the past four years, that with the modifications in the ice sluices which will be completed next summer, and the work completed on the intake, the plant will operate to its maximum capacity the whole year.

One of the most important features in the handling of the ice is to have the proper equipment. When the winter season sets in, the power canal does not freeze over but becomes coated with a rough surface of ice blown in by the wind, the mixture consisting of frazil, sheet ice and sometimes snow. It usually only takes four to six hours with suitable wind conditions to coat the two miles of canal with ice.

We have provided two ice breakers, which are really tugs reinforced for the breaking of ice. It has been found that after the surface of the canal has become coated with the conglomerate mass, it takes several days of extreme cold weather before it becomes consolidated to such an extent that the tugs have difficulty in breaking it up.

With proper ice sluices so as to avoid jamming when the broken surface ice is carried down, a channel one hundred to one hundred and fifty feet can be made from the power house to entrance in from a day to a day and a half, with the two suitable ice breakers.

We have found it necessary at times to resort to the use of explosives in breaking up ice jams, and have experimented with various kinds of explosive to ascertain which would be the most efficient in ice. We have used 60%, 40% and 30% nitro-glycerine dynamite in sticks of 1½ inches in diameter and 8 inches long, made up in charges of 7 to 8 sticks, but they were all too fast and would only pot-hole the ice. With the aid of the Canadian

Explosives Company, we obtained an explosive made from ammonia nitrate, having a strength equivalent to 30% nitro-glycerine dynamite, made up in sticks 3 inches in diameter and 8 inches long. This explosive gives a large gas volume, is much slower in action, and very satisfactory results are obtained. It has the advantage also of not freezing unless the temperature is five degrees or more below zero, and if left in the water an hour or longer dissolves and is not dangerous.

In conclusion, I wish to express my thanks to my assistants, Messrs Read and Cunha and our Resident Engineer at Cedars, Mr. Hawley, for the assistance rendered in the preparation of drawings and photographs, as well as Mr. John Murphy for photographs from which slides have been made.

Discussion

K. B. Thornton, A.M.E.I.C.: The paper presented by Mr. Wilson is of interest particularly to those who are engaged in operating hydro-electric plants. It is of interest not only to engineers but also to business men and investors who have invested capital in hydro-electric enterprises in this country.

In the old days, the advent of winter and frazil troubles was often a nightmare to the operating engineer suggesting strenuous days and sleepless nights; while to the ordinary layman it suggested the stopping of cars, the putting out of lights, the shutting down of waterworks; and, to the business man, it immediately suggested an increase in operating expenses of the hydraulic power company in which he was interested, and a consequent decrease in both gross and net earnings.

The paper of Mr. Wilson, together with papers which have been previously presented on the subject, is another assurance to engineers and the public generally that power plants can be operated successfully here in Canada throughout the winter months. It seems particularly fitting that Mr. Wilson's paper should be read here, in Ottawa, because those of us who are engaged in the hydraulic operation of plants owe a tremendous debt of gratitude to the pioneer investigational work which has been carried on in Ottawa by Mr. Murphy. That work was started about twenty years ago, and the results have been duly recorded from time to time before scientific societies and in the technical journals.

All plants in our northern climate have to contend with ice troubles of one sort or another, but there is no doubt that the contribution of information by Mr. Murphy, Dr. Barnes, and Mr. Wilson, have greatly improved the methods adopted by most companies in handling their ice troubles.

My own opinion is that in the not distant future these methods will be further improved, and that in addition more active steps will be taken to reduce the formation of the ice which causes all the trouble.

In connection, however, with the handling of ice in general at power plants, I would give this word of warning to those who are not specially familiar with such work, that experience has shown that the handling of ice conditions, pertaining to any particular hydraulic development are, as a rule, peculiar to that plant and that it is unsafe, except in a general way, to deduce from results obtained, some general formula for the handling of ice troubles at plants in general.

As to the methods mentioned by Mr. Wilson for the handling of ice at Cedars, they are very interesting indeed. The increasing of the sluiceway openings is, to my mind, a very distinct improvement over the types of openings generally adopted by designing engineers, whose tendency is usually to make these openings far too small.

As regards the protection of the intake, it seems to me that a series of overlapping parallel booms with aprons, not a single boom, would tend to throw the ice farther out into the river and help to prevent its entrance, at least in such large quantities, into the forebay or intake canal.

Mr. Wilson has spoken upon the subject of under-hung dams, and has shown a photograph where sixty per cent of the cross-section was taken up with ice. My own experience has been that such dams will always be formed when rapidly running water reaches a forebay entrance where the velocity in the forebay is low. My experience has been that, where the entrance of the forebay is adjacent to rapid running water, either under condition similar to those at Cedars, or where you have a canal with a forebay at the end of it, as soon as the water adjacent to the forebay, and which has attained a fairly high velocity, comes to the entrance of the forebay, where the velocity is very low, you have an under-hung dam formed. In the plant I am looking after at the present time, this is the one and only source of the trouble that we have; there is a six-mile canal terminating in a large forebay. Where the canal forms the forebay, we have an under-hung dam formed, and every year we have to cut a channel and chop it out.

To digress for a moment, Mr. Wilson referred to the care necessary in the selection of the power site, but my own experience has been that there is little or no latitude in selecting a river power-house site, inasmuch as the site is generally pre-determined by nature, and the conditions must be accepted as they are found. Any small change in location resolves itself into a simple question of the investment involved.

Of course, once a plant is designed and placed in operation, the operating engineer usually finds some improvement that he could make if he were to design the plant all over again. The methods adopted by Mr. Wilson, I have no doubt, are the best, or at least as good as any, that could be designed to combat the conditions under which the Cedars plant has to operate, but, personally, I should not like to make a practice of passing boulders through my water-wheels.

It seems to me, as I have already stated, that some effort should be made to reduce the ice-forming conditions, and I would like to refer to certain statements that have been made in this connection.

In June, 1906, Mr. Wilson, in his article entitled " Influence of Ice on Hydro Development " in the Electrical News, in reference to rapids located above a partially canalized river, states:—

> " Where possible dams should be installed to drown out the rapids and the impounded water drawn from the bottom of the dams by means of sluices or other such openings."

Again, in 1908, before the Undergraduates Society of McGill University, Mr. Murphy delivered a paper entitled: "Ice Troubles in Hydraulic Power Work and Methods of Overcoming them."

In this paper, Mr. Murphy, referring to the reduction of flow due to the blocking of ice, states that the destruction of rapids by the erection of dams is one method of preventing frazil. He says:

> "These troubles can only be removed by the building of dams and thus creating immense storage reservoirs from which an equable, steady flow may be obtained all the year round, the spring floods and the fall and winter droughts will then be unheard of."

Again, in the same year, before the Royal Society, Mr. Murphy said:—

> "The destruction of rapids by the erection of dams will prevent the continuous all-winter formation of ice spicules, or frazil."

I believe the ideal situation is the completely canalized river, or a canal, as opposed to a partially canalized river. I cannot agree with Mr. Wilson that means cannot be provided to mitigate or partially eliminate ice trouble where water is obtained through canals.

A river project, or a partially canalized river, with rapids above, or even below, the site, simply means operating a plant with the foregone conclusion that there will be ice trouble during the winter and that the success in handling the situation will depend largely on the resourcefulness and the ingenuity of the engineer supervising the plant in adopting the best remedial schemes under the circumstances. It seems to me that this field of investigation, covering the reduction in the formation of ice, is one that has been largely neglected.

I am strongly in favour of canals, or completely canalized rivers, as opposed to developments or partially canalized rivers. Attention has been given by numerous boards which have been formed, the Stream Flows Commission in Quebec, the Power Board here in Ottawa, and many other commissions, to the investigation of storage on rivers, with the idea of conserving the water, avoiding floods, and preventing droughts in the fall. If it were realized that by installing these reservoirs and water storage dams, ice conditions will be tremendously improved, I think a good deal more effort would be made to carry on that work in view of the benefits that would accrue from the elimination of the troubles which are due to the blocking of ice, causing floods in the spring and immense losses of time and power in the winter. It is, therefore, my idea that this feature in reducing ice-forming conditions should be given more consideration by engineers, and particularly by government boards that are working on problems of conservation, because it is a field that has been neglected and up to date the efforts of engineers operating plants have been entirely directed to eliminating the ice conditions as they find them at these particular plants.

There are several interesting things that one might refer to in general. Mr. Wilson has referred to the forebay ice being thicker at the edges than in the centre. That always happens whether you vary the forebay level or not. I have seen forebays where we did not vary the elevation a foot, and where, at the end of the winter, at the edge the thickness of the ice was two or three times the thickness of the ice in the centre, which I ascribe to the slow velocity at the banks' edges, and also due to the frost penetrating the banks. I think Mr. Wilson's papee is a very excellent contribution to the discussions that havr taken place at this most excellent Annual Meeting.

John Murphy, M.E.I.C., Ottawa: Mr. Thornton has made complimentary reference to my original or pioneer work on the ice question, and I thank him for his courtesy. I have copies of my various contributions in my hands but I will not read them all to you.

Through the courtesy of the manager of the Chateau, Angus Gordon, and the hearty co-operation of his chief engineer, T. E. McGrail, I have arranged for a demonstration of frazil manufacturing which I think can be made in this room. The engineer has been placing bottles of water in the refrigerator and bringing the temperature of the water gradually down to the freezing point. The water is at that temperature now, and, if he can manage to bring that water up to this room without agitating it and without increasing its temperature, I hope we will be able to show you the creation of frazil in this room. Frazil is instantly formed in water—when water is at the critical temperature—if the water is *disturbed* of if it is even shaken *by the wind;* if the water is agitated by coming into contact with a rack, or with a water-wheel, it turns into frazil. If you went down to the refrigerator plant in the basement of the Chateau I could surely show that to you, but I am quite hopeful of being able to do it in this room. The point I wish to emphasize —the *disturbance* of water and the creation of frazil by such *disturbance* or *agitation*—is so important that it is worthy of special attention. Something spectacular appeals to us all much more strongly than words.

A great deal has been said recently about the damming of rivers, but, if we dam large rivers, such as the St. Lawrence, and do not properly control the water and ice, "where may we land?" "Heat metal and ice will not adhere to it"—that's the whole story of successful frazil combatting which I have preached for 20 years. At this convention where we have representatives of the Quebec Streams Commission, the Commission of Conservation, the Water Powers Branch, the Department of Marine and Fisheries, the International Joint Commission, the Department of Public Works, the Department of Railways and Canals, the Dominion Power Board, the Honorary Council of Scientific and Industrial Research, the Universities, to say nothing of the power companies and corporations which are all intensely interested in the ice question, I think it is advisable to make an appeal so that that question may be taken up and seriously considered by some of those great bodies. When the shutting down of a power plant, or the flooding of a whole district, may depend on whether the wind is, or is not, blowing, it is in my opinion a very serious state of affairs and deserves consideration.

When frazil is about to form or is forming in water, the water is *at* the *critical temperature.* Frazil will be created or formed in water which is *at the critical temperature*—32° F. or 0° C.—under either of two conditions:

first, if the water is *disturbed*, and, second, if the water comes *into contact with anything which has a temperature one ten thousandth (1/10,000)—the most minutely conceivable fraction—of a degree below the freezing point.* When water in the winter time is required to flow uninterruptedly through dams, or over dams, and, when it is needed to operate turbines, it must, of necessity, be disturbed or agitated. Therefore, the edges of the openings in such hydraulic works through which water and frazil are to pass must, it would seem, be *prevented* from having their temperature *lowered* below the freezing point, or otherwise, clogging of these openings will necessarily ensue. Floods will follow because floods are caused by such blockades. Is it not our duty to try to prevent such occurrences? Should we not all join heartily in such a campaign as the one I have been engaged in for many years? Is it not the *duty* of some of the many organizations which I have above mentioned to take up this all-important matter?

I have, many years ago, in a rough but very practical way, shown that the heat from a tons of coal, burned in 24 hours, can prevent 2,000 c.f.s. of water and frazil from shutting down a power house. That demonstration has been repeated many times since, in a number of plants which I can name, but no thorough scientific accurate study has ever been made of: (1) the physical actions involved, or, (2) the actual definite amounts of heat which are required to prevent frazil formation in given quantities of water under various conditions. Had I the personal means of doing this work, I would surely have it done.

Mr. Murphy's remarks were interrupted at this point by the arrival of bottles of water brought directly from the refrigerating plant in the basement of the hotel. These were placed on tables and Mr. Murphy and several members proceeded to demonstrate the process of water crystallization or frazil formation. When the bottles of water left the refrigerator they were absolutely clear. They were clean when handed around the room. Mr. Murphy took some of the bottles up, shook them vigorously, and crystallization, due to agitation, immediately resulted. Other members got similar results.

Mr. Murphy said: The first point I want to make clear is that water, without a trace of ice in it, will crystallize if *disturbized*—frazil will be formed.

The next point I want to make is that if you introduce something that is a little colder than the water, such as any of the chilled vulnerable parts of a water power plant, frazil will be produced.

Mr. Murphy, and others, demonstrated this latter point by inserting in some of the bottles iron rods, the temperature of which had been reduced below the freezing point. Beautiful frazil crystals were formed and clung to the rods like thistles. Continuing, Mr. Murphy said: These natural phenomena have been taught for a generation, but nobody pays any attention to them. Some of you may have seen such demonstrations in laboratories. I often make them at home. E. L. Avery, Ph. D., in his Principles of Natural Philosophy, says:—

> "Touch a pitcher of water standing in a cold room all night, and it turns to ice; or, drop in a particle of ice, and it turns to ice. We may say that liquids, in this condition, *have a tendency to become solid*, and are restrained only by the difficulty of making a beginning."

The "difficulty" as I have shown, is overcome by *agitation*, or by contact with a piece of ice or a cold rod—(an iron rack, a gate or a water wheel.)

Give the frazil-forming a *start*, as when the water is shaken by the wind, or by coming in contact with a rack, or a water-wheel, and the process makes great headway; *prevent it by introducing a little heat and it does not start.* Our esteemed friend, Dr. Barnes, of McGill, in 1906, was good enough to refer to some successful frazil-combatting which I had done before that date. I cannot understand how any McGill graduate can discuss the ice question without praising Dr. Barnes' great work. On page 99 of his book, entitled "Ice Formation," he says:—

> "It is *probable* that crystallization commences on the edges of a stream because of the *continual agitation* always present there. In order to start freezing some *agitation* or *nucleus* must be present, and nothing is so efficient as a minute crystal of ice. These start from the small waves breaking on the shore and freezing to ice by intimate contact with the cold air before it falls back, produces the necessary first ice over which the convection currents of air carry the necessary chill for the ice crystals to spread."

My idea in introducing these demonstrations was to set you all thinking and talking about this important subject.

Mr. Wilson has spoken about the difference between vertical and horizontal wheels and about the difference between the multiple and single-type runner. To my mind, it does not matter whether there be one runner, or a hundred runners, so long as these runners *are kept away from the cold.* If the single runners at his plant did not have the benefit of the heat of the mass of material around them, they would freeze up just as tight as a little exciter wheel, 18 inches in diameter, if there is no heat applied. The latter will run continuously if a little head is applied to it—as I have demonstrated for 15 winters.

In a letter that I sent last year to Mr. Wilson, I told him of a plant in Ottawa which had been frozen up, and stopped completely, at least ten times to my knowledge. *It had to have the ice dug out of it by hand!* I sent him a photograph of it with the following letter:—

"Ottawa, April 18th, 1918.

"Mr. R. M. Wilson, E.E.,
Power Building,
Montreal.

Dear Mr. Wilson:—

"In reply to your letter of April 17th., I beg to say you are welcome to the use of the slide made from my photograph of the Ottawa Electric Railway Company's hydraulic horizontal unit consisting of six 48-inch wheels.

"I may have told you that it *used to be* necessary, several times each winter, to dig the ice out of the unit in question by hand.

"But, since the installation of a boiler with a heating surface of 300 sq. ft., *the operation of that unit has NEVER been affected by frazil.*

Believe me,
Yours truly,
JOHN MURPHY.

To-day he astonishes me with the statement that my picture shows that multirunner wheels are always in trouble. What has the *multirunner* got to do with it? If the water wheels operate while their temperature is 31.999°F. frazil will stick! If their temperature is 32.001°F. frazil will not stick! That's the whole story. An end was put to the frazil clogging in those wheels

Hydraulic Turbine Clogged by Frazil.

shown above by the installation of a little "30 horse power," steam boiler. The steam boiler could only burn a ton of coal in 24 hours, but it enabled the 3000 h.p. hydro-electric plant to give out as much continuous daily power as could have been generated by the use of 150 tons of coal in a steam power plant.

In 1904 a little mutual admiration society, consisting of our esteemed President Col. Leonard, Mr. Kerry, Dr. Barnes, and your humble servant, might have been formed had we happened to meet. But I only learned that fact and what I am going to relate two or three years afterwards. I was in Montreal in 1906, or 1907—in any event a couple of years after I had started up a plant, which had been completely frozen up, with what might be described as "a breath of warm air" (steam) from a boiler, and I was attempting to convert our former esteemed friend, the late Mr. Walbank, the then Vice-President and Chief Engineer of Mr. Wilson's Company, to my view, by telling him what had been actually done over and over again. He said: "you will go crazy if you *think* such things as that!" "But," I said, "I have often done it." "Oh!" he said, "don't talk that way; you will go out of your head!" I told him that on the 30th of November, 1905, there were no electric lights, no cars, and no water services in Ottawa or vicinity, except those electric services supplied from one water power plant where I had installed a little steam boiler. But I could not get either his attention or his interest. He continued:—"Think of a whole river full of ice! It would take millions of horse power to do what *you want* to do." In support of my contention that there was a really good-sized frazil attack in the area which includes Ottawa and Montreal on Wednesday, November 30th, 1905—the time when my steam-heated water-wheels were given a very rigorous test—the three following newspaper extracts are presented:—

"The Montreal Daily Star, Friday, December 1st, 1905.

"*Frazil Tied Up Turbine*

"Electric Light and Car Service Handicapped by Frost.

"Frazil, that dread of all those connected with water power establishments located in climates subject to sudden drops in temperature, caused the Chambly Power House of the Montreal Light, Heat & Power Co. to go out of business yesterday afternoon . . .

"Even the Divine Sarah, playing at the Theatre Francais, was obliged to die in the dark, for electric lights, when they act badly, are no respecters of persons.

". . . . . . minute particles of frost got into the machinery, eventually stopping the turbines and cutting off the 20,000 horse-power ordinarily developed.

"This is the second time this autumn."

"The Gazette" Montreal, Friday, December 1, 1905.

"*Cold Stops Power*

"Sudden Drop in Temperature Knocked out the Chambly Station Temporarily.
"Car Service Affected Too.
"100 Cars Short.

"Ordinarily, the station supplies 20,000 horse-power, but owing to the ice, this power was reduced to about 2,000 horse-power. The Power Company had not anticipated so sudden a change in the temperature, and their steam plants in the city, which are used in such emergencies, were not prepared. The temperature dropped from 45 to 4."

"The Montreal Star," Friday, December 1st, 1905.

"Flurry in Power Was Interesting.
(89½ to 88)

"Yesterday, the rumour got around that there had been a break in the Power Company's dam at Chambly.

"Brokers got to the telephone and began to fire questions at Mr. Walbank.

"He described the accident as 'practically nothing at all.'

"The accident, while annoying for the time being, was not costly.

"It was due to the sudden change in the temperature and the formation of frazil ice."

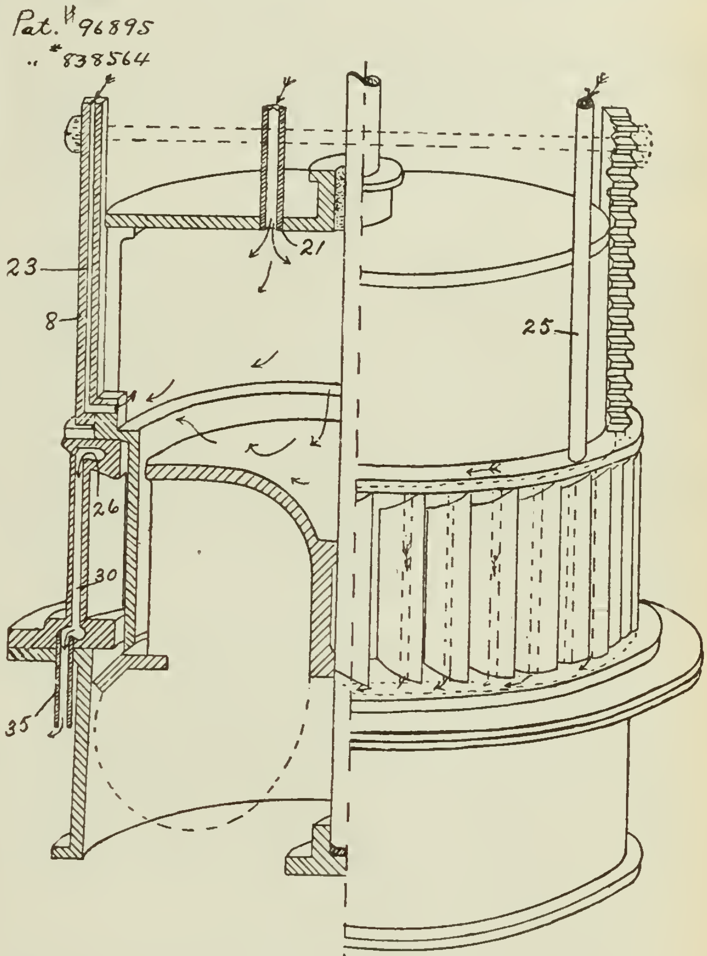
When the official in supreme charge of a public service corporation claims a shutdown of such dimensions is "practically nothing at all" it may be somewhat difficult to interest him or his staff in a scheme which will prevent shutdowns. I found it so.

I do not know whether Mr. Scott, the steam engineer who installed and started up the little ice-combatting steam plant for me, is now here at this meeting or not, but anyway he came down to the power house at two o'clock in the morning, raised thirty pounds of steam, thawed out the frozen wheels, and got the plant running. This occurred long years before I described all this to Mr. Walbank, but he only repeated "You will go crazy if you talk that way!" He proceeded: "I presided at the meeting of the Society a couple of years ago and that kind of thing was all taken up and shown to be wrong." I enquired: "When was that?" He said: "I think last year." I went up to the Society's rooms and got the proceedings—but I could not find anything about a frazil or ice discussion. I saw Mr. Walbank next day and said: "Are you quite sure it was last year?" He said: "Yes." I persisted: "What year was that?" I asked. He said: "Let me see, that was perhaps in 1904." I went back up to the rooms and read all the proceedings for the whole year, 1904,—the index was no good to me—and, as I got pretty nearly through the year's records, I came across a paper entitled "Loss of Heat in Iron Pipes," by R. W. Leonard. Col. Leonard, at that date, had the courage to place hot water in iron pipes, put them out in the cold air and keep a record of the time it took for the heat to be conveyed away from those pipes. He said: "I believe that if power plants were so constructed, ice troubles might be relieved." He said he *thought* it could be done and *I know from experience* that he was correct.

But all the recognized authorities at the meeting, the power men, trampled upon Col. Leonard's suggestion. The late C. B. Smith supplied figures showing how much heat energy must be expended to *heat water* and to *melt ice*—the figures run into hundreds of thousands of horse power—and the proposal was frowned down as well as howled down. I found, however, one line of comfort in the report of those proceedings. It was in Mr. Kerry's contribution to the discussion. He seemed to be the only man at the meeting who grasped the author's point.

Mr. Kerry said: "You have all missed the point; he is not trying to melt ice or heat water; he is trying to warm something to which ice will not then stick." That is the theory and simple fact that I was trying to propound to Mr. Walbank, and that is the message that I have been trying to send out for many years. I trust this little demonstration will set you all believing, thinking and talking. You see that I could go on for quite a long while on this important subject, but I shall not do so—the hour is too late. A *little bit of heat* will work wonders against frazil attacks. D. B. Burke, of the Ottawa & Hull Power Company, who is here, has carried on his operations continuously time and again during the winter since he installed a little steam plant for fighting frazil. His plant could not run on many former occasions without it. Now, it is running without interruption in the winter with the aid of it. There is nothing problematical about the game of frazil-combatting. The Ottawa Electrical Company and the Ottawa Electric Railway Company have had many years of similar experiences of a successful character.

Lt.-Col. R. W. Leonard, M.E.I.C.: The experiments that Mr. Murphy couples my name with were made by me in a crude way in 1904 at St. Catharines. I built the power plant of the Dominion Power and Transmission Company. We had considerable trouble with ice in the racks, and that led me to carry out some very crude



STEAM JACKETED WATERWHEEL

Waterwheels, on the above principle, are in most successful operation at the Ottawa and Hull Power and Manufacturing Company. Several units were built by Wm. Kennedy & Sons, Owen Sound, Ont. The last unit was installed in 1914 and was manufactured by Voith & Sons in Germany. A new one is being made by the Boving Company at Lindsay, Ont.

experiments with the view of preventing the accumulation of ice in the racks. The head was there considered. The wheels were of such a nature that is was not tolerable at all to permit any foreign substance to get into them. After some very crude experiments I arrived at the conclusion that warm water passed through racks made with hollow bars might overcome the difficulty.

John Murphy, M.E.I.C.: Might I interject just one more word? I have heard the statement made time and again by men who ought to know better, that if you build a dam and *destroy the rapids* you will not have any trouble from frazil. That is a bad message to send abroad because it is not true. The Decew Falls plant, to which our esteemed President refers, and which has frazil troubles, gets its water out of the Welland Canal. How far is Decew Falls from Port Colborne, Col. Leonard?

Lt.-Col. R.W. Leonard, M.E.I.C.: The water is taken from the Welland Canal at Allanburg, which is four miles above the plant, and Allanburg is about eight miles above Fort Colborne.

John Murphy, M.E.I.C.: Four miles of reservoir, eight miles of canal, no *rapids* on Lake Erie, no rapids in the Detroit river, Lake St. Clair, the river St. Clair, or in Lake Huron, and you have to go clean up to the Soo, 600 miles away to get rapids! Is anybody going to construct a dam which will make more than 600 miles of clear water without rapids? Dams should alleviate frazil troubles but they will not remove them all.

I would like to add a word about "anchor ice" which forms on the beds of streams on rocks. When rocks are cooled, by radiation, and the water is *agitated* by the presence of these rocks in the path of the flowing water (and the water is at the critical temperature), crystallization takes place and particles of "anchor ice" cling to the rocks. The Century Dictionary says the word "frazil" comes from the French "fraise" meaning a collar or ruff, so called from the manner in which this ice forms around rocks on the beds of streams. So it may be seen from the demonstrations witnessed to-day that *agitation* is at the base or root of all frazil and all anchor ice formation—at least that conclusion seems to me to be a reasonable one in view of the studies and observations I have made.

A review of my own reported positions in regard to combatting frazil may be of interest to-day.

In 1897, before the Canadian Electrical Association, at Niagara Falls, I stated frazil was likely to shut down *any* water power plant. That opinion was based upon 12 years operating experience and personal observation supported by nearly a century's frazil and anchor ice tradition handed down from operators of saw and grist mills, planing mills, foundries and machine shops, etc., etc., on the Gatineau and Ottawa Rivers.

In 1904, before the same organization, I contended that frazil *could* be prevented from shutting down water power plants: (1) if cold air were excluded; and (2) if a small quantity of heat were applied.

In 1905, I was able to report that I had actually succeeded in preventing shut-downs by applying the remedies previously advocated.

Between 1905 and to-day, 1919, such an innumerable number of proofs of the value of my frazil-combatting schemes are available that many honest men actually believed "they were taught by Noah to his sons in the Ark."

To-day I am just about ready to demonstrate that *the prevention of the formation of frazil in a stream can be* successfully carried out.

K. B. Thornton, M.E.I.C.: No, but by the construction of a dam you can reduce ice formation. If you are operating a hydraulic canal you must assist in the formation of surface ice. In our canal, which is six miles long, we have booms stretching across at frequent intervals. These booms are not put across the canal at right angles. We have put them at an angle of forty-five degrees. The ice starts to form in a V-shape from the edge of the canal. Placing booms does help in forming surface ice and consequently reducing the formation of frazil. Mr. Lefebvre tells me, in connection with the La Loutre reservoir built on the St. Maurice River, that, from the general observations they have been able to make the, frazil formation conditions in the river have been very much improved. I believe that ice conditions will always be improved by drowning out rapids. I do not say and have never said that the building of dams will entirely eliminate the formation of ice.

G. Gordon Gale, M.E.I.C.: Our observations regarding frazil may be summarized as follows:—

1. Frazil is seldom formed during the day time, and we have no record of its formation on a bright day.

2. During a cold winter frazil formations are infrequent. Troubles from this source are experienced at the beginning of the winter or after a thaw.

3. Frazil formations are frequent during a mild winter. A thaw followed by a drop in temperature accompanied by a north west wind will surely result in frazil.

Papers presented by Mr. John Murphy and Dr. H. T. Barnes some years ago have shown that the temperature of water after it has reached approximately 32 degrees F., does vary with the temperature of the air, but that this variation is measured in thousands of a degree.

It seems quite evident from our observations that there is a "critical" temperature at which frazil is formed, and also that the formation occurs more frequently when the temperature is dropping.

In previous papers dealing with this question the plant at Deschenes has been referred to as an example of a development which is frequently troubled by frazil although it is located at the foot of a lake twenty-five miles long. This does not accurately describe the Deschenes Plant. As a matter of fact there is a stretch of open water over three-quarters of a mile long, and three hundred feet wide reaching from the bulkhead to the Lake. This power canal is eight feet deep, and for the reasons mentioned in Mr. Wilson's paper it has been found necessary to keep this area open throughout the whole season.

Freshly formed frazil is very sticky and much more difficult to handle than frazil which has passed under the ice. This is probably due to a slight change in the temperature of the floating mass.

Although rapids up stream are not desirable they are probably not so dangerous as open water adjoining the plant.

I have listened to Mr. Wilson's paper, and the discussion which has followed with a great amount of interest as the frazil problem has been with me constantly for a number of years.

Montreal Discussion

At the Montreal Branch Meeting held in the rooms of *The Institute*, 176 Mansfield Street, February 27th, 1919, R. M. Wilson, M.E.I.C., re-read his paper on *The Design of Hydro-Electric Plants for Combatting Ice Troubles*, which was illustrated with lantern slides. Messrs. Murphy and Thornton contributed to the discussion along the lines of theirs at Ottawa, as included in the Ottawa report. The following discussion took place by members who were not at the Ottawa Meeting:—

Chairman: I think that Mr. Wilson is to be congratulated on the excellence of his paper and that *The Institute* is very fortunate in having such a paper presented before the meeting. Mr. Wilson has not chosen to hide any of the difficulties met with but gives a frank and extended address as to how they solved the problem of ice trouble. We will now be glad to hear any discussions on Mr. Wilson's paper. We have with us to-night Sir John Kennedy and would ask him to address a few remarks to us.

Sir John Kennedy, Hon. M.E.I.C.: Mr. Chairman, and Gentlemen: It would be quite impossible for me to take up your time to give a discussion on Mr. Wilson's paper because I was not able to be at Ottawa or to hear the first reading of the paper, I have not had an opportunity to read it since, and it is difficult to discuss a paper on hearing it the first time. I want to say this, however, that it is a very practical discussion and it gives a very liberal account of what has been done regarding the ice proposition, and how it has been done. The difficulty with many papers is that we hear only of success and do not hear of failures, but Mr. Wilson has been quite frank about discussing the failures met with. I will not take up any more of your time, but may at some future time be more capable of discussing this.

Chairman: " We have received letters, regretting their inability to be present, from Mr. Ed. Evans, Mr. H. G. Acres, Mr. J. B. McRae, and Mr. R. L. Dobbin, as follows:—

(The letters were then read; the remarks of Mr. Dobbin being particularly interesting because of his statement that this open winter has caused him a great deal of ice trouble at the Peterborough Water Works Plant on the Otonabee River.)

Chairman: We have with us Mr. Smith, of Shawinigan Falls and Cedars.

Julian C. Smith, M.E.I.C.: Mr. Murphy spoke of the shutting down of several plants about ten or twelve years ago, due to frazil. I am sure Shawinigan is outside of these, and I think it is only fair to mention that the Shawinigan plant was supplying power to Montreal on the date mentioned. I do not want the members to assume that all our plants were shut down on that day.

In considering the paper which Mr. Wilson has just presented to *The Institute*, we should keep clear in our minds the fact that Mr. Wilson has dealt principally with the ice troubles and methods applied at the Cedars plant.

The conditions at the Cedars plant are somewhat exceptional. The huge size of the units, the large amount of water involved, the size as regards both length and width of the canal are all factors that have an important bearing on the ice problem, and are factors that are met with only in part in most plant.

Mr. Wilson is to be congratulated on presenting the problem so clearly, and the fact that the plant has operated so successfully speaks eloquently of the very large amount of work done by Mr. Wilson, and his associates, on this problem. I am sure that he has spent many days and nights under extremely hard weather conditions in bringing this problem to a successful conclusion.

As a general proposition, if Mr. Wilson had been dealing with the problem of operating any plant under all sorts of ice conditions, it would seem natural that he would have given an historical resumé of this subject, in which case he would have no doubt pointed out the pioneer work done by Dr. Barnes, Mr. Murphy, of Ottawa, Mr. Kelsch, and other prominent members of this *Institute* who were engaged on these problems many years ago.

Mr. Murphy, in his part of the discussion, referred to certain interruptions of power which occurred to the Montreal service, November 30th or December 1st, 1905. I think I can say correctly, that the service supplied by the Shawinigan Co., was not affected on that date by frazil ice or other ice troubles.

The ice problem on the St. Maurice River is of quite a different nature from that which has been presented by Mr. Wilson. There, practically, is no trouble from frazil ice and the only difficulties which are experienced at all, either at Grand Mere, at the Laurentide Plant, or at Shawinigan, occur during the few hours when the ice is forming on the river. Occasionally, the first ice which forms on cold nights is broken up next day by wind or fluctuations of water levels. This ice comes down in the shape of small pieces, and would block the racks at these plants, if it was not permitted to come through.

As a matter of fact, the problem of ice in the wheels in a high head plant, that is a plant operating at a head of more than 100′, is principally a mechanical problem. The formation of ice in the wheels is largely prevented by increased pressure, and the blocking of the wheels, if it takes place, is due to the fact that ice which comes down cannot pass through the openings fast enough. It does not, I believe, under these high head conditions, congeal in the wheel case or stick to the metal parts of the wheel unless these metal parts are exposed to low temperatures. In most cases of high head plants, this exposure to low temperatures does not take place, and consequently, the ice difficulties in high head plants are almost entirely limited to troubles at the racks, or in the canal and water passages in front of the racks.

This whole question of formation of ice and the study of ice is only a particular problem in the general study of the different states of matter. We are probably somewhat mislead in our viewpoint in considering ice and water, on account of the conditions of temperature in which we live. Almost every substance has the liquid and solid state, and most substances have a certain crystalline form intermediate or merging into other conditions. Take for example a salt such as magnesium chloride or potassium chloride; in the solid state this consists of a crystalline mass. As the temperature is slowly increased, nothing happens until a melting point is reached at a temperature in the neighborhood of 800° C. This material begins to melt, and at the melting temperature, or near the melting temperature, the material exists in both the liquid state and the solid state. A curious condition, and one which I believe has a parallel in water also, is the fact that the solid material is actually soluble in the liquid material, that is to say that water at or near freezing temperature doubtless does dissolve ice crystals and holds these crystals in the same manner that any solvent holds in solution, the material dissolved.

As the energy contained in water is given up by further lowering its temperature, the ability to carry this dissolved material in solution apparently decreases, and ultimately reaches a critical point beyond which, or at which, a disturbance to the conditions suddenly brings out of solution the material dissolved.

Mr. Murphy, at Ottawa, gave a beautiful illustration of this by showing that water cooled below freezing point was still water, but upon shaking the water the ice crystals began to appear.

The discussion this evening has pointed out that one of the most serious elements in water power development in this country has been, if not entirely solved, at least brought so close to a solution that it is not a serious factor in considering a proposed power development.

Most of the men here remember the fact that, ten or fifteen years ago, there was a great deal of discussion and talk against waterpower developments, particularly on the St. Lawrence River, due to the fact that the ice hazard seems to be an almost prohibitive factor.

Canada necessarily suffers by reason of its climate. The low temperature in the winter adds to the expenditure of every citizen by reason of the need of extra fuel, extra clothing, and the fact that buildings and houses have to be constructed to meet climatic conditions. To compensate for this Providence has located extensive waterpowers in Canada and, now that the ice problems have been so well solved, these water powers should be developed as rapidly as possible in order that citizens of this country may compete, on equal terms at least, with those countries which are more favourably situated as regards climatic conditions.

The true conservation of waterpowers, as has been stated by some of the members of *The Institute* here present, consists in the immediate utilization of these waterpowers.

Chairman: I think everybody will agree with Mr. Smith in the conservation and the utilizing of electricity and our natural resources thus saving fuel that would otherwise be burned. We have with us Mr. Woodyatt, of the Southern Canada Power Co., and I am sure his experience will be very interesting.

J. B. Woodyat, A.M.E.I.C.: As I have not had much ice trouble I do not think I could add anything very much to the discussion.

Chairman: Perhaps Mr. Wm. Kennedy would add something.

William Kennedy, M.E.I.C.: I was very grateful to Mr. Wilson for his paper and for giving us the information that he has. He has dealt with one particular case and has given much detailed information on it, which certainly does not apply in all cases. For instance, he states that in every case the canal must be kept open, whereas in our case the object is to get it frozen over as quickly as possible. I was very interested in the illustrations because it brought to my mind a small mill I was in charge of some forty years ago. We had to close down this mill about 4.p.m. in winter, when the ice was forming, and then cut branches of trees and extend these across the canal in order to get the surface frozen over, otherwise they had to close down every night and remain closed until about 10.a.m. This actually confirms Mr. Thornton's theory, although in another way. The condition of the Peterboro plant is very much the same. They have no trouble whatever when the ice forms; the trouble this year is due to the open winter. They have had more trouble this winter than in twenty-five years. We have been running the new plant now for two or three years without very much trouble. The conditions at Peterboro are not very favorable as regards anchor ice, yet, the plant has been running very regularly without the application of steam and with only a few days shut-down. The DeCew Falls plant had very little trouble, and any that did occur was through carelessness, either because ice blocked the racks or sufficient heat was not on. I may say that the trouble with nearly all the plants is caused by frazil, when we cannot get surface ice formed. Mr. Wilson's case requires that the canal be kept open. The need in most of our plants is to get the canal frozen over, after which we have no trouble with frazil. I do not agree altogether with the statement confidently made that the large single-runner turbine is the best. I think that the application of heat to keep milti-runner turbines in operation is as satisfactory as the installation of single-runners. Mr. Murphy has stated that even a small plant can be run satisfactorily when heat is introduced. This, so far as I know, is a fact and I do not expect to have trouble with the plant now building at Ottawa.

R. M. Wilson: The point I wanted to bring out in the paper was to show that the condition at Cedars is a condition such that, if it can be solved, there need be no more ice troubles. I have been connected with the operation of hydro-electric plants for over twenty-two years. At Cedars we have got a short canal; we have the river partly dammed across; and we have the troubles already stated. The question we have been solving is the keeping of ice from getting in and beyond the sluices and racks and so blocking them up entirely. Mr. Murphy has spoken of heating. The units at Cedars are ten thousand h.p. each, the total installation of which will be 18 units. If we had the same size as Mr. Murphy, 2,500 h.p. each, we would have seventy-two units, and it would be impossible to keep operating. A great number are under the impression that this winter, being a mild one, there has not been very much ice trouble. Our experience has been that where winters are mild ice troubles are greater and more frequent.

Such conditions as those existing this winter never give you an opportunity of getting and keeping the headrace of the plants permanently frozen over. It may be of interest, in conclusion, to state that, on the Richelieu

River, during twenty years operation, conditions have never been as bad as they are this year.

Chairman: I am sorry that we have to cut short the discussion. I think we all agree that we should publish the paper and the discussion in *The Journal.* It is a step gained now that these ice problems have been solved, and that no further fear of winter need be had. I would now ask a vote of thanks from Mr. Ross.

R. A. Ross, M.E.I.C.: Mr. Wilson, I thank you for your paper, and also Mr. Murphy for his discussion. If I may be allowed to say so, I think the paper, with the discussion, is a classic. We have been groping in the dark for a number of years and now it has come down to a stage where any plant, small or large, can be handled effectively. I have not had experience in actual operating, but have been taking up the matter from the side lines, so to speak. I can remember when Mr. Walbank stated that his trouble could be solved in this way, and also Mr. Murphy with his *heresies,* and am struck with the picture of the *doubting Judas* which would illustrate my frame of mind at that time. We have gone over the matter thoroughly and I think that a great number of points were brought up which are of exceptionally great value at the moment. These gentlemen have labored long and well in the ice fields and I sincerely hope that they will be amply rewarded for their labors, and that, in their future state, they will look back on their ice experiences as some of their most pleasant memories.

Frederick B. Brown, M.E.I.C.: May I be allowed to second the vote of thanks, proposed by Mr. Ross. The discussion, to my mind, shows that every plant must solve its own particular ice troubles, if it has any. I know of some plants in Canada that have none. It is clear in this case that what is one man's meat is another man's poison. It reminds me of an old Justice of the Peace who was given a knotty question to decide between the parties before him. After thinking it over he said, "*Both are right—go ahead gentlemen.*" In this case, I think, it is a case of both being right, and *The Institute* is to be congratulated on the paper and the discussion. The whole shows that Canadian engineers can and do successfully solve ice problems, and, as my friend Mr. Thornton has just remarked to me, the answer is—the plants keep running. I, therefore, have great pleasure in seconding Mr. Ross's motion.

Applause and the thanks of the meeting were extended to the speakers by the Chairman

Written Discussion by R. M. Wilson

My object in submitting my paper to the members of *The Institute* was to place before them the experience gained over a number of years in the handling of the ice problem at the Cedars plant, dealing particularly with the open canal and the single runner type of unit. The references to other plants were only casual and illustrative of the points in connection with the Cedars development.

It was not my intention to write a paper on the subject of handling ice under all conditions existing in Canada. If I had presented a paper on this subject the first thing I should have done would have been to refer to Dr. Barnes and the investigation work carried out by him on the St. Lawrence River, and also to his several excellent publications on the subject of ice formation.

It would have given me also great pleasure to have referred to the work done by Mr. Kelsch, Mr. Murphy, Mr. Groat, the engineers of the Shawinigan Company, and other men in Canada, and elsewhere, who have contributed to our knowledge on this subject.

I agree most heartily with Mr. Thornton that an effort should be made to reduce, as far as possible, the ice forming conditions in our rivers, which are responsible for a great deal of trouble to hydraulic plants and the cause of considerable damage being done yearly to property. It would also, in my opinion, be a great help toward earlier navigation in the Spring; an important matter on a river such as the St. Lawrence.

Mr. Murphy has mentioned results he obtained from a small amount of steam, produced by the burning of a ton of coal, in preventing frazil from adhering to parts of wheel installations under water.

Experiments carried out in November, 1904, by Mr. Fleet and some of our operating staff, at one of our hydro-electric plants, demonstrated that the steam produced by the boiler of a small dinkey locomotive, when turned into one of the steel flumes, prevented the unit installed therein from being shut down by frazil; the method of using the steam being a most inefficient one.

Mr. Murphy mentions that on November 30th, 1905, there was a good sized frazil attack in the area which includes Ottawa and Montreal, and quotes extracts from two of the Montreal daily papers of December 1st, 1905. In these extracts mention is made that 20,000 h.p. was cut off. In order to remove any wrong impression which might be created by reading the extracts a statement of facts will serve to set the matter right.

In the first place, there was trouble experienced from ice at the Chambly plant on the day mentioned, but 20,000 h.p. was not cut off. The plant could only develop, at the time, about 7,000 h.p. due to low river flow, which occurs every year during the fall and early winter. In the second place, only 5,000 h.p. out of 7,000 h.p. was affected, and, whilst a part of the trouble was due to frazil in the wheels, the greatest difficulty was from ice on the racks, consisting of frazil and small size shore ice shutting the water off from the units. The trouble was overcome in a few hours.

The other plants serving Montreal with light and power at the time were in no way affected, viz.: the Lachine plant, and the plant of the Shawinigan Water & Power Company, Shawinigan Falls. Inconvenience was caused to some customers for a short time, which could have been avoided had there not been at the time a two-phase system operating in Montreal, and which was in the course of re-construction, as all the load could have been taken care of by the plants not affected.

Railway Electrification

By John Murphy, M.E.I.C.

An entire session of the Ottawa Professional Meeting was devoted to this subject, being that of the morning of Thursday, February 13th. It was introduced by John Murphy, M.E.I.C., electrical engineer, Department of Railways and Canals and Railway Commissioners, and was continued by W. G. Gordon, F.A.I.E.E., Toronto, and F. H. Shepard, A.A.I.E.E., New York.

Enthusiasts on the subject of railway electrification, and, I think, I may also speak for Mr. Gordon and Mr. Shepard, never intend, while advocating electrification, to say a word in disparagement of that great machine, the steam locomotive. It would be folly to do so. The progress and the development of the whole world have been largely dependent upon the steam locomotive. Many, however, who have given the subject of railway electrification serious thought feel that an educational campaign should now be undertaken so that the public at large, as well as all railway men, may the sooner appreciate the real value of its more capable brother, the electric locomotive. In order that one important economic feature of the operation of electric railways may be easily appreciated, I have had officials of the Ottawa Electric Railway Company prepare the following figures: The equipment of the Ottawa Electric Railway consists of 106 cars; and the average horse power of the motor installation on each car is just about 106 horse power. 106 multiplied by 106 is 11,236 horse power. And, if those 106 cars were equipped as steam locomotives, there would, of course, be fires always burning under 106 boilers; and coal would be being consumed continuously, while these 106 cars were out on the road, whether they were or were not moving. But instead of 11,236 h.p. being necessary to operate the Ottawa Electric Railway, the maximum power ever demanded is only 7,000 h.p., and the average power is about 4,500 h.p. Therefore, a power plant having a load-carrying capacity of from 40 per cent to 62½ per cent of the total aggregate capacity of the cars is quite large enough to supply the power demands of all these cars— when they get their power from one or more stationary plants, either steam or water-power.

It is many years since the N.Y., N.H. & H.R.R. cut its coal consumption in two by electrification.

Canada's coal shortage and its transportation difficulties, coupled with Ontario's power shortage during the war, have forced forward the question of railway electrification. It demands attention. Canada's steam locomotives use 30 percent of all the coal consumed in Canada. But what is obtained *at the wheels of the steam locomotives* as the result of the mining, the hauling, the handling and the consuming of some 9,000,000 tons of coal on locomotives each year in Canada? That is surely a pertinent question. The answer is as follows:—Only 3 (or 4) percent of the mechanical energy which is in the coal itself, in the form of heat, becomes available in the form of power at the wheels of the steam locomotive! The 97 percent (or 96%) of the energy in those 9,000,000 tons of coal, *which is lost* every year in the transformation of the heat energy of the coal into the mechanical energy of the steam locomotive, cries out against a continuance of such wasteful procedure, and as engineers who are expected to guide the non-technical public, it is our duty, in my opinion, to industriously advocate the electrification of railways at every advisable opportunity.

The steam locomotive needs on an average 6 lbs. of coal per h.p. hour because it burns coal while in the round house getting ready for its run, while standing on sidings and at stations, as well as while hauling its loads. The stationary steam plant, with its condensers and other fuel-saving apparatus—to say nothing of its better load factor —can produce power *at the switchboard*, which can be transmitted electrically to the *wheels of the locomotive* in such an efficient manner that from one-half to two-thirds of the railways' present coal needs can be saved by electrification.

No argument is required, I think you will agree, to support the contention that eliminating the need for coal at a considerable distance from the mine *is* a greater measure of relief, and of true conservation, than increasing mine production and thereby adding more load to the already overburdened railways. Reducing coal consumption automatically relieves or releases men and apparatus all along the route from the mine to the consumer; it also relieves the route itself from some of its congestion.

So eminent an authority as Mr. E. W. Rice, the President of the American Institute of Electrical Engineers, addressing that body in New York in February, 1918, made the following statement:

> "It is really terrifying to realize that 25% of the total amount of coal which we are digging from the earth is burned to operate our steam railroads—and burned under such inefficient conditions that an average of at least 6 pounds of coal is required per horse-power-hour of work performed. The same amount of coal burned in a modern central power station would produce an equivalent of three times that amount of power in the motors of an electric locomotive, even including all the losses of generation and transmission from the power station to the locomotive."

Here in Canada steam locomotives consumed about 9,000,000 tons—30% of the 30,000,000 tons of coal imported into and mined in this country. Our 9,000,000 tons cover, I believe, wood and oil consumed on steam locomotives; some 49,000,000 gallons of oil are covered by the Canadian record. But, in the United States figures, 40,000,000 barrels of oil, 15% of the total oil output, are not included.

The total conservation of the elimination of the necessity for mining—those great quantities of fuel would be secured if all the railways were operated electrically and if the electrical energy were generated from water power. Modern steam central stations can save from 50% to 66% of the coal now used in steam locomotives if the latter are discarded and electric locomotives used instead.

With such possibilities for fuel conservation in sight may we not soon expect to learn that the fuel controllers in both countries have asked the railways, and that the railway managers have asked their engineers:—" How many of these millions of tons of coal can you save—when will the good work of railway electrification begin?"

It is said our fuel shortages in the years 1917 - 1918 were due to a combination of bad weather and inadequate transportation. Railway electrification will reduce coal consumption, coal haulage and the mining of coal; it will also greatly improve traffic conditions; electrification, therefore, seems to be the solution of the problem.

Railroading in the mountains is the most strenuous kind of railway work, and I have chosen some mountain sections as examples of what can be done to them. The Butte, Anaconda & Pacific Railroad, by electrification, is said to have increased its ton-mileage 35% and at the same time decreased the number of trains, and their incidental expenses, 25%. The time per trip was decreased 27%. It is said their savings in the first year's operation, after electrification, amounted to 20% of the total cost of electrification. That railway buys electrical energy from water power plants.

On the Norfolk & Western Railway electrical energy is obtained from their own steam station. Twelve electric locomotives have replaced 33 Mallets of the most modern and powerful type. The tonnage has been increased 50%, and electrification obviated the necessity for double tracking. The salvage value of the released steam engines was 45% of the cost of electrification. Electric locomotives make 8 times as many miles per train-minute-delay as the steam engines. Their terminal lay-overs average only 45 minutes and they are double-crewed every 24 hours. Pusher engine crews have been reduced from 8 steam to 4 electric. Steam pusher locomotives have been reduced from 7 steam to 2 electric. Steam locomotives used to " fall down " in cold weather—the electrics always " stand up," they are really more efficient, in cold weather. As you all know, during our severe winter weather, trains are delayed by the extreme cold as well as by storms. In conversation with a superintendent of a northern division not long ago, I was told that when the temperature fell to zero he at once reduced his train-loads ten per cent ; that if the temperature went to twenty below zero, he reduced his train-loads twenty-five per cent; and from that on he was in mortal terror of his trains being tied up entirely. With extremely low temperatures and heavy snow storms tie-ups are inevitable on steam railways.

Speaking at the New York Railway Club in March, 1917, the electrical engineers of the Norfolk & Western Railway stated that: " coal wharves, spark pits, water tanks and pumps as well as roundhouses and turntables have disappeared from the electric zone. Our track capacity has been doubled. Our operating costs have been reduced. From an engineering, an operating and a financial viewpoint our electrification has been a success." Speaking of the value of *regenerative electric braking* they went on to say:—" The use of the air brake is practically eliminated, it is only used to *stop* trains; it is regrettable we are unable to put a dollars and cents value on this great asset; to appreciate it properly one must have had experience with the difficulties of handling 90 car trains with air. Trains of 103 cars are now taken over the summit, 12 to 20 times every day, down the 2.4% grade without even touching the air. We never broke a train in two or slid a wheel. It is done so nicely we would'nt spill a drop of water out of a glass in the caboose."

The 440 route miles of the Chicago, Milwaukee & St. Paul Railway which have been electrified will soon be augmented by 450 miles more. Nearly 900 miles of railway and about 33% in addition for passing-tracks, yards, industrial tracks and sidings will soon represent the extent of the world's greatest railway electrification. Among the advantages secured by this railway on its electric sections are the following:—The " cruising radius " of each electric locomotive is twice that of the steam engine. Sub-divisional points, where freight crews and steam locomotives were formerly housed and changed, have been abolished; the passenger crews' runs are now 220 miles instead of 110. For railway purposes, these stations do not now exist; 7 or 8 miles of track at each old station have been taken up. In many months the electrics were not delayed a minute; the latter can do more work in cold weather. Many of the delayed steam trains were double-headers—but never more than one electric is hitched to a passenger train. An entire suspension of freight service, due to steam engines losing their steaming capacity and freezing up, was not an uncommon experience. Electrical energy for the operation of these trains cost considerably less than coal. This latter statement is one of the most interesting in connection with the operation of the C. M. & St. P. Ry. and it is especially interesting because it was made before they had improved their load factor.

The foregoing actual operating experiences on large railway electrification projects show what the electric locomotive is doing every day. As the vice-president of the last mentioned railway said; " electrification has made us forget that there is a continental divide."

The limitations of the steam locomotive are due to the fact that it is a mobile steam power plant of limited capacity; it is compelled to carry its own supply of coal and water; and, it is unable to take advantage of many of the economical refinements of the large modern stationary steam plant. On the other hand the electric locomotive has no such limitations; it merely acts as a *connecting-link* between efficient stationary steam or water power plants of unlimited capacities—because their number may be extended indefinitely—and the train to which it is connected. The Electrical World summed up the situation a short time ago when it said:—"Why continue to haul millions of tons of coal, for and by uneconomical steam locomotives, all over the country, and thus add more loads to the already overburdened railways, when the power which they need so badly can be much more economically and efficiently transmitted to electric locomotives over a wire the size of one's little finger?"

The increasing cost of coal and fuel oil will force railway managers to look more and more carefully into railway electrification. Estimates of a few years ago now need revision. Money may be hard to get but if, at times, fuel cannot be obtained at all some substitute must be obtained—if normal life is to be continued in northern latitudes.

A representative of the National City Bank of New York, writing of the period after the war, referred to the stagnation which may ensue, in all the great industries which were engaged in war work; the multitude of the people thus thrown out of work in addition to the men of the returning armies might create unbearable conditions unless suitable employment will have been arranged for them in advance; he referred to the economic advantages of railway electrification and was of opinion that this work might solve the whole question if soon taken up with vigor. The Minister of Public Works, Hon. F. B. Carvell, M.P., addressing the Ottawa Branch of *The Engineering Institute of Canada* spoke of the necessity of conserving the energy of our water powers—instead of letting them *run to waste*—so that this great store of energy might be employed in assisting to build up our own country and to rebuild other countries. How harmoniously these two ideas, water power development and railway electrification, would work together if properly carried out.

With the view of securing something worthy of presentation on the subject under discussion I wrote to an eminent engineer, a man of international fame and recognized as an authority on railway electrification, requesting him to send me his views. Here is a short extract from his interesting reply:—"Generalization is always dangerous, especially in connection with electrification of railways, where so many factors such as the physical location, character of loads, the power situation, etc., come in to affect the decision if applied locally." From this sober statement it may be seen that my correspondent is an engineer—not a politician. He proceeded as follows: " . . . with present equipment-prices the cost is absolutely prohibitive." This opinion, let me point out, is in connection with the proposal to *Electrify Everything*. Do not let it dampen our enthusiasm. Listen to this also and kindly keep it in mind; it is another extract from the address of Mr. E. W. Rice above referred to. He said:— "I think we can demonstrate that there is no other way known to us by which the railroad problem facing the country can be as quickly and as cheaply solved as by electrification."

While the recent fuel shortage and kindred questions have made us look to railway electrification for relief, such projects, on a large scale, can only follow or go hand in hand with water power plant development and co-operative operation of power plants. The location of a number of plants—large water power plants and perhaps, auxiliary steam plants—so situated and interconnected that a failure at one plant, or the connections to it, will not jeopardize the others or completely cut off and isolate an important railway district is, in my opinion, an essential and a prime necessity in connection with any large railway electrification project.

The 99 year power contract of the C. M. & St. P. Ry. above referred to is worthy of special attention. That railway has a contract with a power company which has a series of plants stretching across the whole country parallel to the railway. The railway owns its sub-stations and secondary lines but it is not concerned with the high tension lines or power plants of the power company. A reasonable rate for power arranged between a willing purchaser and a willing seller—*a contract, in fact, which each party knows the other will respect*—is the basis and the real reason for that great railway electrification. Neither party questions the other's integrity or financial soundness. One delivers the power it has undertaken to supply and the other uses it. The arrangement is ideal in its simplicity and entirely satisfactory to everybody concerned. It will, in my opinion, be necessary to have such attractive power conditions as those outlined above, backed by abundant supplies of power, in order to foster and encourage *railway electrification*.

Railway electrification is a truly economic (financial and engineering) problem—a problem worthy of the best attention of the most highly trained and experienced specialists.

The Economics of Electric Operation of Railways

By W. G. Gordon, Toronto, Transportation Engineer, Canadian General Electric Co., Ltd.

Much has been written descriptive of the different roads now operating electrically, wholly or in part, and of the results as compared with steam operation. I will present some of the latest figures regarding the economies effected by electric operation.

Mr. E. W. Rice stated at the June Convention of the American Institute of Electrical Engineers last year:— "Electric locomotives have been so improved and simplified that they are competent to haul the heaviest train that can be held together with the present train construction; to operate at the highest speed permissible by the alignment of the road and independent of its grades; and that the electric locomotives can meet in the most efficient and adequate manner the transportation problems confronting the country, and offer better results than are now obtained or seem possible with steam locomotives. It should not be forgotten that steam locomotives burn about 25% of the entire coal mined in the United States, and that 12% of the entire ton mileage movement of freight and passengers carried is represented in cars and tenders required to haul coal to supply steam for the locomotives."

This percentage is shown from the following table of one year's ton mile movement:—

	Millions Ton Miles	Percent of Total
Revenue Coal	204,600	12.56
Railway Coal	52,000	4.96
Revenue Freight	372,040	35.60
Railway Freight	5,600	0.55
Locomotives	148,200	14.20
Locomotive Tenders	74,630	7.14
Passenger Cars	186,890	17.90
	1,043,960	100.00

The comparative percentages for the different classifications are very close to those given above for the operation of our steam railroads in Canada.

Where a trunk line is electrically operated from water power stations, it means that the total movement of railway coal and locomotive tenders is eliminated, and even if partially or wholly operated from steam power stations, the movement of locomotive tenders is eliminated and the movement of railway coal greatly decreased.

The benefit is self evident of being able to apply this ton mileage, at present absorbed by steam operation, in the movement of revenue tonnage.

The cost of maintenance of the electric locomotive is very much less than that of the steam locomotive. The following table gives the cost of maintenance in cents per locomotive mile for a number of railroads, these costs being for the years they have been operating electrically to 1917, inclusive.

The costs are given for an average of 5 years for three railroads, an average of 4 years for two railroads and an average of 2 years for the Chicago, Milwaukee and St. Paul R.R. The average locomotive weight in tons is given for each railroad, and in order to obtain a comparison I have given the cost also on the basis of the locomotives weighing 100 tons in each case.

Cost of Maintenance of Electric Locomotives:—

Road	Average Loco. Wt. in Tons.	Average Maint. per Loco. Mile	Average Maint. on basis of Loco. weighing 100 tons.	No. of Years.
Baltimore & Ohio R.R.	98	5 13	5 24	5
Butte, Anaconda & Pacific R.R.	80	5 66	7 08	4
Chicago, Milwaukee & St. Paul R.R.	290	8 94	3 09	2
Michigan Central R.R.	108	4 39	4 06	4
N. Y. C. & H. R. R.R.	118	4 12	3 50	5
Pennsylvania R.R.	156	5 30	3 40	5
General Average		5 59	4 39	

The cost of maintenance per locomotive mile for steam locomotives compared with the above will be from 10 cts. to 20 cts. or higher, depending on the capacity and service of the locomotive.

A very interesting comparison is given in the following table giving comparative results between steam and electric operation on the Butte, Anaconda and Pacific R.R. In 1913 the operation was entirely steam, since then it has been gradually superseded by electric operation. The figures for electric operation are averaged for 3 years, and, as there was still a considerable amount of steam operation during these 3 years, the figures do not show full credit to the benefit of electric operation.

Comparative Results—Steam and Electric Operation.
B. A. & P. R. R.

	Steam, 1913	Electric Average for 3 yrs.	Saving in Amount	Electric Operation Percent.
Fuel and Power	$294,830	$175,165	$119,665	40 59
Loco. Repairs	97,492	57,881	39,611	40 61
Enginemen's Wages	99,611	74,036	25,575	25 67
Engine House Expenses	28,342	16,703	11,639	41 06
Lubricants	9,345	5,444	3,901	41 76
Water	4,491	2,084	2,407	53 59
Other Supplies	5,435	4,308	1,127	20 74
Total	$539,546	$335,621	$203,925	37 80
Revenue Ton Miles Hauled	153,168,648	169,553,405	16,384,757	10 70

The above table shows a saving in electric operation of 37.8 percent, and at the same time an increase in the revenue ton miles hauled of 10.7 percent.

Had these increased ton miles been hauled in 1913. the total cost would have been $597,277, so that the actual saving in electric operation is 44 percent.

On this railroad 17 electric locomotives were in operation in 1914, 24 in 1916 and at present there are 28,

Where mountain divisions are electrically operated, a further marked economy is effected by regenerative breaking. This is obtained by exciting the fields of the motors on the locomotive on down grades so that the counter electro-motive force builds up higher than the line voltage and returns power to the line; this action retarding the train to whatever extent desired without the use of the air brakes, as well as supplying power to other trains running on the level or up grades. This action, of course, reduces the total demand on the sub-stations with consequent reduction in the power demand on the primary source of supply.

The following table showing the saving thus obtained on the Chicago, Milwaukee & St. Paul R.R., and is the result of careful tests just worked up by the engineers of the General Electric Co.

The above results are of extreme interest. It will be noted that the runs were taken in both directions over the total electrified distance of 437.6 miles with trains as high as 2,853 tons trailing load, giving a general average in watt hours per ton mile without regenerative braking of 24.06, and with regenerative braking of 19.72, or a reduction in power due to regenerative braking of 18.04%.

As a direct result of regenerative braking, a large saving is effected in brake shoe wear, apart from the elimination of wrecks caused by overheating of the brake shoes, brake heads and wheels, where heavy trains are handled on long down grades. The air brakes are only required for emergency, as the braking is all done by the locomotive. It has been estimated that on the Chicago, Milwaukee and St. Paul R.R. the saving per year in brake shoe wear alone is close to $200,000. On the 4% grade of

CHICAGO, MILWAUKEE & ST. PAUL TESTS

Watt Hours per Ton Mile

PRELIMINARY CALCULATION MADE FROM WATT HOUR METER READING TAKEN ON LOCOMOTIVES.
THIS CALCULATION INCLUDES TON MILEAGE OF ROAD AND HELPER LOCOMOTIVES.

Run No.		No. of Cars.	Trailing Tonnage.	Ton Miles Trip Including Locos.	With Regenerative Braking		Without Regenerative Braking	
					K.W. Hrs. For Trip.	W. Hr. Ton Mile	K.W. Hours For Trip.	W. Hr. Ton Mile
	MISSOULA DIVISION—211.2 Miles.							
3	Avery to Deer Lodge	57–56	2497–2457	596,485	15,068	25.23	16,432	27.55
7	Avery to Deer Lodge	58	2767	656,516	17,207	26.20	18,374	27.97
10	Avery to Deer Lodge	61–60	2836–2796	665,505	17,971	27.00	19,622	29.48
6	Deer Lodge to Avery	62	2383	575,436	6,943	12.05	8,927	15.51
9	Deer Lodge to Avery	82	2853	674,700	9,344	13.85	11,618	17.24
	AVERAGE VALUES							
	Avery to Deer Lodge		..		...	26.14	......	28.35
	Deer Lodge to Avery		...		......	12.95	....	16.37
	Round Trip Average, Missoula Division				....	19.51	......	22.35
	ROCKY MOUNTAIN DIVISION 226.4 Miles.							
4	Deer Lodge to Harlowton	58–56	2539–2466	637,367	10,392	16.30	15,141	23.75
11	Deer Lodge to Harlowton	60	2817	712,518	12,155	17.06	17,405	24.42
5	Harlowton to Deer Lodge	67	2264	588,640	14,654	24.90	16,792	28.52
12	Harlowton to Deer Lodge	64	2762	700,021	14,929	21.32	18,498	26.40
	AVERAGE VALUES							
	Deer Lodge to Harlowton	......	....	....	....	16.68	....	24.08
	Harlowton to Deer Lodge	......	....	....	....	23.11	....	27.46
	Round Trip Average, Rocky Mt. Div.	......	....	....	....	19.89	....	25.77
	GENERAL AVERAGE	......	....	....	....	19.72	....	24.06

REDUCTION IN POWER DUE TO REGENERATION..........................18.04%

the Denver & Rio-Grande R.R. between Soldier Summit and Tucker, the instructions are, with steam operation, not to exceed 8 to 10 miles per hour, and to stop every 5 to 7 miles, for from 15 to 30 minutes, to cool brake shoes and wheels. Under these conditions the energy dissipated between each brake shoe and wheel may be as high as 20 horse power; so it is readily seen that, even on much easier grades of long extent, the brake shoe wear with steam operation is a serious factor of expense.

The steam locomotive is a power plant which, owing to physical limitations, can attain only a certain capacity and efficiency. On the other hand the electric locomotive, itself very efficient, can draw any amount of power desired from a system fed by hydro-electric plants or highly efficient steam electric plants. The continuous draw bar pull of the electric locomotive is limited only by the strength of the draft rigging on the cars. By series and various series-parallel combinations of the motors a wide range of running speeds can be obtained without rheostatic losses. This range can be further varied by shunting the motor fields. Due to the power input available, draw bar pulls can be maintained at speeds impossible with steam locomotives. This means that, over any line, trains of heavier tonnage can be hauled at a much better schedule speed than with steam locomotives. In the case where a single track steam line has reached its capacity and would have to be double tracked to handle increased ton mileage, electric operation will obviate the necessity of double tracking and permit of a large expanse in ton mileage handled. The curve sheet giving "Typical Locomotive Characteristics, Steam and Electric," shows a comparison of lbs. tractive effort, at various speeds, of two steam locomotives; a Mallet with 190 tons on drivers and a Consolidation with 100 tons on drivers, with an electric locomotive having 160 tons on drivers. It will be noted that the tractive effort of the Mallet drops off rapidly above 8 miles per hour while the tractive effort of the Consolidation drops off steadily, though not so rapidly, above 10 miles per hour. Curves are given for 3 of the 6 running speeds of the electric locomotive. At 16 miles per hour, the continuous tractive effort which the electric locomotive can exert is greater than that of either of the steam locomotives, while at about 35 miles per hour the continous tractive effort of the electric locomotive is more than 3 times the tractive effort of the Consolidation.

With regard to collection of current, experience has shown that with the slider type of pantograph 1000 amperes can be taken sparklessly from a single trolley wire. Using two trolley wires suspended side by side, as on the Chicago, Milwaukee & St. Paul R.R., 2000 amperes can be collected. This at 3000 volts is 6000 K. W. or over 8000 h.p. As there is no sparking, the wear on the trolley wire is exceedingly slight, as may be judged from the fact that here in Canada we are getting a life of from 10,000 to 12,000 miles from a single wearing strip on the pantograph.

As regards the substations, a further decided economy is now credited to electric operation through the perfection of automatic control. One serious operating condition was the flashing over of the generators from some short circuit outside the station. This might be severe enough to necessitate cleaning up the brush rigging and commutators. Continuity of operation required an attendant at each substation while the generating sets were in operation. This trouble has been entirely overcome by the use of a high speed circuit breaker which will open a short circuit of many times the normal full load value of the generators in less than eight thousandths of a second.

With the further use of flash barriers on the commutators, flashing over of direct current generators is absolutely eliminated. With automatic control, the sets are stopped and started through the voltage drop reaching a definite value at any point on the system. In addition to doing away with substation attendants, this also improves the all day efficiency of the generator sets as they are shut down during periods where they are not automatically started up to maintain the line voltage at a fixed value.

With the refinements now available for substation operation, it can be confidently asserted that the substation equipment is 99% efficient.

The question of load factor on the power supply lines of the Chicago, Milwaukee & St. Paul electrification is of considerable importance since the price of energy per kw. hr. is based upon an assumed load factor of 60 per cent. In cases where the ratio of the average to the maximum load is less than this amount, the price is somewhat higher. Because of the desirability for maintaining a relatively high load factor, there has been designed and installed a power limiting and indicating system which automatically limits the maximum load to certain predetermined peaks and also indicates to the dispatcher the exact amount of power which the whole system is receiving at any instant.

This apparatus is installed in the dispatcher's office at Deer Lodge and in each of the substations which are connected to the main office by pilot wires. Two totalizing kw. meters are located over the dispatcher's desk indicating respectively the amount of power being drawn by the 220 miles east and the 220 miles west.

By means of the pilot wire control, acting upon the motor-generator sets in the substations, the trolley voltage is reduced temporaily on the overloaded substations so that the total k.w. consumption on the totalizing meters never exceeds the predetermined maximum. By careful dispatching, it is thus possible to keep the maximum load within reasonable limits without materially slowing up the movement of trains.

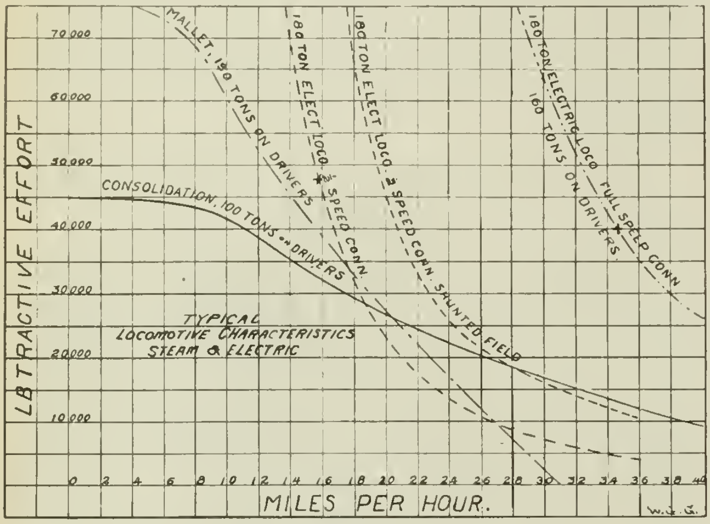
As to the reliability of the modern electric locomotive for continuous service the returns for 1918 just made public by the New York Central Lines show that the locomotives were inspected after each 3000 miles of running and that they averaged 33,000 miles per detention.

In conclusion of this brief review of the present status of electric operation for trunk line railways, it is of interest to note that, in changing to electric operation, there is practically no upsetting of the regular steam organization; as the engine crews, under instruction, readily become highly efficient in the operation of the electric locomotives.

Railroad Electrification

By F. H. Shepard, Director of Heavy Traction,
Westinghouse Electric & Mfg. Co.

The electrification of the railroads is a subject of the greatest importance to all of us. Ours is a continent of great distances, and our growth and prosperity have depended upon our ability to transport ourselves and our goods quickly and easily over these distances. Hence, without our great railroad systems our development would have been insignificant indeed. If, therefore, the use of



Typical
Locomotive Characteristics
Steam and Electric.

electricity can improve our transportation facilities, it will increase the well-being of every inhabitant of the North American continent.

There is no longer in anyone's mind a doubt as to the sufficiency of electric power to accomplish any kind of service, even the most difficult and exacting. This has been amply demonstrated in every case where steam service had been supplanted by electric power; this substitution having been invariably attended by conspicuous betterment in service.

The first use of electricity for heavy haulage was through the Baltimore tunnel on the Baltimore & Ohio Railroad in 1895. This installation, contracted for in 1891, was looked upon by most of the executives and operating staff as a gigantic experiment, and of very doubtful working. This was emphasized to me by the following incident: On one of our early trips with a number of the road's executives aboard, a successful run had been made through the tunnel, trailing one of the road's largest steam locomotives with a full-sized freight train. Stop was made, and then on signal the engineer opened up; the slack had all run out on the grade (this being before the days of air-brakes in freight service); he kept on opening up, without jerk, from a standstill. Before I could stop him, we heard a crash about six cars back in the train—the whole end of a car, loaded with oats, had been torn out on a dead pull. There seemed to be more oats on that track than I had supposed existed in the whole world. By the time we got the car set out, and incidentally smashed two couplings, we had "laid out" the Royal Blue Limited thirty minutes. The following morning this admonition was given me by the general manager in his office: "Shepard, there is no longer any question in mind about the ability of that motor to pull; it could pull anything—this building right off its foundations—but the important thing, and it is serious too, is to get up some way to restrain its tremendous power."

This was before the days of high voltage distribution, the power being furnished direct from the 700-volt dynamos in the powerhouse adjacent to the railroad. There could, obviously, not be any general expansion of this method of electrification, owing to the economic impracticability of low voltage systems of generation and transmission.

The present universal use of alternating current generation, with its great adaptibility for transformation, has led to concentrated generation of power in large amounts and to its wide distribution through large networks of transmission lines. This has enormously expanded the field for electric power, so that now its use is universal for the various railways—street and interurban, elevated and subway—but to a limited degree only on main or steam railroads.

The urgency for steam railroad electrification, until the present time, has not been as obvious as that which determined the electrification of street and elevated railways; although subways and certain railroad terminals were predicated entirely on the use of electricity. An explanation, why railroad electrification is so limited, may be ascribed to that inertia which halts the undertaking of large works; accompanied, as they inevitably are, by such complications as questions of finance, immediate necessity, immediate return, etc.

Grand Trunk Railway
St. Clair Tunnel—Weight, 132 tons—Tunnel Service.

If prevision could have been possible and acted upon, a somewhat general electrification of the railroads would have mitigated the dangerous fuel shortage obtaining during the war, and at a saving to the community not possible to be measured in any mere matter of operating economies. In fact, the propriety may well be questioned, whether as a matter of right, the diversion of fuel for railroad operation from the household or industry should be permitted, when hydro-electric power could be utilized.

Pennsylvania Railroad
Entering New York Terminal—Locomotive weight, 165 tons.

An advantage of railroad electrification rests largely in the east with which large amounts of power can be used for a single train, and in the facility with which electric power can be transmitted, applied, regulated and controlled. These advantages secure fewer and accelerated movements of train units and larger trains as well.

Increased capacity and service, therefore, directly obtains from existing tracks, terminals and equipment. Prominent examples of this are the electrification of the surburban service of the Pennsylvania Railroad at Philadelphia, and the heavy service of the Elkhorn Grade of the Norfolk & Western Railroad.

At Broad Street Station in Philadelphia, congestion due to growth in traffic, required a large increase in terminal facilities under steam operation—one that involved a large expenditure. Increase in capacity was obtained by elecrification of the suburban service of the main line and Chestnut Hill branch, without terminal changes and secured at a lesser investment than for terminal expansion. Moreover, there was a vast improvement in regularity and character of service. In fact, during the rigors of last winter, the electric service was conspicuously the only dependable service into this terminal. Multiple unit equipment is used, each car being a motor car with two motors totalling 450 h.p. Trains of three to ten cars are run.

The growth of traffic on the Norfolk & Western caused so great a congestion on the Elkhorn Grade as to limit the output of the celebrated Pocahontas coal field, from which a great part of the revenue of the whol railroad is derived. The topography of this section i such that either additional tracks or revision of line was practically impossible. Electrification has doubled the capacity of this division and, during the past severe winter, the freedom of movement of traffic over this section was markedly the easiest of the whole railroad. A noteworthy feature of this operation is the large size of trains and the expeditious manner in which they are handled. On the lesser grades, trains of 5000 tons are operated, and on the 2% grades, trains of 3250 tons, at twice the speed of former steam operation, with three large Mallet engines per train. Trains are accelerated to a speed of 14 m.p.h. on the 2% grade in a little over a minute—in fact to quote a brakeman on one of his first trips: " these trains start like a trolley car."

Relatively large amounts of power are used per train, the input during acceleration ordinarily equaling 12,000 h.p. Plans are under way to further increase the size of trains so that inputs as high as 18,000 h.p. will be reached.

The position of the Norfolk & Western Railroad, it should be understood, is somewhat unique, this being due to its being a large coal carrier with a large proportion of heavy steel rolling stock. For its tidewater service, for instance, they have standardized a car which holds 200,000 lbs. of coal. These are the largest cars in regular operation, a single car weighing, complete with load, about 130 tons. Many of the mining operations are adjacent to the heaviest grades, so that the service involves many stops with a full tonnage train. In order to speed up the movement quick starts are necessary.

The curvature of the electrified district is extremely heavy. In fact, there are only about two places in the whole zone where one end of the train may be seen from the other. On the heaviest grades a second locomotive is used as a pusher. On account of the length of train, curvature, and the intervening mountains, it was found to be very difficult to communicate to the pushers at the rear even by whistle, so that it was somewhat of a problem to secure the unison of effort between locomotives at each end necessary to start these large trains. This was finally secured by dropping the slack of the train back against the pusher, the bump being taken as the signal for the pusher

New York, New Haven & Hartford Railroad
High speed express service.

to open up and help start. The manner of operation, on the part of the road engine and pusher, in this service is somewhat interesting. At any fixed speed, the ammeters on the road engine and those on the pusher read alike, each engine taking its share of load. The proper indication is known for the different grades and sizes of trains, so that the road engine, which, of course, controls the movement of the train, shifts to more or less than its share of the load, depending on whether speeding up or slowing down is desired.

The operator of the pusher is thus advised instantly of such desire by the indication on his ammeter so that slow-downs, and stops as well, are negotiated very smoothly. Regeneration is also a very successful feature of this operation.

The financial returns are understood to show a satisfactory profit on the net investment, without taking into account the great value of increase in capacity, and are also understood to be better than the original conservative estimates of the road's consulting engineers.

The ability for service of electrical equipment, as compared with steam, is truly amazing. The reliability of power generation and of electric locomotives is astounding. A very notable example is the service of the Grand Trunk Railway through the St. Clair Tunnel; the first year's operation being accomplished with a total delay of seven minutes. Among other examples may be cited the record of the Pennsylvania-New York Terminal locomotives, which over a term of years averaged approximately 100,000 miles per locomotive detention. The length of time out of service necessary to insure reliable operation is comparatively small—a common schedule for inspection of electrical equipment is at the end of 3000 miles operation, while a much greater mileage is frequent and there are individual records as high as 10,000 to 12,000 miles.

New York, New Haven & Hartford Railroad
Fast freight service.

In heavy haulage particularly, the capacity for service of a single electric locomotive is ordinarily equal to three or four of the heaviest steam locomotives. During an emergency shortage of power, for instance, on the Norfolk & Western Railroad, it was found necessary to retire from service four electric locomotives: sixteen of the heaviest Mallet engines were assigned to the division to take their place. Railroad operation has naturally been built up and determined by the limitations of steam locomotives, involving the necessity for attention at approximately 100 mile intervals. Divisional and terminal points have grown up around these limitations, thus establishing conditions for assignment of train service, as well as engine labor. The absence of such limitation in the use of electric power secures great freedom in the operation of train service, so that it is entirely practicable to eliminate intermediate terminals, with the attending direct and incidental expense. On the Chicago, Milwaukee & St. Paul R.R., two such intermediate terminals on their 440 mile electrification have been eliminated.

The ever present necessity for increased efficiency in transportation has already brought about a very material increase in size of trains. With steam power this has been secured at great increase in size of locomotives, revision of line, reconstruction of bridges, etc. Undoubtedly, had electrification been available, much of this capital expenditure would have been obviated, owing to the flexibility with which electric power can be applied.

The steam locomotive, with its single boiler, of necessity, requires, in large powers, great concentration in weight, this affecting, directly, bridge and track conditions. An electric locomotive, on the other hand, is essentially an aggregation of subdivided power, possessing the capability of increasing the number of driving axles to an unlimited extent. Electric locomotives are now built up to twelve driving axles and a further increase is even contemplated.

In multiple unit service, as is well known, the driving axles are distributed throughout the entire train, control of the individual motors being secured through pilot wires in an electric train line. It is, therefore, obvious that there is no practical difficulty in the extension of an electric locomotive to any length which may be decided upon, resulting in great increase in power, and depending only on the number of driving axles.

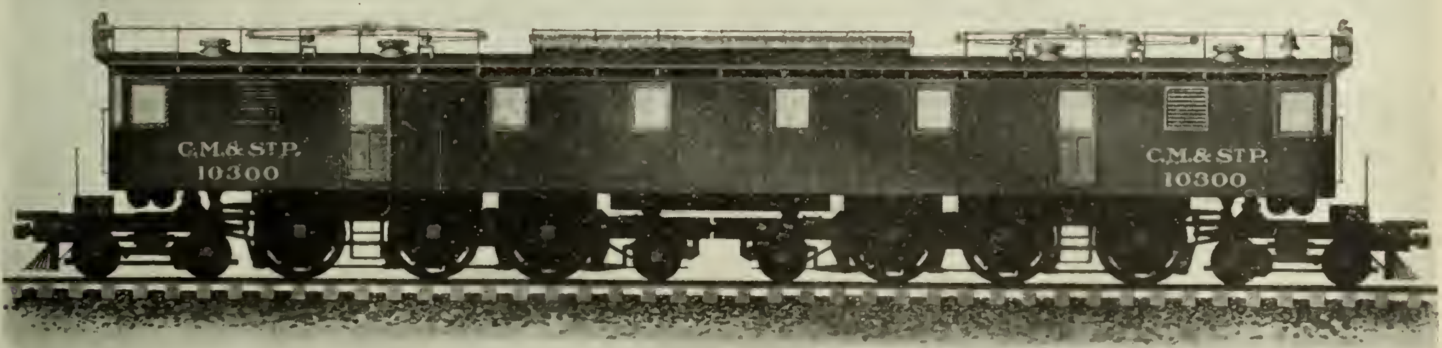
On electric locomotives, whether gearless, geared or of the side rod type, there is an entire absence of reciprocating parts, so that there is not the increase above dead weight on the axles due to reciprocating parts or their counterbalance. This increase, commonly amounting during each revolution to an additional load at the wheel of 50% above the actual weight, is technically termed "the dynamic augment." It should be permissible for the same effect upon track and structures to greatly increase the axle loading on electric locomotives, or, providing this were not undertaken, there should result a material reduction in track maintenance for the same axle weights.

The saving of fuel due to the use of electric power is, of course, complete in the case of hydro-electric supply and is 50% or more from steam-electric generating stations. This considerable saving is due both to the great efficiency of steam generation in large units under the economical arrangements obtaining in modern power-houses and to the avoidance of losses at the locomotive itself. An electric locomotive consumes power in proportion to its load and only when working. A steam locomotive is notoriously inefficient at light loads and large quantities of fuel are consumed in preparation for service and in keeping the engine hot at standstill or when no work is being done. The capacity of a steam locomotive is always dependent upon the grade of fuel used, skill with which the engine is fired, condition of flue and boiler surfaces, fire-box conditions, joints, packing, etc., and very largely upon temperature conditions, the capacity being very greatly reduced at low temperatures.

Generally speaking, a steam locomotive is in prime condition when new, or after a general overhauling, and suffers a progressive reduction in capacity until sent to the shop for general overhaul. On the other hand, with electric locomotives there is no diminution in capacity dependent upon the condition of the locomotive. In other words, if in condition for service, it is a 100% engine and in cold weather, the normal limitations, determined by temperature of the motors, are largely removed.

Along with its increase in size, a steam locomotive has developed far greater complications as a machine and, with very large locomotives especially, the time out of service reaches a high percentage. The difficulty and expense of maintenance are also very greatly increased. The upkeep and maintenance of steam locomotives has proven to be a very great burden, owing to the shortage of labor and particularly of skilled mechanics. The maintenance of electric locomotives, on the other hand, is accomplished with a surprisingly small amount of attention and expense; in fact, the repairs and renewal of the purely electrical equipment are almost insignificant if the apparatus is properly proportioned to the work, and its performance has been restricted to the limitations of its design Apparatus, when operating under such conditions, has service records of years with no expense whatever except that for cleaning, a little paint and a few brushes. For example, the Pennsylvania Terminal locomotives, in New York City, have been in operation for nearly ten years and the only work done on any of the motor windings up to date has been due to damage from a monkey-wrench left in a motor, or some other incident of a similar kind, but, of course, these cases have been most infrequent.

In order to secure this kind of service, discrimination and firm control of the operation of electric locomotives must be assured. The reason for this is that an electric motor is really a transformer; that is to say, it transforms electric power into mechanical work. It possesses the characteristic, however, that the limit to the work a motor will endeavor to perform is determined by the amount of electric power available. At standstill, this would amount to a short circuit condition; so that, between proper load and this condition, there is a wide opportunity for abuse to



Chicago, Milwaukee & St. Paul Railroad
Transcontinental passenger service.—Weight, 267 tons.

electrical equipment in its handling. Any motor is less rugged after such abuse and this is inevitably reflected, although in some cases deferred for a term of years, in ultimate failure of the windings.

The cost of maintenance of electrical equipment is, therefore, very largely determined by the history of its

Pennsylvania Railroad
Suburban service.—All coaches, motor cars.

operation. This limitation does not obtain, in any such corresponding degree, with steam locomotives and, in view of the newness of railroad electrification, has not been given universal consideration in the service exacted of electrical equipment. This, therefore, is a good reason for the disparity which exists in such figures as have developed upon maintenance costs of electric locomotives. However, with the growing appreciation of this condition, we may look to the future for low records of cost of maintenance of electric locomotives generally, equaling, and even surpassing, those which have been made in certain installations up to the present. Thus, it may be assumed that the saving in maintenance of electric locomotives, which is generally taken to be around 50%, will be materially increased as an average condition in the future.

The method of general railway electrification is now universally accepted, on this continent, as an overhead working conductor at high voltage. This is due to our method of working the railways, influenced, of course, by the conditions, as to location of tracks, stations, yard working, etc., obtaining on this continent. There has been a distinct advance in the character of overhead construction and there is promise of still further improvement, all in the direction of a more satisfactory working conductor at lower first cost. This is manifestly important, as affecting the investment, since the mileage of track, including that in yards, is enormous.

In these days of increased costs, that for the supply of electric power is almost alone in having been stationary or even reduced during recent years. This has been due to the economies obtained by the generation and distribution of large amounts of power.

The present seems to be a particularly opportune time for actively undertaking the extension of railway electrification for reasons which might be summarized as follows:—

(1) The necessity for freer movement of traffic over existing track facilities.

(2) The greater strength of rolling stock, permitting the operation of higher tonnage trains.

(3) The availability of large amounts of electric power now produced at advantageous cost.

(4) The greatly enhanced cost of fuel which is believed will remain permanently at a high figure.

(5) The need for more expeditious movement of trains, due to the modified conditions in the employment of labor in train service.

(6) The general shortage of both skilled and unskilled labor available for railroad operation and maintenance.

(7) Recognition of need of increased capacity for movement of traffic, thereby avoiding embargoes and removing the restriction of growth and general prosperity.

The transportation problem is unquestionably one of our major problems of the present. We now realize, better than ever before, the value of planning for our future and this applies with great force to transportation. For its relief, railroad electrification should be one of the most important factors. The problem is a large one and, for its solution, engineering skill and breadth of vision of the highest order should be applied.

Discussion on Railway Electrification

H. H. Vaughan, M.E.I.C.: Mr. President, ladies and gentlemen, owing to the fact that I have not been connected with railway work during the last three years, I feel exceedingly 'rusty' on the question of the electrification of railways. One loses touch with a subject of this kind when he does not think of it to any great extent for a considerable time. But, I have been discussing electrification since about 1900, and, while our electrical friends were prophesying that the steam locomotive would soon be only of historic interest, as Mr. Shepard did to-day—and Mr. Shepard has grown from the slim young man you saw in the picture to what he is to-day—the steam locomotive is

Pennsylvania Railroad
Heavy freight service.—Maximum output during acceleration 7,000 horse power.

still going on. My chief connection with this question came when I was with the C.P.R. I do not mind telling you, now that I am away from the road, that it was always a great ambition with me to electrify some part of the C.P.R. I always had the greatest interest in the designing of electric locomotives. I had the pleasure of knowing several electrical engineers very intimately, and I would naturally have liked to have been connected with some electrification scheme. I would have liked to undertake this work from another point of view, and that is that I always believed, even from the first, that the reliability of the electric locomotive would be very much greater than that of the steam locomotive. One of the curses and troubles of the railroad man is the daily statement of engine troubles. The electrical locomotive has done a great deal to make the lives of railway men happier, on account of the better service given by the electrical locomotive.

We used to discuss the cost of repairs and fuel. I have never believed that, with a normal electrical service,

Norfolk & Western Railroad
Elkhorn Grade Electrification
Coal train of cars weighing 130 tons each with load.

the saving of fuel would be as great as our electrical friends tell us. Figures of coal consumption that are given are very frequently those for a service in which steam locomotives are notoriously inefficient, as on certain portions of the Chicago, Milwaukee and St. Paul Railroad. When we come down to a normal service, such as that from here to Montreal, or from here to Winnipeg, it is not unusual to get down, on fairly level divisions, to from 80 pounds of coal per thousand ton miles, up to 120 pounds of coal on a one per cent ruling grade division. I have seen the figures of the Smiths' Falls section, and they were down to 70 pounds per thousand ton miles. My recollection is that 20 kilowatt-hours per ton mile would be a very good figure on this service, and that means that your kilowatt-hour has to be distributed to the trains at 3½ lbs. of coal per kilowatt-hour on a 24 hour service. There is a saving, but it is not as great in high-grade railway service as it is commonly understood to be. The figures are frequently collected from conditions under which the electrical locomotive is peculiarly efficient.

The item of repairs is another matter that comes in. If you wanted to equip a division of a railway with entirely new locomotives, you would have surprisingly low cost repairs for the first four or five years. In equipping a railway for electrical railway service, the machinery is all new. The steam locomotive is generally very light on repairs for the first three or four years. It then comes to the point where it gets down to a steady, average cost for the next ten or twelve years. It then often requires rebuilding, or partial reconstruction, which sends the cost up again for a short period, after which it comes down again to the normal amount for another ten or twelve years. We have not got to that yet in the development of any high-grade electrical service. It always seems to me that wheels, motors, and the various apparatus, will require renewing, and that the renewals will correspond, more or less, with the renewals of wheels and boilers of steam locomotives, after ten, twelve, or fourteen years service. The tables, which were shown on the sheet, gave four and a half cents per locomotive mile, for locomotives averaging 100 tons. Steam locomotives in the same service would cost 100 to 150 per cent more than that, but the steam locomotive cost would be derived from the average of locomotives and not from entirely new ones. As a matter of fact, the designs of electric locomotives, that are being developed now, follow so closely the steam locomotive wheel arrangement that the only difference is that you are substituting for the cylinders and boilers of the steam locomotive, the motor and drive gear of the electrical locomotive. The boiler and cylinders are not the only things that cost money on the steam locomotive. It is the general maintenance and upkeep of the entire locomotive that costs. However, I do not say that the electrical locomotive will cost as much as the steam locomotive. I do not think it will, but I do not believe that it will be so far below the cost of our steam locomotives as some of the estimates of our electrical friend would indicate.

On the C.P.R. we investigated the question of electrification and, as I was concerned, I know what occurred. I was really quite interested in it. We did not oppose it. We did feel that the contingent advantages, such as smoke avoidance, delays, the increase of suburban traffic in the Rocky Mountains, and things of that kind, made it important that the matter should be very carefully studied. We figured it out for the Quebec section. There was a twenty-five cycle generating set at Shawinigan, and it looked as if we could use the single phase on the Quebec section advantageously. We could have secured the advantages, which Mr. Shepard spoke of, in getting more power out of a given axle load, and in getting the capacity that was required on the Quebec section, while retaining the old bridges and the old construction, by using electrical locomotives. But, when we came to figure it out, we found that we could obtain almost the same practical results by strengthening our bridges and investing in a heavier class of equipment. The management decided to do that, and to put the line in first-class shape, rather than to keep the old line and to make an equal investment in electrification. That is the way we figured it out.

Then, we figured out the Fort William-Winnipeg section, and it was very difficult to show results. Some five years ago the Connaught Tunnel came under our consideration, and we figured up the electrification from Beaver to Albert Canyon. We were unable to show a saving by electrification in that case, even if the traffic should be absolutely doubled. The traffic figures taken were rather greater than we could expect in the future. The result was that that was turned down and steam traction was continued through the Connaught Tunnel. One other thing I figured out was the electrification of the C.P.R. from Smiths Falls to Montreal, including the Montreal terminals. Mr. Shaw and myself figured that out and tried to get the management interested in it. We could have utilized the Cedar Rapids power line which could have been thrown across the Smiths Falls,-Montreal section, and we could have avoided an immense amount of expense in connection with the Montreal terminals. I think the figures will prove that the electrification of this section, with the traffic there is, will be a paying proposition. The great trouble about electrification, and the

New York, New Haven & Hartford Railroad
Trolley construction for six-track line.

one that makes railway men hesitate, is the enormous investment required. Mr. Shepard spoke of the financial trouble. The financial trouble is the biggest trouble in the world. It is not so much opposition on the part of the financial man, as it is the fact that, unless you can really justify the investment of the amount of capital required, it is an unhealthy thing to go into. You have to show a positive saving when you ask a railway company to invest the enormous amount of money that is required for the electrification of any considerable portion of its line.

In connection with that, one of the great disadvantages of electrification is the inflexibility of the system. The most of the arguments in favour of electrification, that apply to the conditions of an electrical drive in a factory, do not apply to the conditions on a railway. In putting an electrical drive in a factory, you can put your motor down at any place and connect it up with a wire. But, when you get a railway electrified, you have a large investment in one district. A railway company must be sure of making money when it invests money. That seems to be becoming more or less difficult, especially in the United States, with the restrictions that have been put on railway profits. If a man has a million dollars to spend and he has bought fifty additional locomotives, they can be swung from one district to another, as necessity arises. In the one case his million dollars is tied up in one particular district where he may make seven and half per cent on the investment, whereas, in the other case, his million dollars is spread all over the whole system, and he may make twenty-five per cent on the additional investment.

I do think, however, that our railway men and financial men do not look at this electrification problem in the right light. They look at it altogether from the dollars and cents point of view now. That is the natural way, and in a sense, is the proper business way to look at any proposition. I would firmly agree with that proposition when it comes to a question of substituting, for the steam locomotive, a steam power plant, and using coal for generating electricity, but in this country, where we have such a magnificent supply of water power, I believe it would be wise foresight for our railway people to invest money in electrification and to utilize that water power, instead of burning up the supply of coal which, in the days to come, will be needed by our descendants and who, if we consume it now, will bitterly regret the wastefulness of which we have been guilty.

We can justify electrification if we take into account its contingent advantages and give it credit for all the saving that it can make. I believe, if that was done, the railways and railway engineers would find that it would pay to go ahead with the work of electrification.

Comments on Mr. Vaughan's Discussion

W. G. Gordon, Transportation Engineer, Canadian General Electric Co., Ltd.: I cannot agree with Mr. Vaughan that the maintenance of steam and electric locomotives over a period of 12 or 14 years could nearly approach each other.

The steam locomotive is a complex moving power plant. Apart from wheel wear, the maintenance of the motors—the new motors being built for this service are gearless—and the control apparatus must remain constantly low on the electric locomotive. All current is broken on arcing metal tips which are replacable at very small cost. How small the matter of wear on the control amounts to has been pointed out in the electric locomotive requiring inspection only every 3000 miles, and operating as high as 33,000 miles per locomotive detention.

Mr. Vaughan's experience, as he admits, with electrification projects is several years old. Much has been done in the last two years to cut down the total operating costs with electrification by the development of the automatic sub-station and quick acting circuit breaker, doing away with sub-station attendance formerly required. Heavy overload peaks are also eliminated by the dual control of the dispatcher over trains and power as described in my paper.

F. H. Shepard. — It is to be regretted that Mr. Vaughan has not been connected with the analysis of railway electrification problems during the past three years.

In his conclusion that railway and financial men do not look at these problems in the right light, I heartily concur. The weak point in the electrification analyses, Mr. Vaughan refers to, has been the limitations under which they were more or less arbitrarily studied. These points are peculiarly those established through practice with the steam locomotive. Electrification is, of course, a major change and involves a large investment not unlike that involved in construction of terminals, second track, and new lines. The justification of these latter is almost never determined by the prospect of immediate return, but rather by that determination which governs the expansion of, and provision for, facilities for a *first-class railroad.*

Electric operation will secure its greatest return when the investment is kept working, and again, electrification increases the ability to get work out of existing railway facilities. These are larger propositions than the question of fuel-saving and engine repairs.

Since Mr. Vaughan's activity on this question, there has come to exist a broader view of the electrification proposition as well as a change in the relationship of labor to traffic movement and maintenance, which materially augments such advantages as were considered during Mr. Vaughan's experience.

There is no disposition to deny the great improvement in steam locomotive practice during recent years or that its field will be one of great extent for many years to come. In the meantime, the electrical art is advancing, the design and efficiency of electric locomotives are improving and, with the necessities due to the growth of business and changing conditions, the advantages fundamental to electrification are continually increasing at an accelerated rate.

I hope Mr. Vaughan will again have substantial interest in this development.

Mineral Springs of Canada Described

Bulletin issued by Mines Branch says Waters equal to Europe's Spas.

In a bulletin issued by the Mines Branch, Department of Mines, and prepared by R. T. Elworthy, B.Sc., on the chemical character of Canadian mineral springs, it is stated that " It is probable that Canadian waters will be found equal in every respect to any of the famous European waters."

" Not more than a dozen mineral spring resorts in Canada are open at the present time," says the bulletin. " Several have been temporarily closed on account of the falling off in business due to war conditions.

" Passing from east to west, Abenakis Springs, Quebec on the St. Francois river, in Yamaska county, is one of the few health resorts in Quebec. The springs yield saline waters and somewhat resemble those of Kissingen or Nauheim spas in Germany. A sanatorium is also established at Potton Springs, in Brome county, Que. Potton sulphur spring is a calcic, alkaline (sulphuretted) water.

" Caledonia Springs is the site of a hotel and sanatorium, under the management of the Canadian Pacific Railway. The hotel is situated close to three of the springs—the Caledonia saline, sulphur, and gas springs.

"A sanatorium is established at Carlesbad Springs, near Ottawa. The springs range from alkaline to strongly saline, with intermediate mixtures of the two types of waters.

" St. Catharines, near Niagara Falls, is one of the oldest of Canadian mineral spring resorts. One spring is reported to have been in use since 1812. Several sanatoria enable visitors to utilize the waters with the greatest benefit. The springs yield strongly saline, bromic, and iodic waters, and resemble the famous waters of Kreuznach, Prussia.

"A sanatorium is also situated at Winnipeg; the Winnipeg Mineral Springs Sanatorium, under the direction of Dr. A. D. Carscallen.

" The most famous of all Canadian springs is undoubtedly the group of hot sulphur springs at Banff, Alta. A sanatorium has been established in Banff for many years, and a modern hydropathic establishment has lately been built, besides the provision made at Banff Springs hotel for many of the special European baths and massage.

" There are seven hot springs in the neighbourhood of Banff. They may be all classified as moderately mineralized, calcic, sulphated, saline (sulphuretted) waters. Save in the Basin Spring water, calcium sulphate forms about 60 per cent, magnesium sulphate 18 per cent, and calcium bicarbonate about 15 per cent of the total solid matter in solution. The waters somewhat resemble those of the famous Bath Hot Springs in England, and would, therefore, be of similar therapeutic value.

" Harrison Hot Springs, famed in the West for their curative properties, have not as yet been examined, nor the noted Halcyon Hot Springs on Arrow Lake, B.C. Hotels are situated at both these springs."

* * *

On April 16th the Ottawa branch of the Canadian Building and Construction Industries was formed in the Chateau Laurier where nearly one hundred Ottawa contractors and supply dealers were present. J. P. Angin, President of the Association, was president and addressed the meeting followed by A. S. Clarson, A.M.E.I.C., general secretary of the association who discussed the reconstruction problem and the aims of the organization. A representative from each line of contractors and supply dealers was appointed on an executive committee to interview the Minister of Labor on the labor question and appoint a council to meet representatives of organized labor to arrange a compromise should any trouble arise.

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOL. II. MAY 1919 No. 5

The Salary Situation

Members throughout Canada are eagerly awaiting news regarding what the Dominion Government proposes in connection with increasing the salaries of engineers and technical men employed by the Government. This is a matter which concerns every member of *The Institute*, either directly or indirectly, and is also one in which every member can give assistance. In the last number of *The Journal*, following the direction of Council, a notice was inserted asking every member to use his influence in this connection. From that time up to the present no definite information has been received as to what the Government proposes apart from the fact that an announcement has been made that a Bill is to be brought before the House embodying the recommendation of the experts of the Civil Service Commission.

As an evidence of the interest which this question has aroused, practically every branch has notified headquarters that local members of Parliament have been interviewed and their promise of favorable consideration for support to the engineering profession has been received.

There is still a lot to be done.

Every branch, besides securing influence of the members of the Federal House representing its district, has an opportunity of enlisting the support of the public through the press, for no fair-minded editor, on being presented with the facts, would refuse to lend his support to such a worthy cause.

In connection with this question, the chairman of a committee on salaries in one of the branches writes that he has never seen a committee take up a problem with such earnestness and such enthusiasm, so that successful results are expected.

The problem of increased salaries for technical men involves more than a mere increase in monetary award, as a failure, at this time, to secure such a result means a continuance of the lack of recognition of the value of engineering training and knowledge to the country. It means, further, the continued humiliation of having highly educated, trained, technical men, in positions of responsibility, earning less than the mechanic or foreman under their charge. Surely we are not going to allow this condition to continue.

So strongly do some of the members of Parliament feel on this subject that a number of men have pledged themselves to do their utmost to secure a more equitable basis of remuneration. These supporters are being supplied with information by a committee of the Ottawa Branch and are being well-grounded in the merits of our case.

Whatever differences of opinion members may have on questions of legislation and other subjects, it is universally agreed that here is one problem upon which all can act in hearty accord and to which we should all direct our efforts.

Engineers to the Fore

In an account of an address on water power projects given by K. H. Smith, A.M.E.I.C., Secretary-Treasurer of the Halifax Branch before the Commercial Club of Pictou, Nova Scotia, the *New Glasgow Enterprise*, which devoted several columns to an account of Mr. Smith's address, stated that what most impressed the audience was the fact that people are just beginning to realize that the brainy engineer with a vision will be far more valuable than most other professions during the coming era. The nations of the world are looking forward to material progress to aid them to recover from the losses of the war and no body of men is more greatly needed than engineers to carry on this work.

If, in the face of a tribute such as this, popular appreciation existed to such an extent that the engineer might be enabled to collect at least a reasonable share of the amount he earns, it would give rise to a condition of affairs towards which we have been looking for many years and which it is hoped may before long be attained

AN ACT RESPECTING THE ENGINEERING PROFESSION

In accordance with a resolution passed at the Annual Meeting in Ottawa on the 12th of February, 1919, providing for the formation of a special committee composed of one delegate appointed by each branch, this committee met at ten o'clock on the morning of Saturday, April 5th, with C. E. W. Dodwell, Chairman, and A. Surveyer, Secretary.

The concrete result of the labours of this committee after three sessions daily for five days, is a tentative Bill which is printed below for the information of members of *The Institute.* A ballot will be issued to all the members in accordance with the resolution calling for its approval, or otherwise, by the corporate membership.

THE PROPOSED ACT.

Whereas it is considered advisable to establish by legislation the qualifications necessary to permit persons to act or practise as Professional Engineers.

Now, therefore, His Majesty, by and with the advice and consent of the Legislature of the Province of ...., enacts as follows:—

Short Title

1. This Act may be cited as the "Engineering Profession Act."

Interpretation

2. In this Act, unless the context otherwise requires, the expression:—

(*a*) "Professional Engineer" means any person registered as a Professional Engineer under the provisions of this Act.

(*b*) The practice of a Professional Engineer within the meaning of this Act embraces advising on, making measurements for, laying out and the design and supervision of the construction, enlargement, alteration, improvements or repairs of public and private utilities, railways, bridges, tunnels, highways, roads, canals, harbours, harbour works, river improvements, lighthouses, wet docks, dry docks, dredges, cranes, floating docks, and other similar works, steam engines, turbines, pumps, internal combustion engines, and other similar mechanical structures, air ships and aeroplanes, electrical machinery and apparatus, chemical and metallurgical machinery, and works for the development, transmission or application of power, mining operations and apparatus for carrying out such operations, municipal works, irrigation works, water works, water purification plants, sewerage works, sewage disposal works, drainage works, incinerators, hydraulic works, and all other engineering works. The execution as a contractor of work designed by a Professional Engineer, or the supervision of the construction of work as a foreman or superintendent, or as an inspector, or as a roadmaster, track master, bridge or building master, or superintendent of maintenance shall not be deemed to be the practice of a Professional Engineer within the meaning of this Act.

(*c*) "The Association" means the Association of Professional Engineers of the Province of ....

(*d*) "Council" means the Executive Council of the Association.

(*e*) "President" means the President of the Association.

(*f*) "Registrar" means the Registrar of the Association.

(*g*) "The Secretary" means the Secretary-Treasurer of the Association.

(*h*) "Board" means the Board of Examiners of the Association.

The Association of Professional Engineers of the Province of ....

3. (*a*) All persons registered as Professional Engineers under the provisions of this Act shall constitute the Association of Professional Engineers of the Province of ...., and shall be a body politic and corporate, with perpetual succession and common seal.

(*b*) The seat of the Association shall be at ....

4. The Association shall have power to acquire and hold real estate not producing at any time an annual income in excess of ten thousand ($10,000.00) dollars, and to alienate, mortgage, lease or otherwise charge or dispose of such real estate or any part thereof as occasion may require; and all fees, fines and penalties receivable and recoverable under this Act shall belong to the Association.

5. The Association may pass By-laws not inconsistent with the provisions of this Act for:—

(*a*) The government, discipline and honour of the Members.

(*b*) The management of its property.

(*c*) The maintenance of the Association by levying fees not in excess of $5.00 per annum.

(*d*) The examination and admission of candidates to the study and practice of the profession.

(e) All other purposes reasonably necessary for the management of the Association.

6. All By-laws or amendments thereto shall become effective only after ratification by two-thirds majority of the votes received from the Members of the Association in good standing.

Who May Practise

7. (*a*) Only such persons who are Members of the Association hereby incorporated and registered as such under the provisions of this Act, or who have received a license from the Council of the Association as hereafter provided, shall be entitled, within the Province of ...., to take and use the title of "Professional Engineer" or any abbreviation thereof, or to practise as a "Professional Engineer."

(*b*) Any person residing in the Province of .... at the date of the passing of this Act, who is at that date and has been for five years previously practising as a Professional Engineer shall be entitled to be duly registered as a Member of the Association without examination, provided that such person shall produce to the Council, within one (1) year of the passing of this Act, satisfactory credentials of having so practised.

(*c*) Any person who may come to reside in the Province of .... and who at that time is a duly registered Member of an Association of Engineers similarly constituted of any other Province of the Dominion of Canada, may become a duly registered Member of the Association without payment of fee for that year providing he shall produce to the Council a Certificate of Membership in good standing in such Province, and an application for Transfer of Registry endorsed by the Registrar of the Province in which he lately resided.

(*d*) Any person not otherwise qualified as hereinbefore mentioned, residing in the Province of.......... and who may desire to become a registered member of the Association shall make application to the Council, and shall submit to an examination, or shall submit credentials in lieu of examination, whichever the Council may decide, and shall be admitted to Registry as a Member of the Association on payment of prescribed fees after the Council shall have certified in writing that such examination or credentials have been found satisfactory to it.

(*e*) Any person not residing in the Province of ...., who is a registered member of an Association of Engineers similarly constituted of any other Province of the Dominion of Canada, shall obtain from the Registrar a license to practise as a Professional Engineer in the Province of .... upon production of evidence of his registry in such other Province, and upon payment of a fee of one dollar. In the event of such person being unable, by reason of emergency or neglect on the part of the Registrar or for any other good and sufficient reason, to obtain such license within three (3) months of his making application therefor, he shall be entitled to practise as a Professional Engineer in the Province for such period of three months without holding such license.

(*f*) Any person who is not a resident of Canada, but who is a Member of any engineering or technical organization or society of standing, recognized by the Council, may obtain a license to act in an advisory or consultative capacity to a registered member of the Association.

(*g*) Any person who is employed as a Professional Engineer by a public service corporation, a private corporation, public utilities or Government department, whose business is normally carried on in two or more of the Provinces of Canada, and who is by reason of his employment required to practise as a Professional Engineer in other Provinces than that of his residence, may so practise in the Province of ...., without holding a non-resident license, or payment of fee, providing such person can on demand of the Council produce credentials satisfactory to the Council showing that he is a registered member of an Association of Engineers similarly constituted of some other Province of Canada. It shall be the duty of such person to produce such credentials whenever so required by the Council.

(*h*) Any Professional Engineer who is a resident of some other Province of Canada in which there is no Association of Engineers similarly constituted, may obtain a license to practise, subject to the discretion of the Council.

(*i*) Assistants working under the direct supervision of a Professional Engineer and not taking responsibility for their work other than to their direct superiors shall not be deemed to be practising as Professional Engineers when so engaged.

(*j*) The provisions of this Act shall not apply against any person employed in actual service in His Majesty's Naval, Military or Aerial Service.

(*k*) In the case of Engineers who were practising in the Province of ...., and who have been accepted for overseas service in the present war in the forces of Great Britain, or any of her Allies, shall on their return to Canada be entitled to all the rights and privileges conferred under sub-section "b" of Section 7.

Partnership

8. In the case of two or more persons carrying on practice as Professional Engineers in co-partnership only such members who are registered or licensed under this Act, shall individually assume the function of a Professional Engineer. A firm as such cannot be deemed to be a Member of the Association or be licensed to practise.

Administration

9. (*a*) There shall be a Council of Management of the Association to consist of a President, Vice-President and .... Councillors, to be elected by the Association, and hold office as hereinafter provided. All Members of the Council shall be registered under the provisions of this Act.

(*b*) The President shall be elected annually and shall hold office until his successor is elected. He shall act as presiding officer at the meetings of the Council and of the Association, voting only when the votes are evenly divided. On retirement he shall hold office as Councillor for the next year succeeding.

(*c*) The Vice-President shall be elected annually and shall have all the powers of the President during the absence of the latter.

(*d*) .... Councillors shall be elected for the first year after the coming into effect of this Act; thereafter only .... Councillors shall be elected each year. The .... Councillors receiving the largest number of votes at each annual election, after the first election, shall act for two years.

Suspension for Misconduct

10. (*a*) The Council may, in its discretion, reprimand, censure or suspend or expel from the Association any Engineer guilty of unprofessional conduct, negligence, or misconduct in the execution of the duties of his office, or convicted of a criminal offence by any Court of competent jurisdiction.

The Council shall not take any such action until a complaint under oath has been filed with the Registrar and a copy thereof forwarded to the party accused. The Council shall not suspend or expel an Engineer without having previously summoned him to appear to be heard in his defence, nor without having heard evidence under oath offered in support of the complaint or on behalf of the Engineer. The Council shall have the same powers as the .... Court to compel witnesses to appear and to answer under oath in the manner and under the penalties prescribed by the code of .... The President of the Council or person acting as such in his absence, or the Secretary, is hereby authorized to administer oaths in such cases. All evidence shall be taken in writing or by a duly qualified stenographer.

(*b*) Any Engineer so expelled or dismissed may, within thirty days after the order or resolution of suspension or expulsion, appeal to a judge of the Supreme Court from such order or resolution, giving seven days' notice of appeal to the Council, and may require the evidence taken to be filed with the proper officer of the Court, whereupon such judge shall decide the matter of appeal upon the evidence so filed and confirm or set aside such suspension or expulsion, without any further right of appeal; and if the suspension or expulsion be confirmed, the costs of such appeal shall be borne by the Engineer.

(*c*) Unless the order or resolution of suspension is set aside on such appeal, or the judge or the Council otherwise order, the Engineer so suspended or expelled shall not practise further, except (in case of suspension) upon expiry of the period of suspension. Pending an appeal the Engineer so suspended or expelled shall not practise.

Penalties

11. Any person who not being a registered or licensed Professional Engineer in the Province or who is suspended or has been expelled under the proceedings of the next preceding section:

(*a*) Practises as a Professional Engineer; or,

(*b*) Usurps the functions of a Professional Engineer; or,

(*c*) Assumes verbally or otherwise the title of Professional Engineer, or makes use of any abbreviation of such title, or of any name, title, or designation which may lead to the belief that he is a Professional Engineer, or a member of the Association; or,

(*d*) Advertises himself as such in any way or by any means; or,

(*e*) Acts in such manner as to lead to the belief that he is authorized to fulfil the office of or to act as a Professional Engineer,

shall be liable upon summary conviction to a fine of not less than $100.00, nor more than $200.00, and on failure to pay the same to imprisonment for not more than three months for the first offence, and for any subsequent offence to a fine of not less than $200.00 nor more than $500.00, and on failure to pay the same to imprisonment for not more than six months.

Evidence

12. The certificate of the Registrar under the seal of the Association shall be *prima facie* evidence of registration or license, or non-registration, as the case may be.

Examinations

13. The Board of Examiners shall be nominated and appointed annually by the Council, subject to such approval as the Government of the Province may require.

14. (*a*) Examinations of candidates for registration or license shall be held as often and at such places as the Council may direct.

(*b*) The scope of the examinations and the methods of procedure shall be prescribed by the Council with special reference to the applicant's ability to design and supervise engineering works which shall insure the safety of life and property.

(*c*) The candidate shall submit to examination before the Board on the Theory and Practice of Engineering, especially in one or more of the recognized branches of engineering at his option.

(*d*) As soon as possible after the close of each examination the Members of the Board who shall have conducted such examination shall make and file with the Secretary a certificate stating the result of such examinations, whereupon the Council shall notify each candidate of the result of his examination and of their decision upon his application.

(*e*) A candidate failing on examination may after an interval of not less than one year be examined again.

(*f*) The Council shall, from time to time, prescribe the fees payable by candidates for examination.

Registration Without Examination

15. The Council shall consider an application for registration or license from any person who submits proof of qualifications possessed by such person by virture of experience, training or examination by another examining body of recognized standing.

16. The Council shall have power to establish conjointly with any Council of any Association similarly constituted in one or more of the Provinces of Canada, a Central Examining Board, and to delegate to such Central Examining Board all or any of the powers possessed by the said Council respecting the examinations of candidates for admission to practise, provided that any examination conducted by such Central Examining Board shall be held at least in one place within this Province.

17. The board shall examine all degrees, diplomas, certificates and other credentials presented or given in evidence for the purposes of obtaining registration or license to practise, and may require the holder of such credentials to attest by oath or by affidavit on any matter involved in his application.

18. (*a*) Notwithstanding any other provision of this Act, no person shall be registered unless at least twenty-three (23) years of age, and unless he has been engaged for

eight (8) years in some branch of engineering, except in the case of a graduate from a recognized Engineering College, in which case the period of engagement in engineering work shall be reduced to six (6) years, which may include his term of instruction.

(*b*) Candidates for admission to practise who, for any reason, have been unable to take advantage of an academic engineering course, must serve at least six (6) years under a registered Engineer or under a Professional Engineer of recognized standing, and pass a preliminary examination satisfactory to the Board.

19. The Registrar shall issue a certificate of registration or a license to practise to an accepted candidate upon written instructions from the Council, and upon payment in advance of the prescribed fee by the candidate.

20. The Registrar shall keep his register correct, in accordance with the provisions of this Act, and the rules, orders and regulations of the Council.

21. (*a*) Each person who is registered or licensed to practise shall pay in advance to the Secretary-Treasurer, or any person deputed by the Council to receive it, such annual fee as may be determined by By-laws of the Association, which fee shall be deemed to be a debt due by the practitioner and to be recoverable with the costs of same in the name of the Council in any court of competent jurisdiction.

(b) If any registered practitioner omit to pay the prescribed annual fee within six months of the date upon which it became due, the Registrar shall cause the name of such practitioner to be erased from the register, and such practitioner shall thereupon cease to be deemed to be a registered practitioner; but such practitioner shall, at any time thereafter, upon paying such fee, be entitled to all his rights and privileges as a registered practitioner from the time of such payment.

(*c*) The Registrar shall not be required to issue a license to practise to any non-resident practitioner otherwise entitled to such license unless the fee provided for by the By-laws of the Association shall have been previously paid.

22. Any person entitled to be registered under this Act who shall neglect or omit to be so registered shall not be entitled to any of the rights and privileges conferred by the provisions of this Act so long as such neglect or omission shall continue.

23. In the case of any refusal by the Council to register the name of any person as a Member of the Association, or of refusal to issue a license to practise, the person aggrieved shall have the right to apply to a judge of the Supreme Court, who, upon due cause shown, may issue an order to the Council to register the name of such person, or to grant him a license to practise, or make such other order upon such appeal as may be warranted by the facts, and the Council shall forthwith comply with such order. Such order when so made shall be final.

24. If the Registrar makes or causes to be made any wilful falsification in any matters relating to the register, he shall forfeit a sum of not less than one hundred dollars ($100.00).

25. If any person shall wilfully procure or attempt to procure himself to be registered or licensed under this Act, by making or producing, or causing to be made or produced any false or fraudulent representations or declaration, either verbally or in writing, every such person so doing, and every person knowingly aiding and assisting him therein, shall forfeit and pay a sum of not less than one hundred dollars.

26. All penalties imposed under this Act, or any of them, and all sums of money forfeited shall be recoverable with costs under the provisions of the law respecting summary convictions.

27. Any information for the recovery of any such penalty or forfeiture may be laid by any Member of the Association or by any person appointed by the Council.

28. Any sum forfeited under this act being recovered shall belong to the Association for the use thereof under this Act.

29. No prosecution shall be commenced for any offence against this Act after one year from the date of committing the offence.

30. The following persons are hereby constituted a Provisional Council of the Association:—

President....................................

Vice-President...............................

Councillors..................................

....

....

The duties of the Provisional Council shall be to provide the register called for by this Act, to enter therein the names of those who are entitled to registration and who apply therefor under the provisions of Section 7, clause "b," and to call within six months from the coming into force of this Act the first General Meeting of the Association for those purposes and any other organization purposes of the Association; they shall have the powers conferred in this Act on the Council of the Association. Their powers shall cease on the election of the regular Council of the Association.

31. No provisions of this Act restricting the practise of the profession or imposing penalties shall take effect until one year after the passing of this Act.

32. Every person registered under this Act shall have a seal, the impression of which shall contain the name of the engineer and the words "Registered Engineer, Province of ...." with which he shall stamp all official documents and plans.

33. The activities of the Association are hereby restricted to the functions necessary to the administration of this Act.

Professional Engineers

On another page will be found a copy of the draft act submitted by a special committe of the branches, which is designed to establish a body of professional engineers in Canada. The committee who drew up this act as a result of the resolution of the annual meeting were:—C. E. W. Dodwell, M.E.I.C., Chairman; A. Surveyer, M.E.I.C., Secretary; C. C. Kirby, M.E.I.C.; A. R. Decary, M.E.I.C.; R. F. Uniacke, M.E.I.C.; Willis Chipman, M.E.I.C.; E. R. Gray, M.E.I.C.; N. L. Somers, A.M.E.I.C.; E. E. Brydone-Jack, M.E.I.C.; H. R. McKenzie, M.E.I.C.; F. H. Peters, M.E.I.C.; R. J. Gibb, M.E.I.C.; A. G. Dalzell, A.M.E.I.C.; and A. E. Foreman, M.E.I.C.

The western delegates met at Winnipeg en route to Montreal and spent two days together discussing the broad subject of legislation. No group of men could have worked harder than the men sent by the different branches for this purpose. It is to be noted that the members of *The Institute* are given no preference whatsoever in this proposal, while the expense of this meeting is being borne entirely by *The Institute;* that is, *The Institute* is unselfishly working in the interests of the whole profession. Other organizations in Canada, comprising professional engineers, will no doubt appreciate the work of *The Institute* in this connection.

A ballot will be submitted to the members very shortly and the result of this ballot will doubtless determine what action the various provinces will take in connection with legislative enactments.

Results of Memorial

A memorial published in the April issue of *The Journal*, which was forwarded to the Premier of Canada and to the Prime Ministers of the various provinces, have brought a number of replies, all of which promise consideration to the situation as outlined in the memorial. Space does not permit publishing the various replies. That of Sir Lomer Gouin, Prime Minister of the Province of Quebec is particularly encouraging. It reads:—

Dear Sir:—

I have received the memorial of the Engineering Institute of Canada, dated April 5th instant. Do I need to tell you that I am pleased to recognize the great utility of technicians at all times, but especially during the difficult times through which we are passing. It is because I appreciate their value that I have always tried to encourage both technical and polytechnical education in the Province. You may rest assured that we will always be glad to have recourse to the skill of civil engineers whenever the occasion presents itself.

Yours very truly,

(Signed) LOMER GOUIN.

It was reported that Yarrow Limited will gradually discontinue their great shipbuilding on the Clyde and complete their work at Esquimalt, B.C., due to the better industrial prospects of British Columbia. The Times' shipping correspondent, describing a recent visit to Vancouver, contrasts the activity of Tacama and Seattle to the comparative stagnation of Victoria and Vancouver, and insists on the capacity for development of the latter's shipbuilding plant, including Yarrow's, which was acquired from the British Marine Railway Company five years ago. Yarrow's managing director is at present in Vancouver, it is stated, preparing for its removal.

The Special Legislation Committee of the Institute which drew up the proposed bill for professional engineers during its sessions at the headquarters of the Institute from April 5th to the 10th, reading from left to right:

Arthur Surveyer, M.E.I.C., Montreal, Secretary of the Committe; E. E. Brydone-Jack, M.E.I.C., Winnipeg, Man., R. J. Gibb, M.E.I.C., Edmonton, Alta., F. H. Peters, M.E.I.C., Calgary, Alta., R. F. Uniacke, M.E.I.C., Ottawa, Ont., E. R. Gray, M.E.I.C., Hamilton, Ont., A. R. Decary, M.E.I.C., Quebec, Que., Newton L. Somers, A.M.E.I.C., Sault Ste Marie, Ont., A. E. Foreman, M.E.I.C., Victoria, B.C., H. R. McKenzie, M.E.I.C., Regina, Sask., C. C. Kirby, M.E.I.C., St. John, N.B., Willis Chipman, M.E.I.C., Toronto, Ont. and in the foreground C. E. W. Dodwell, M.E.I.C., Halifax, Chairman of the Committee. A. G. Dalzell, A.M.E.I.C. Vancouver, was present at the early sessions of the committee.

REPORT OF COUNCIL MEETINGS

On April 7th the meeting of the Council adjourned from March 25th was held at headquarters and was attended by nine members of Council.

Soldiers Civil Re-establishment: Major George Reilly, on behalf of the Professional and Business Occupational Section, of the Information and Service Branch of the Department of Soldiers' Civil Re-establishment, was invited to give a summary of the work of his department—which he did. He strongly urged the co-operation of *The Institute* in connection with this work. He was assured that the Montreal Branch would co-operate, and that the other branches throughout the Dominion had been, or were being, organized to assist the Government in placing returned professional men. A Committee for *The Institute* was constituted, consisting of Sir Alexander Bertram, W. F. Tye, H. H. Vaughan, D. H. McDougall, F. H. Peters, A. E. Foreman, George D. Mackie, A. R. Decary, W. G. Chase and A. H. Harkness.

The following committees were approved: Montreal—S. F. Rutherford, W. Winterrowd, W. F. Tagge and Norman Campbell; Quebec—G. K. Addie, P. Joncas, Altheod Tremblay, A. Dick, J. E. Gibault, A. Fraser; Toronto—W. Cross, E. T. Wilkie, T. H. Hogg, R. O. Wynne-Roberts and R. T. G. Jack.

It was resolved that a circular letter be sent out from *The Institute* asking every member to give his assistance towards this laudable work. The Secretary was instructed to further aid in every way, in accordance with the previous policy of Council.

Technical Organization in British Columbia: President Leonard reported visits to Victoria and Vancouver and his attendance at meetings held at both these places where he found a strong feeling, on the part of technical men, for improvement in conditions, and an absolute need of organization towards helping to increase salaries. He stated that *The Institute* must realize the need of supporting such a movement. The President's report opened up a general discussion on the subject of the salary situation in the engineering profession, and ways and means of assisting to remedy same, which took up the major portion of the evening. As a result of the discussion and to show the attitude of Council, a committee, consisting of R. A. Ross, H. H. Vaughan, Julian C. Smith, and G. Gordon Gale, was appointed to enquire immediately as to what the government proposes to do in the way of increasing salaries of technical men, and to report to Council a scheme whereby the most effective method of dealing with the government on this question could be adopted.

Legislation:—President Leonard announced that it was desirable that the Members of Council take congnizance of the meeting of the Special Legislative Committee now in session. He took pleasure in inviting Council and the Committee to luncheon with him on the following day. This Special Committee was entertained at dinner, by the Montreal Branch, immediately preceding this meeting.

Copyrighting:—The Secretary reported that a new copyright act was before Parliament which would protect *The Institute's* papers in a very simple manner. He read a letter from Mr. Budden giving information on this subject and it was decided to await the action of parliament before taking any further steps in this connection.

Certificates:—The committee reported that the certificates were under way, that the engravers had completed the plate for the certificate, and that the proof had been approved, so that the certificates would be available very shortly.

Official seal:—The committee recommended that the offer of Messrs. Walker & Campbell to make one long reed seal at a price of not less than twenty dollars, nor more than twenty-five dollars, be approved.

The Institute Emblem:—On behalf of the committee, appointed to secure an emblem for *The Institute*, Mr. Francis reported, and recommended, the acceptance of the offer from Messrs. Caron Brothers to make a die for seventy-five dollars, for the new badge. It was resolved that the committee be authorized to secure the die at the price mentioned. The price of the badges would depend on whether they were bronze, silver, or gold.

* * *

The regular monthly meeting of the Council was held at the rooms of *The Institute*, 176 Mansfield Street, on Tuesday, April 22nd, at 8.15 p.m.

Present: Lieut.-Col. R. W. Leonard, President, in the chair; G. H. Duggan, Professor, H. E. T. Haultain, Walter J. Francis, Arthur Surveyer, G. Gordon Gale, Alex. Gray, Brig.-Gen. Sir Alexander Bertram, A. R. Decary, Professor Ernest Brown and John Murphy.

Previous minutes:—The minutes of the adjourned meeting held on April 7th, were approved as read.

Legislation:—The major portion of the evening was devoted to a discussion of the report of the Special Legislation Committee, which was before the councillors in printed form, with the letter of transmittal.

It was resolved that the bill submitted should be published in the first issue of *The Journal* and that an immediate opinion be secured from all absent members of Council as to whether, or not, it was considered advisable, or necessary, for Council, in submitting the ballot in connection with proposed legislation, to send a letter of transmittal giving advice to the members. The Secretary was instructed to write the absent Montreal members and wire all out-of-town members asking for immediate expression of opinion. These are to be considered at an adjourned meeting on May 6th.

Uniform Branch By-laws: As a result of a number of suggestions received regarding branch by-laws submitted for approval, these had been referred to a special by-laws committee; Professor Brown, Chairman. The report of this committee consisted of a set of branch by-laws, which, it was proposed by the committee, should constitute a standard branch act. The Secretary was instructed to have this prepared and forwarded to the branches for consideration. It was resolved that the various by-laws of the branches, now before the Council, be held until the reports were received from the branches based on the suggestions submitted.

At a special, adjourned meeting of Council held on Thursday evening, April 24th, the following elections and transfers were effected:

Members.

William Newman, C.E. (S.P.S.), head of W. Newman Co., Ltd., Winnipeg, Man.

Associate Members.

Matthew Balls, asst. engineer, Dominion Government, Hydrometric Survey, Vancouver, B.C. Marius Eugene Bene, App. Sc. (Geneva), engineer superintendent of construction for the Provincial Building & Engineering Co., Montreal. George Philip Frederick Boese, assistant engineer, C.P.R., department of natural resources, engineering branch, Calgary, Alta. John James Newman (S.P.S.), town engineer of Leamington and Amherstburg, and township engineer of Anderson, Sandwich West, Colchester South, Tilbury North and Tilbury West; of Windsor, Ont. George Earl Templeman, chief engineer, Electrical Commission of Montreal.

Juniors.

Erwin Alfred Childerhose, B.E.E. (Univ. Man.), assistant to chief engineer, City of Winnipeg Light & Power Dept., Winnipeg, Man.

Transferred from the Class of Associate Member to that of Member.

Francis Thornton Cole, B.Sc. (McGill), chief engineer of Eastern Canada Steel Company, Quebec, Que. Donald Laird Derrom, B.Sc. (McGill), works manager for Winslow Bros. Co., Chicago, Ill. Frederic Harcourt Emra (Captain), asst. chief engineer, Ministry of Shipping & Extensions Department of the Admiralty, London, England. Franklin McArthur, B.Sc. (Queen's), city engineer, Guelph, Ont. John Alexander McFarlane, B.A.Sc. (Toronto), chief draughtsman, Hamilton Bridge Works, Hamilton, Ont. Bertram Stuart McKenzie, B.A., B.Sc., (McGill), consulting engineer, Winnipeg, Man. Edlin George William Montgomery, acting asst. chief engineer bridge branch, highways dept., Regina, Sask. Harold William Birchfield Swabey, officer in charge of inspection of steel (Canada) for Ministry of Munitions, Ottawa, Ont.

Transferred from the Class of Junior to that of Associate Member.

Frank Chatham Askwith, B.Sc., deputy city engineer, in charge of Works Department, City of Ottawa, Ont. David Gordon Calvert (S.P.S.), engineer in charge of construction, Dayton Wright Airplane Co., Dayton, O. Arthur Dixon, district public works engineer for British Columbia, South Fort George, B.C. William Harold Hunt, B.C.E. (Man.), road engineer, Department of Public Works, Winnipeg, Man. Robert Chesley McCully, B.Sc. (McGill), designer and estimator, Imperial Oil Co., Ltd., Sarnia, Ont. John Earle Porter, B.A.Sc., field engineer, Canadian Steel Corporation, Ojibway, Ont. Michael Joseph Rutledge, B.Sc. (Univ., N.B.), designer with Henry Holgate, Montreal, Que. Gordon S. Stairs, B.Sc. (Dalhousie, N.S.), assistant to Third Division Officer, R.C.E., M.D., Halifax, N.S. Joseph Henri Valiquette, B.A. Sc. (Laval), assistant engineer in charge Department of Surveys & Design, Montreal, Que. McClelland Barry Watson, B.A. Sc., C.E., M.E., assistant engineer Department of Public Highways, Toronto, Ont.

Transferred from the Class of Student to that of Associate Member.

Lieut. George Francis Dalton B.A.Sc., of Ottawa, Ont., 3rd Canadian Engineers, B.E.F., France. Leslie Henry Hornsby, designing draughtsman, Toronto Terminals Ry., Toronto.

Transferred from the Class of Student to that of Junior.

Capt. Wm. F. Hadley (Grad., Honors, R.M.C.), of Hull, Que., Assistant Director of Signalling, Militia Headquarters. Walter George Hunt, B.Sc., (McGill), asst. engineer, Laurentide Co., Grand Mere, Que.

Good Roads Congress

The Sixth Annual Good Roads Congress will be held at the Parliament Buildings in the City of Quebec on May 20th, 21st and 22nd, under the auspices of the Canadian Good Roads Association. This will be one of the most important good roads conventions yet held.

The good roads movement has received great stimulation by the financial assistance from the Federal Government and the active interest the Provincial Governments are taking in this important subject. The Canadian Good Roads Association has carried on an active educational campaign which has a Dominion-wide character and has had much to do with the growth of public sentiment on behalf of good roads.

It is expected that there will be a large attendance of engineers at this Congress and the members of *The Institute* are all heartily invited. The executive officers are: Honorary President, Capt. J. A. Duchastel, M.E.I.C.; city manager, Outremont; President, S. L. Squire, Honorary President, Ontario Roads Association; First Vice-President, A. F. Macallum, M.E.I.C., Commissioner of Works, Ottawa; Second Vice-President, P. E. Mercier, M.E.I.C., Chief Engineer and City Surveyor, Montreal; Secretary-Treasurer, Geo. A. McNamee, 909 New Birks Building, Montreal.

Other executive officers of the Association are : W. A. McLean, M.E.I.C., Deputy Minister of Highways, Ontario; J. E. Griffith, M.E.I.C., Deputy Minister of Public Works, Victoria; and W. G. Yorston, M.E.I.C., formerly Assistant Road Commissioner, Province of Nova Scotia.

* * *

The Naigai Kagakubussan Kabushikikaisha, which being interpretated means The Naigai Chemicals Trading Company of Osaka, Japan, has sent in an inquiry desiring to be placed in touch with exporters and importers of chemicals and dyes and manufacturers of iron and steel and wire cable, etc. This firm gives as reference the Yokohama Specie Bank, and the Sumitomo Bank, which has branches in New York, San Francisco and London.

BRANCH NEWS

St. John Branch

A. R. Crookshank, M.E.I.C., Sec'y.-Treas.

The St. John Branch met on March 27th and April 17th, and sustained interest has been shown by the members in the different lines of endeavor being carried on by *The Institute.* Committees have been appointed and have appealed to all the members in the province to assist with the Soldiers' Civil Re-establishment work for returning engineers, and to enlist support for the passage of the Civil Service Amendment Act to bring into effect the revised schedule of salaries for Government engineers. Another committee has been appointed to work out a definite scheme to assist engineers to obtain positions, and employers to find suitable engineers for their work; this committee will co-operate with the first named committee, and will also act for the present as an employment bureau for all engineers in this locality. Still another committee is gathering information regarding the salaries and fees received by New Brunswick engineers, so as to be able to compare them with those received elsewhere, and to prepare the way for work in making up minimum schedules of remuneration later.

The Branch placed itself on record as favouring the League of Nations Union; this appealed to the members as being a constructive idea, and it was realized that unless the majority of the individuals that form the population of the contracting nations do not personally uphold the larger co-operative ideals that are necessary for world government. the League of Nations cannot be a lasting success.

Considerable time has been devoted to the discussion of the draft of the act for engineers, and to the report of the good work done at the legislation conference by our chairman, who acted as our delegate. Steps will shortly be taken to obtain a list of all the engineers in the province who will come under the act.

An interesting paper, illustrated by reflectoscoped photographs, was read by Geo. G. Hare, A.M.E.I.C., City Engineer of St. John on the "Re-construction of Bridges on the Dominion Atlantic Railway." Mr. Hare was engineer of maintenance and construction on this railway for several years. As this railway parallels the north coast of Nova Scotia for the greater part of its length, along the Bay of Fundy, the water crossings are numerous.

Between the years 1912 and 1915, some 6,500 lineal feet of wooden bridges were replaced by steel bridges on concrete piers and abutments, or concrete arches and fills, totalling some 500,000 cubic yards, besides repairing other structures. This work was part of the renovation of the line which included repairs to roadbed and stations; the building of water tanks, small wharves, branch lines, etc., etc.

The construction of the substructure for the Windsor bridge 1146 feet long, spanning the Avon River, was particularly interesting, on account of the high range of tide—an average of 34 feet—which cut down the working hours to not more than four per tide, for foundation work; the high current— an average rate of 10 miles per hour at half ebb and flood; the shifting nature of the river bottom. such that a new channel would be eroded up to 20 feet deep or an old one filled in during a single tide; and the large amount of greasy sediment deposited by each tide on new concrete or other work. Coffer dams were sunk through the sand and mud to a hard clay substratum, which was blasted to form pockets to take pier foundations and so keep them from sliding. Excavated coffer dams with tops about six feet above low water were several times filled by moving sand banks.

The foundation work for the Shubenacadie River bridge was under somewhat similar conditions, but was placed on rock ledge.

The Gaspereaux, Bridgetown, Allen's Creek, Weymouth and Clementsport bridges each had their difficulties and variations of conditions.

The Hantsport Aboideau was a rather unusual type of structure, built under adverse conditions. The concrete of the several structures was protected by timber sheeting from erosion by frost, and current action, and from abrasion by drifting field ice.

Quebec Branch

J. A. Buteav, A.M.E.I.C., Sec'y.-Treas.

At a meeting of the Quebec Branch held on the 17th of March the following committees were appointed to assist in placing returned engineers:

Employers Committee: G. K. Addie, Quebec; P. Joncas, Beauport; Alth. Tremblay, City Hall.

Employees Committee: A. Dick, Quebec; J. E. Gibault, Quebec; A. Fraser, Quebec.

Ottawa Branch

M. F. Cochrane, A.M.E.I.C., Sec'y.-Treas.

The first meeting of the Ottawa Branch, since the Annual Meeting, was held on March 20th in the testing room of the Naval Radio-Telegraph Service, when Lt.-Com. Edwards read a paper on Radio-Telegraphic Reception. This was illustrated by a number of beautiful experiments in which Commander Edwards was ably assisted by his staff.

Each member of the audience was provided with a telephone receiver and in this way was enabled to listen to some of the high power stations at work, including Arlington sending time signals, Glace Bay, Tuckerton, N.J., and the United States Naval Station at Annapolis, which at the time was in communication with a United States station in the south of France.

Wireless telephony was also demonstrated for the first time in Canada, and, by means of gramophone records connected with the telephone receivers, the audience listened to the characteristic sounds of a submarine running on the surface and submerged as compared with the sounds of other vessels, thus showing one of the most effective methods employed for destroying German submarines in the War.

A meeting of the Branch was held on March 27, to discuss the question of legislation. A. G. Dalzell, A.M.E.I.C., Secretary of the Vancouver Branch, was present and explained the position of the British Columbia members.

Lt.-Col. Peck, V.C., M.P., was the guest of the Branch at luncheon at the Chateau Laurier on April 3, and gave an interesting address on "Some Phases of the Great War."

Toronto Branch

W. S. Harvey, A.M.E.I.C., Sec'y.-Treas.

At an open meeting of the Toronto Branch held on February 28th, 1919, a resolution was adopted to appoint a committee on engineering fees and a committee on engineering salaries. The committee on salaries was to make a thorough and comprehensive study of various engineering organizations, and ascertain the nature of the duties, responsibilities and the qualifications required of the different engineering members of these organizations. This study was to be made with to view to determining the value of the services of these engineers, and accordingly to prepare a schedule of minimum salaries for engineers in all classes and in all grades of engineering work.

The resolution also called upon the Secretary of the Branch to communicate with the other branches of *The Institute* and request them to take similar action in appointing similar committees, and in this way to co-operate with the Toronto Branch in raising the financial status of the engineering profession to a higher level.

The Toronto Branch has already appointed a strong Salary Committee, including some of the most prominent members of this Branch. This Committee has taken up its work quite seriously and energetically and will meet regularly ever two weeks until its work will be completed.

* * *

The following is an extract from the minutes of the meeting of the Salaries Committee of the Toronto Branch held on April 2nd.

A general discussion took place on the classification of engineers for the purpose of the work of this Committee. It was at first suggested that, as a basis to work upon, the engineers should be divided in accordance with the particular line or branch of the profession that they follow, such as Civil, Mechanical, Electrical, etc., and these should then be subdivided into the various branches that they form. After some discussion, however, it was agreed that the most practical procedure of classifying would be to consider each kind of organization that employes engineers, as a division or a unit by itself, such as a railway organization, or a municipal organization. So many different kinds of organizations should be considered, that every engineering employee, no matter what line of work he follows, will find a place in one or more of these organizations. Schedules of salaries should then be worked out for each of these organizations in such a way that similar duties, responsibilities, and qualifications in different organizations will command similar salaries.

The following general divisions of engineers were then suggested:—

1. Engineers employed by Railways.
2. " " by Municipalities.
3. " " on Public Works (Dominion or Provincial.)
4. " " by Public Utilities other than Railways.
5. " " in Industries.
6. " " with Consulting Engineers.
7. " " on Mining Work.

Sub-committees were then appointed and were instructed to secure all available information with respect to the organization, titles, responsibilities and duties of engineers in the particular division to which they were appointed. Progress to be reported at the next Committee meeting.

The Committee then took up the communication from Mr. Keith with respect to the proposed bill which is intended to be submitted to Parliament, asking for a general increase of the salaries of engineers in the Government employ. The Committee decided that no definite action can be taken until a copy of the bill has been received, when this matter will be taken up again.

It was suggested that the Salaries Committee shall meet regularly every 1st and 3rd Wednesday of the month until it will have its work completed and a report ready to submit to the Branch. This suggestion was adopted.

Hamilton Branch

H. B. Dwight, A.M.E.I.C., Sec'y-Treas.

The opening of the new auditorium in the Westinghouse general offices on April 11th was marked by a joint meeting of *The Engineering Institute of Canada* and the Toronto section of the American Institute of Electrical Engineers. E. R. Gray, M.E.I.C., City Engineer of Hamilton and A. H. Hull of Toronto jointly officiated as Chairmen.

G. E. Stoltz, of the Westinghouse Electric and Manufacturing Company of Pittsburgh, gave an illustrated talk on the electrification of steel mills and he described, with the help of many lantern slides, the advantage of electric motors over steam engines and the application of power in the manufacture of steel.

On the following day visitors from Toronto accompanied by a number of local engineers visited the plants of the Dominion Foundries and Steel Limited, the Dominion Power and Transmission Company and the Steel Company of Canada.

On March the 28th, the Hamilton Branch of *The Engineering Institute of Canada*, was privileged to hear at first hand the story of the building of the Quebec Bridge, as told by George F. Porter, M.E.I.C., Engineer of Construction of the St. Lawrence Bridge Co. His clear and interesting description of the work, and the remarkable collection of lantern views, conveyed a strong idea of the record-breaking character of this bridge which is a monument to Canadian engineering. This lecture, which has been given with great success before nearly every branch of *The Engineering Institute of Canada*, was thoroughly appreciated in Hamilton, as was evidenced by the large audience. E. R. Gray, Chairman of the Branch, presided at the meeting, and a vote of thanks was tendered the lecturer by E. H. Darling, M.E.I.C.

Niagara Peninsula Branch

R. P. Johnson, S.E.I.C., Sec'y.-Treas.

Smoker.

A meeting of the Branch was held on the evening of April 1st, in the room of the Clifton Club, Niagara Falls, Ont., with the Chairman presiding.

Many visiting engineers were present.

The minutes of the organization meeting were read and approved.

The Chairman announced that, the formation of the Niagara Peninsula Branch had been approved by Council, also the officers.

The Chairman called upon Lieut.-Col. Leonard, President of *The Institute*, for a short address.

Col. Leonard complimented the Branch upon its formation and upon the large attendance of engineers at the meeting. The speaker told of the great revival and activities of *The Engineering Institute* in the past two or three years and recounted his recent visit to the branches at Winnipeg, Vancouver and Victoria and described the success of the Annual Meeting at Ottawa. The status of engineers, as compared to the trades was reviewed by the speaker and the fact was brought out that the position and standing of the engineering profession must be raised by engineers themselves, through the organized effort of *The Engineering Institute*. The speaker closed with an eulogy of the work of H. H. Vaughan, M.E.I.C., immediate past president of *The Institute*.

The chairman called upon E. W. Oliver, M.E.I.C., of the Toronto Branch, for a short talk. Mr. Oliver told of the recent revisions to the constitution of the Canadian Society of Civil Engineers which had brought about the change of name to that of *The Engineering Institute of Canada*, accompanied by the broadening of the organization to include all branches of the profession. The benefits of the change were already very apparent in the marked rejuvenation of *Institute* affairs. The speaker pointed out the necessity of obtaining, through the channels of *The Institute*, legislation to protect engineers and the public from imposters and incompetent engineering services. The speaker closed by urging the Niagara Peninsula Branch to lend its weight towards this end.

H. S. Baker asked if the meeting was held to advance the legislation proposal to make engineering a closed profession. The speaker opposed the idea of excluding any individual from the engineering profession, stating that many incompetent men would pass the necessary examinations and competent engineers would not.

Col. Leonard answered the question by reading the objects of *The Engineering Institute* as set forth on the cover of *The Journal*.

The chairman announced that the meeting was held as a " Smoker " and that the evening was now given over to cards and billiards.

An enjoyable two hours was spent around the tables, followed with sandwiches and coffee.

The members of the Branch are very much indebted to the members of the Clifton Club for the use of their splendid quarters.

There was an attendance of fifty-three.

Ontario Provincial Division

George Hogarth, M.E.I.C., Secretary

Organization Meeting

On February 13th, 1919, a meeting of the Ontario Provincial Division was held at the Chateau Laurier, Ottawa. There were present at the meeting the following members:—Prof. Peter Gillespie, Chairman; J. B. Challies; G. Gordon Gale; G. H. Bryson; J. L. Morris; W. H. Magwood; R. F. McClelland and E. M. Proctor. Fraser S. Keith, while very busy with the professional gathering kindly consented to be present to explain the by-laws respecting the Division.

In opening the meeting the Chairman referred to a meeting called in Toronto to elect officers, but on account of outside representatives being absent, an adjournment to Ottawa at the time of the Annual and General Professional Meeting was considered advisable.

A general discussion was entered into regarding the objects and activities of the Division. It was felt that the Division because of its constitution should represent the engineers of Ontario in bringing before the authorities matters affecting engineers and engineering. The Division might also arrange for the presentation of papers of interest to the general body of engineers.

Nominations for officers was next taken up. The Toronto Branch representatives pointed out that because of the Division representing all Ontario, it was highly desirable that the officials should be selected from those members not now a member of the larger branches. Other members held the view that, to get prompt action on all matters of business interest in the Division, it was necessary that the officers of the Division should be in a position to travel and meet the members of the various branches. J. B. Challies, M.E.I.C., was then nominated Chairman of the Division and Geo. Hogarth, M.E.I.C., Sec'y.-Treasurer.

In order that official representation on the Division should be from various parts of the Province, E. R. Gray, M.E.I.C., of Hamilton, was nominated as Vice-Chairman, and Council was requested to authorize a revision of by-laws so that a Vice-Chairman for provincial divisions could be elected.

The raising of funds for the ordinary expenses of the Division was discussed and the secretary instructed to ask Council for a grant of $100.00 for that purpose.

A scale of remuneration for engineers was considered. It was moved by Mr. Morris and seconded by Mr. Proctor that Professor Gillespie be a committee of one, with power to add to the number, to report on a recommended scale of remuneration for engineers in Ontario.

By-laws for the Division have been prepared by Mr. Keith and a motion was carried that the existing draft by-laws be accepted but that the chairman and secretary be a committee to amend such by-laws as they think necessary.

The object in publishing this abstract of the meeting of the members of the Provincial Division in *The Journal* is to bring to the attention of all Ontario Members of *The Institute*, the business that was transacted and also to request a discussion by all interested on the objects and activities that should particularly be engaged in by the Division. It is hoped that many of the non-resident members of Branches will be heard from, and that they will take a lively interest in a movement which will undoubtedly prove of value to them.

Manitoba Branch

George L. Guy, M.E.I.C., Sec'y-Treas.

Luncheon was held at the Fort Garry Hotel on March 15th, at which time A. G. Dalzell, A.M.E.I.C., addressed the members on the work of the Vancouver Branch with reference to legislation for engineers.

On March 20th, a meeting was held in the Engineering Building of the Manitoba University, at which meeting T. A. Hunt, Esq., K.C., read a paper on Civic Management. Mr. Hunt gave special attention to the various forms of government which had been tried in the City of Winnipeg, with special reference to the last Board of Control system, pointing out its faults and the reason for its disappearance. He then dealt with the city managership form of government. An interesting discussion took place in which a large number of the members took part.

On April 3rd, a meeting was held in the Engineering Building of Manitoba University, T. R. Deacon, M.E.I.C., read a paper on "Overhead Costs." Mr. Deacon analyzed the various items which enter into the final selling cost of a product, and brought out very plainly the necessity of a proper consideration of the various costs of production other than the labor and material costs.

A committee was appointed at this meeting to draw up a resolution of condolence to be inscribed on the minutes, expressing the sympathy of the Branch with W. P. Brereton, M.E.I.C., city engineer, on the recent loss of his little daughter; and to the family of the late A. T. Fraser, A.M.E.I.C.

* * *

W. P. Brereton, M.E.I.C., City Engineer, who has been seriously ill with influenza, is now recovering.

Water from Shoal Lake was turned into the Winnipeg mains on Saturday morning, April 5th. This completes the Greater Winnipeg Water District project, which was one of the largest on this continent.

Calgary Branch

C. M. Arnold, M.E.I.C., Sec'y.-Treas.

The activities of the Calgary Branch are largely centred on the subjects of legislation and increased remuneration. This Branch has been a leader in the matter of legislation from the start and has contributed a great deal to the discussion thereon. Members here look forward to an early agreement of all engineers of Canada on this subject.

On the question of salaries it is felt very strongly that something should be done and appreciation is expressed of the activity of *The Institute* along these lines.

The following is a copy of a letter on the subject sent to Major Lee Redman, M.P. and T. M. Tweedie, M.P., of Calgary, and Dr. Alfred Thompson, M.P., member for Yukon, expressing the opinions of the Calgary Branch, and is signed by the Secretary-Treasurer.

Dear Sir:—

In further explanation of wire of March 22nd, from the Calgary Branch of *The Engineering Institute of Canada*, to you regarding salaries of engineers in the Government employ, we wish to state that these salaries, as you are aware have always been very low.

During the past three or four years, they have not been increased, in spite of greatly increased cost of living, but on the other hand, in many cases, the salaries paid by the Government for certain specific duties have actually been reduced to an amount equal to from fifty to seventy-five per cent of the salary paid for the same work or position prior to the war.

This means that men, in receipt of such salaries, have been force to try to live and to provide for families on an amount with a purchasing power of about one-third the amount that was paid by the Government for the same work or position four years previous. It is, therefore, evident that many of these engineers in the Government employ have found it an impossibility to live on these meagre salaries and in order to exist have been forced to draw on their savings.

These facts, in regard to several of the engineers in question, who are employed in one of the Government departments in Calgary, are well known to the Calgary Branch of *The Engineering Institute*. Three of the engineers in this Government department are college graduates, have had from ten to twenty years experience, are full members of *The Engineering Institute of Canada*—the leading national engineering society of the Dominion, and which has a high standard of requirement for admission. The salaries paid these engineers are, $1300, $1600 and $1600, per year, respectively.

Another man is an Associate Member of *The Institute* with excellent experience covering twenty years, is a college graduate, and now draws a Government salary of $1200 per year. All the men, above referred to, are considered competent and all are married men with families.

In another of the Government departments three competent engineers have been employed—two for three years and one for two years—at salaries of $1200 per year.

Latterly (within six months) the departments have found it impossible to get men with exactly similar qualifications, for exactly similar duties, to fill other vacancies, at the same salary of $1200 per year, and have been obliged to advertise and to pay salaries of $1500 per year for new men to fill these vacancies. At the same time they have absolutely refused to increase the salaries of the old and well-qualified men, first above referred to, who have served two or three years, from $1200 to $1500 per year. Also, at the same time, these $1200 men, already in the service who knew the work, have had to teach the new $1500 men, coming into the service, much before they could be of value in their positions.

It is understood that the Civil Service Commission has a staff of efficiency experts working on the re-classification of salaries. In this connection the Calgary Branch of *The Engineering Institute* submits through you this earnest recommendation:—

"That the Civil Service Commission causes an examination of all Government offices, in all the cities of Canada, to be made most thoroughly, by representatives of their efficiency experts, as to salaries and as to all questions of unfairness in connection with employment.

Particularly, that such investigation, as it affects engineers in Government employ, should be made in such a way that the Branch of *The Engineering Institute* at the point at which the investigation is taking place will be allowed to make its representations to such representative and to point out any unfair conditions which need to be remedied.

It is the opinion of this Branch of *The Engineering Institute* that the Civil Service Commission and its staff cannot properly make an intelligent re-classification of salaries, or adjustment of unfair conditions, unless all Government offices are visited, conditions in each thoroughly investigated, and representatives of the employees given a chance to be heard.

It is quite apparent that engineers and technical men generally are woefully underpaid at the present time not only by the Governments but by all employers of technical men. In the Government service worse unfairness seems to exist which should first be corrected, and then the salaries of engineers should be considerably raised. The Government demands such high qualifications as a college education and many years of practical training. The various Governments, Dominion and Provincial, are spending money on technical education to enable young men to fit themselves with such training. What encouragement or inducement is there for young men to take up this kind of work with such poor remuneration which hardly provides a decent living for himself and family?

From time to time, the Government advertises for applications for various positions many of which require only mediocre education and experience, but for which a remuneration is offered which is far higher than for engineers, and other technical employments, for which special education and special training are required.

Great dissatisfaction exists over the manner of the payment of the war bonus asked for, and granted in part, for the fiscal year 1918-19. The Civil Servants Federation asked for a war bonus of $350 to be paid to all employees alike, including Deputy Ministers. In partly granting this the Government seems to have given the maximum bonus of $250 to those in receipt of salaries less than $1100 per year, $200 to those with salaries $1100 to $1200, $150 to salaries $1250 to $1500, and $100 to those in receipt of salaries from $1550 to $1880.

In actual practice this has resulted in giving the maximum bonus to stenographers, clerks and office boys, mostly unmarried or with no dependents, while the less bonus has been paid to most of the married men with families. In one case in one of the Government departments in Calgary an unmarried man on salary of $1600 per annum who entered the service in September, 1918, and who left the service April, 1919, received a bonus, for a half year's service, of $109, while married men, at the same salary, who had been in the service continuously for from three to five years, received but $100. An office boy but a short time in the service received a bonus of $109. Stenographers mostly with no dependents received $250, while married men with families who have been in the service for three years, five years, or even longer, engineers of special education and training and with from ten to fifteen or even twenty years experience and who are the backbone of the particular service in which they are employed, have been thus discriminated against in favour of office boys, stenographers, and clerks most all of whom have no dependents.

Since the Government is providing for an extension of the war bonus for the first three months of the fiscal year 1919-20, the Calgary Branch of *The Engineering Institute* particularly requests that you protest against the payment of the bonus by the method followed last year. That you request that in so far as possible this matter be adjusted so that those with dependents may receive a greater total bonus for the fiscal year 1918-19 and the first three months of fiscal year 1919-20 combined, than that received by those without dependents and that as far as possible this adjustment be made out of money provided for bonus for the first three months of the fiscal year 1919-20."

I trust that in trying to set before you the position of the engineers in the Government service you will not find this communication unnecessarily long. The facts contained herein are absolutely true and can be verified. In fact, other unfairness exists which has not been mentioned.

If any further information is required it will be cheerfully furnished.

I attach a copy of memorandum presented to members of the Dominion Parliament from British Columbia, by the Vancouver Branch of *The Engineering Institute* dealing with the same subject.

Yours very truly,
(Signed) C. M. Arnold,
Sec'y.-Treas.

Victoria Branch

J. B. Holdcroft, A.M.E.I.C., Secretary.

The visit which Col. Leonard, President of *The Institute*, paid to the Victoria Branch on March 12th, was very much appreciated, and a special meeting was called to enable the members of the Branch to meet him. Though the notice was necessarily short, a good number gathered, and most interesting discussion on entirely informal lines followed Col. Leonard's description and account of the Annual Meeting at Ottawa. He touched upon many points of present day interest in the course of his remarks, and particularly outlined the present position as regards legislation and *The Institute's* efforts to obtain better recognition in the shape of increased scales of salaries.

It is hoped that such visits may occur oftener in the future than has been the case in the past, for in no other way will a thorough understanding between the far-western branches and the parent body be so well maintained.

The Victoria Branch is initiating a new departure in connection with "reconstruction" work, by appointing a committee to form what is to be called, tentatively, the British Columbia Board of Industry, which committee is to include representatives of various interests, finance, manufacturing, etc., returned soldiers, boards of trade, and such like organizations, with a view to investigating and assisting in the development of industrial propositions and the industrial development of the province generally.

The membership it is proposed should represent engineering, mining, finance, boards of trade, B.C. Manufacturers Association, returned soldiers, labour, etc. The following have signified their approval of the plan and it is expected will form the preliminary membership of the Board: D. O. Lewis, M.E.I.C., member, Board of Trade; Geo. G. Bushby, past-president, B. C. Manufacturers Association; L. W. Hargreaves, manager, Canadian Bank of Commerce; L. A. Gritten, Department of Soldiers' Civil Re-Establishment; C. W. Winkel, Department of Soldiers' Civil Re-Establishment; W. M. Everall, A.M.E.I.C., Captain, C.E.F.; G. P. Napier, A.M.E.I.C., Lieutenant, C.E.F.; N. A. Yarrow, A.M.E.I.C., manager, Yarrow's Limited; R. W. Macintyre, M.E.I.C., Councillor, *The Engineering Institute of Canada;* J. B. Holdcroft, A.M.E.I.C., secretary, Victoria Branch, *The Engineering Institute of Canada;* G. W. Wilkinson, chief inspector of Mines, B.C.

It is intended that the above shall form an expert council for the purpose of investigating and reporting upon proposed developments, conducting an industrial survey of the province, and such other activities as may be determined upon, and more especially to use its influence to secure the actual undertaking of such developments under satisfactory conditions.

The organization meeting was held on April 16th at the rooms of *The Institute,* the objects being to furnish a central body to co-ordinate the efforts of all the existing organizations, boards of trade, etc., for the industrial development of the province.

Peterborough Engineers' Club

A meeting of the Club was held on April 12th, 1919 at which Fraser S. Keith, Secretary of *The Engineering Institute of Canada* was present. The matter of organizing a branch of *The Institute* was discussed and a committee was appointed to bring in a report at the regular meeting in May on the advisability of taking this step. There are already in Peterborough about fifteen corporate members of *The Institute* and at least fifteen more have signified their intention of joining. Mr. Keith addressed the meeting on the aims and scope of *The Institute.*

The annual election of the Club took place at the same meeting with the following results: Honorary President, C. E. Canfield; President, G. R. Munro, A.M.E.I.C.; Vice-President, R. H. Parsons, A.M.E.I.C.; Secretary-Treasurer, R. L. Dobbin, A.M.E.I.C.; Directors: two years, R. B. Rogers, P. L. Allison, H. O. Fish; one year, E. R. Shirley, Jas. Mackintosh, G. R. Langley.

The Border Cities Branch

A. C. Williams, M.E.I.C., Secretary.

The name "Border Cities" as chosen for our branch is derived from the fact that the five cities or towns of Ford, Walkerville, Windsor, Sandwich and Ojibway, adjoin one another and are located in Essex County, Ontario, on the Detroit River, which is the natural border line between the State of Michigan, U.S.A., and the Province of Ontario at this point. The name follows out the idea widely advertised by the Border Chamber of Commerce and the Windsor daily paper, which is called "The Border Cities Star."

The big outstanding feature in the establishment of this branch was the fact that the idea met with no opposition whatsoever but was warmly supported by all engineers and others interested in the profession. The branch idea was first suggested and fostered by Mr. A. J. Stevens, Acting District Engineer, Dominion Public Works Department, Windsor, Ontario, and great credit is to be given him for promulgating the big idea and ably assisting in bringing about the results which we have attained. The first informal gathering was held in Mr. Steven's office on the afternoon of January 17th, for the purpose of ascertaining the expression and spirit, of the local engineers to the proposed branch. Mr. Stevens was unanimously elected Chairman and Secretary *pro tem,* and stated briefly the objects of *The Institute* and the advantages of having a branch established in this vicinity. The Chairman asked each and every member present for an opinion on the subject, and without exception it was given hearty approval and support. The meeting adjourned after the Chairman had called a meeting for the evening of January 23rd for the purpose of crystallizing action.

At the meeting of January 23rd, the Chairman read a communication from Fraser S. Keith, stating that all members residing within a certain radius of Windsor Post Office were members of the Branch. This ruling admitted all members residing in Detroit and neighboring suburbs. It was moved, seconded, and unanimously approved that the Chairman draw up a formal application for the establishment of a local branch, procure as many names as possible, and submit same to Headquarters in Montreal. The formal application went forward from Windsor under date of January 17th, signed by more than twenty members and associate members. Under date of February 25th, Mr. Stevens was advised that, at a meeting of the Council held since the Annual Meeting, our application was favorably acted upon and we were forthwith authorized to proceed with the organization of the Branch.

It was particularly desirous to have Fraser S. Keith, General Secretary, Montreal, present to assist in the organization, and with this in view Mr. Stevens opened negotiations with Mr. Keith, who arrived in Windsor the afternoon of Friday, March 14th. He was met at the

Windsor Ferry and taken by automobile to the offices of the Canadian Steel Corporation, in Ojibway. Here Mr. Keith was welcomed by officials of the Corporation and shown over the extensive grounds, where, some day, is destined to stand the largest steel mills in Canada. The party examined in detail the great coal and ore unloading docks, blast furnace sites, and other points of interest.

In the evening an open meeting of engineers and those interested in engineering was held, to meet Mr. Keith, Secretary, *The Engineering Institute of Canada*, in the Banquet Room of the Border Chamber of Commerce in the city of Windsor, on the 14th day of March, 1919, Mr. A. J. Stevens acting as Chairman.

An informal lunch was held at 6.30 p.m. The following gentlemen were present: E. J. McIntyre, W. G. Mixer, Geo. J. Burgess, F. G. Campbell, J. E. Porter, H. J. Townsend, A. E. Eastman, R. A. Ferguson, R. A. McAllister, L. E. Collins, H. Thorne, J. S. Nelles, all of Canadian Steel Corporation; C. D. Henderson, G. C. Vrooman, D. L. Alexander, F. H. Kester, R. A. Spencer, S. E. McGorman, G. C. Williams, all of Canadian Bridge Company; E. F. Considine and S. G. Newlands of the Great Lakes Dredging Company; Chas. O. Farr, W. R. Rhoads and L. T. Venney, of Morris Knowles, Limited; F. J. Bridges, R. A. Carlyle and A. J. Stevens, of the Public Works Department; R. W. Code, A. H. McPhail, J. R. Sculland, B. A. Rose, S. E. Dinsmore, M. E. Brian, L. McGill Allan, J. J. Newman, C. R. McColl and R. Westcott, of Windsor; E. G. Henderson, Canadian Salt Company; J. Shand, Shand Contracting Company; and John A. W. Brown, Trussed Concrete Steel Company.

After lunch, Mr. Stevens, in a few chosen words, dealt with the value of the engineer to the public, the interest he should take in public problems, and the possibilities of this district from an engineering standpoint. He then introduced Mr. Fraser S. Keith, the guest of the evening.

Mr. Keith then dwelt upon the aims and objects of *The Engineering Institute of Canada*, the necessity of joining such an organization, and the benefits to be derived therefrom.

At the conclusion of Mr. Keith's remarks, a "get-acquainted-movement" was started,—each man present being called upon to tell what his name was, his business, and any statements he would like to make for the betterment of *The Institute*.

A hearty vote of thanks was tendered Mr. Keith upon the motion of E. C. Henderson and seconded by E. E. Brian, for his interest in *The Institute* and the information imparted to the gentlemen present.

Owing to the lateness of the hour, it was decided to postpone to March 21st the formal organization and election of officers.

At the meeting for the purpose of organization, election of officers and other business held on March 21st, the following officers were elected: Chairman, J. A. Brown, A.M.E.I.C.; Secretary, G. C. Williams, M.E.I.C.; Treasurer, F. J. Bridges, M.E.I.C.; Executive Committee, H. J. Thorne, A. J. Stevens and M. E. Brian.

Meetings of the Executive were held, at 4.30 p.m., on March 24th and April 1st, for the purpose of drafting Branch By-laws to be submitted at the next regular meeting for discussion, and, if approved, to be forwarded to Montreal for final approval.

PERSONALS

C. J. Mackenzie, A.M.E.I.C., who recently returned from overseas has resumed his duties as Professor of Civil Engineering at the University of Saskatchewan.

W. M. Everall, A.M.E.I.C., has been appointed by the Victoria Branch as Chairman in place of W. Young, M.E.I.C., resigned, and E. N. Horsey, A.M.E.I.C., has been appointed to the vacancy on the Executive Committee.

Lieut. H. L. Swan, A.M.E.I.C., who served in France with the 3rd Divisional Engineers, has returned to Canada and has resumed his occupation with the Kettle Valley Railway Company at Penticton, B.C.

Lieut. A. J. Lawrence, Canadian Engineers, A.M.E.I.C., recently returned from overseas, has been appointed Sales Engineer in the Storage Battery and Fire Alarm Section of the Northern Electric Company, Limited, with headquarters in Montreal.

W. J. Gale, A.M.E.I.C., who has taken a prominent part in the affairs of the Calgary Branch, enjoys the distinction of being the partner of the acting-mayor of the City of Calgary. Mrs. Gale is the first woman in the history of the British Empire to sit in the chief magistrate's chair of an important municipality.

Major Jas. McGregor, A.M.E.I.C., resident engineer of the Halifax ocean terminals is back after two years' service in the Third Battalion of Canadian railway troops. Major McGregor reached France in time for Vimy Ridge and has been engaged chiefly in building light railways and repairing standard gauge roads destroyed by the Germans.

Brigadier-General McCuaig, C.M.G., D.S.O., A.M.E.I.C., arrived in Halifax on the Olympic on April 21st, which conveyed the first, second, third and fourth battalions of the Canadians. Brig.-Gen. McCuaig was the senior officer aboard the Olympic. His great war record is already well known throughout Canada and to his fellow members in *The Institute*.

J. N. de Stein, M.E.I.C., the enthusiastic secretary-treasurer of the Saskatchewan Branch has joined with R. W. Parsons, M.E.I.C., and Lt.-Col. J. L. R. Parsons, C.M.G., D.S.O., in the Parsons Engineering Company, engineers and surveyers, 1704 Scarth Street, Regina. Lt.-Col. Parsons is President, W. R. Parsons, Vice-President, and J. N. de Stein, Manager. They propose carrying on their business of surveying and engineering work.

Wallace R. Harris, M.E.I.C., who has been connected with the Portland Cement Association in an official capacity has accepted the position of editor of Engineering World, Monadnock Block, Chicago, and assumed the responsibility of his editorship on the 1st of April. Mr. Harris brings to his new position, training, experience and ability, which assure for him an unqualified success in his new field of activity.

Lieut. F. G. Aldous, R.E., A.M.E.I.C., writes from the 7th Field Survey Company, Royal Engineers, Egyptian Expeditionary Force, inquiring as to conditions in Canada and what the prospects will be on his return. It is most interesting to note that Lieut. Aldous is at present on a survey of the country between Damascus and Aleppo. Lieut. Aldous was assured that *The Institute* is prepared to do its utmost to secure positions for men like himself who have been far afield and exiled from their former associations.

A. D. Creer, M.E.I.C., who has been for a number of years chief engineer of the Vancouver District, Joint Sewerage and Drainage Board, left Montreal on April 19th for England on a combined pleasure and business trip. Mr. Creer was secretary of the Vancouver Branch for a number of years and has taken a very active part in *Institute* affairs. On his return he proposes engaging in consulting engineering, having already been appointed consulting engineer to the Vancouver Disrict, Joint Sewerage and Draining Board at Vancouver.

Major C. C. Lindsay, B.Sc., S.E.I.C., of Quebec, returned to Canada from overseas in March and has been appointed Assistant Engineer of the Reclamation Branch of the Department of the Interior. Major Lindsay went overseas in 1915 as a sapper with the Sixth Field Company, Canadian Engineers, and in August, 1915, he was transferred to the Royal Engineers as Second Lieutenant. He won promotion on the field and was finally gazetted a Major. During his military operations he was wounded and received the Belgian Croix de Guerre.

Major A. R. Sprenger, A.M.E.I.C., C.E., returned to Canada recently on a hospital ship, and is at present convalesing at the military hospital, St. Anne de Bellevue. For over a year Major Sprenger was employed in aerodrome construction, in the war office and air ministry, and supervised the construction of over forty aerodromes representing a cost of over thirty-three million dollars. Major Sprenger saw active service with the 1st Division, and was wounded at Cagnicourt in September last, since which time he has been incapacitated. He expects to return to engineering work as soon as his physical condition permits.

Lieut.-Col. Robert Bickerdike, D.S.O., M.E.I.C., as been appointed commanding officer of the Grenadier Guards and will bring the 87th Battalion home when its turn comes. Lieut.-Col. Bickerdike entered military service after his graduation from McGill University. Before the outbreak of war he joined the 58th Westmount Rifles as a Lieutenant. When the 87th Grenadiers were raised he joined as a subaltern and went overseas with that unit. Early in 1916, Lieut. Bickerdike received his captaincy. After being severely wounded in Regina Trench, October, 1916, he received his majority. Now he has been appointed Lieutenant-Colonel in command of the 87th Battalion.

Colonel Alexander McPhail, C.M.G., D.S.O., M.E.I.C., has returned to Canada on the Olympic. Col. McPhail who is a brother of Sir Alexander McPhail, graduated from the Faculty of Applied Science, McGill University, and after winning a scholarship studied for three years in Germany. He took up construction work in the United States and afterwards became lecturer at Queen's University, and from there he went to the Royal Military College. Col. McPhail sailed with the First Division as a Captain and has made a great name for himself as commander of the First Brigade Canadian Engineers, and in carrying on engineering operations in connection with the war.

Dr. John S. Bates, A.M.E.I.C., has resigned his position as Superintendent of the Forest Products Laboratories of Canada, at Montreal, where he had been for the past five years, and has accepted the position of Chemical Engineer with Price Brothers & Company Limited, Kenogami, Quebec. He will undertake special technical work in their pulp, paper, and lumber mills, and other organizations. Dr. Bates is a graduate of Acadia University, Nova Scotia, and Columbia University, New York, having the degrees of Chemical Engineer and Ph.D. For three years of the period when he was Superintendent of Forest Products Laboratories, he occupied the position of chemical representative, Explosives Department, for the Imperial Munitions Board. From the time of its organization, in 1915, to the present date he has been chairman of the technical section of the Canadian Pulp and Paper Association and has taken a leading interest in all matters pertaining to the development of this branch of Canada's natural resources.

New Chief Engineer

Ivan E. Vallée, B.A.Sc., A.M.E.I.C., is a member of the Quebec Branch of *The Institute*, and has recently been appointed Chief Engineer and Director of Railways in the Department of Public Works and Labour of the Province of Quebec, and is also Engineer of the Public Services Commission.

At a recent sitting of the Provincial Cabinet Mr. Vallée was called to fill the important position left vacant through the death of his father, L. A. Vallée, M.E.I.C.

Mr. Vallée was born at Quebec, February 11th, 1887. He completed his engineering course in 1910 at the Ecole Polytechnique, Laval University; when he was granted, with honours, the diplomas of Civil Engineer and Chemical Engineer, and the B.A.Sc. Degree.

From 1910 till recently he has occupied the position of Assistant to the Chief Engineer and Director of Railways.

The Quebec Branch heartily congratulates Mr. Vallée on his promotion.

New Military Organization

Major F. J. O'Leary, M.C., (two bars), S.E.I.C., arrived in Montreal on April 19th, on the Carmania. After graduating from McGill University, Major O'Leary went west where he was engaged in construction work in Saskatoon. He went overseas with the 53rd Infantry Battalion from Winnipeg and Saskatoon and crossed to France with the 142nd battalion as Lieutenant. Shortly afterwards he was put in command of the Canadian Trench Mortar Battery, 11th Brigade Staff, then at Canadian Corps Headquarters on the staff of the D.A.A.G., and later as staff captain with the first Canadian Division Engineers.

Major O'Leary is taking an active interest in the welfare of all the Canadian Engineers and is secretary of an organization composed of the engineers with the First Canadian Division which is organized to look after the interests of the engineers who have seen service. The officers of the new association elected in France are Sir A. C. Macdonell, K.C.B., C.M.G., D.S.O., M.E.I.C., Col. A. Macphail, C.M.G., D.S.O., M.E.I.C., Lieut.-Col. J. M. Rolston, D.S.O., M.E.I.C., Lieut.-Col. E. Pepler, D.S.O., and Major F. J. O'Leary, M.C. (two bars).

Returns from Siberia

Colonel J. S. Dennis, C.M.G., M.E.I.C., Chief Commissioner of the Department of Colonization of the C.P.R., returned from Russia by way of Japan and Vancouver, arriving in Montreal on Tuesday, April 22nd.

Colonel Dennis went to Siberia last fall as Director of Transportation and Information on the General Staff of the Canadian Military Expedition and in addition was chairman of the Canadian Trade Commission, appointed by order-in-council last October, to study trade conditions in Siberia. He was also Canadian Red Cross Commissioner for Siberia.

At the meeting of the Montreal Branch held on April 24th, Colonel Dennis was warmly welcomed. He outlined briefly the situation in Siberia which lead to the decision to withdraw the Canadian forces.

He stated that, for an engineer, Siberia possessed great possibilities and the undeveloped natural resources were possibly the greatest on earth. The great problem, at the moment, from an engineering and national viewpoint, was to resurrect the Trans-Siberian Railway and until that was done there would be little progress. The existing political and transportation conditions there render it impossible to hope for the establishment of trade relations on a satisfactory basis at present.

Railway Construction in France

Major H. B. Muckleston, M.E.I.C., returned to Canada last month after spending several years at the front engaged in the construction of railways, and has returned to Calgary to resume his former duties as assistant chief engineer, irrigation branch, Canadian Pacific Railway.

Going overseas with the 4th Pioneer Battalion, he joined the 1st Canadian Railway Troops in France and was engaged with them on standard gauge work all over France. Major Muckleston was invalided on October 25th, 1918, and spend two months in a London hospital. He returned to Canada on the Scotian, landing at St. John, March 1st.

During a pleasant call at headquarters' office, Major Muckleston outlined some of the work which was carried on by the Railway Troops under the command of Lieut.-Col. Blair Ripley, M.E.I.C. There was included in the same Battalion, Major Thos. Louden, A.M.E.I.C., Major A. R. Ketterson, A.M.E.I.C., and Major F. B. Cross, A.M.E.I.C.

The first piece of work ran to Albert—"The Canadian Pacific"—followed by a 60 c.m. gauge road over the first Somme. After the German retirement in the spring of 1917, the Canadian Railway Troops were placed on the construction of standard gauge lines, including the building of a line from Lechapellette, through and including the yards at Peronne, to Roiselle, and to Epehy. This was a double track standard gauge line and included three bridges over the Somme, and a dozen other bridges. In July, 1917, the battalion moved to Dunkirk and made a division line around Dunkirk. From there the battalions were directed to the International Corner in Belgium where about five miles of line were built under fire, and a bridge over the Yser Canal. The battalion remained there until March of 1917, when they were ordered to Palestine; but were held when the German drive commenced and were immediately engaged in building defences, including a hundred miles of trenches, machine gun pits, etc. Following this a railway line was built from Frevent to Hesdin, a distance of seventeen miles, including a bridge sixty feet high and five hundred feet long.

On August 8th, 1918, when the allied drive commenced the battalion moved to Amiens and rebuilt the line from Amiens through to Marcoing, with the exception of five miles built by the French and by other Canadians, which included a line built in the spring of 1917, with additions at each end. They then moved to Lecateau, east of Cambrai, and from there built into Mons following the drive.

Brig.-Gen. C. H. Mitchell, C.B., C.M.G., D.S.O.

The early anticipated return of Gen. Mitchell to Canada to assume the position of Dean of the Faculty of Engineering and Applied Science of Toronto University, draws attention to the wonderful career which has been his since going overseas with the First Canadian Division on September 22nd, 1914. Immediately on the outbreak of war, Gen. Mitchell enlisted with the First Central Ontario Regiment of the Canadian Overseas Forces and was appointed to the General Staff Intelligence Department as General Staff Officer, third grade, and seconded for Imperial service. On September 13th, 1915, on formation of the Canadian Army Corps, he was promoted as General Staff Officer, second grade, and on October 12th, 1916, was appointed General Staff Officer, first grade, with the Second Army in France as an officer in the Imperial service. On the despatch of the force to Italy on November 10th, 1917, he was again promoted as General Staff Officer at Headquarters with the British forces in Italy and remained in this capacity until January 18th, 1919, when General Headquarters disbanded.

His honours and awards include the following:—Distinguished Service Order, June, 1916; Companion of St. Michael and St. George, June, 1917; and Companion of the Bath, June, 1918. His foreign honours are:—Legion of Honour, Officier (France), February, 1916; Order of Leopold, Officier (Belgium), June, 1917; Croix de Guerre (Belgium), January, 1918; Crown of Italy, Officier (Italy), March, 1918; Croci di Guerre (Italy), December, 1918. In addition to this he was mentioned in despatches January and May, 1916; May and December, 1917; and May and December, 1918.

Gen. Mitchell was engaged in operations as follows: With the First Canadian Division, France, from February 9th to September 12th, 1915; in line—Neuve Chapelle to Bois Grenier— March 1915; Second Battle of Ypres—April 22nd to May 4th, 1915; Battle of Festubert—May 19th to 28th, 1915; Battle of Givenchy—June 15th to 16th, 1915; and Ploegssteert to Wulverghem—June to September, 1915. He was with the Canadian Army Corps, September 13th, 1915, to October 11th, 1916; in line—Ploegssteert to St. Eloi—September, 1915, to March 1916; and—St. Eloi to Hooge—April to August, 1916; Battle of St. Eloi—April 6th to 7th, 1916; Battle of Observatory Ridge—June 2nd to 13th, 1916; the Battle of the Somme—1916; Courcelette—September 15th; Schwaben Redoubt and Hessian Trench—September 26th; and Regina Trench—October 8th. He served with the Second Imperial Army, October 12th, 1916, to November 10th, 1917; line—Neuve Chapelle to Boesindhe (Ypres)—October, 1916, to June, 1917; Frelinghien (Lys) to Hooge—June to August, 1917; Frelinghien (Lys) to Zonnebeke—September to October, 1917; Frelinghien (Lys) to Passchendaele—October to November, 1917; Battle of Messines—June 7th, 1917; Battle of Flanders, Menin Road—September 20th, 1917; Polygon Wood—September

Brigadier-General, Charles Hamilton Mitchell, C.B., C.M.G., D.S.O., M.E.I.C.

26th, 1917; Broodseinde—October 4th, 1917; and Passchendaele— October 12th, 1917, October 26th, 1917, October 30th, 1917, November 6th and 10th, 1917. He served with the British forces in Italy (G.H.Q.), November 10th, 1917, to January 18th, 1919; in line Piave—Montello, November, 1917, to March, 1918; and on Asiago Plateau—April to September, 1918; and Battle Asiago—Austrian "Offensive"— June 15th, 1918; in line on Piave (Grave Di Papadopoli)—October to November, 1918; Battle of Vittorio—Veneto (Piave and Tagliamento Rivers), October to Armistice, November 4th, 1918.

Word has just been received of the promotion of Col. Mitchell to the rank of Brigadier-General while seconded to the Imperial Service, the promotion to date from October last.

OBITUARIES

Louis André Vallée, M.E.I.C.

The City of Quebec lost a valuable citizen; the engineering profession, in the Province of Quebec, one of its leading members; and the Provincial Government, one of its most responsible officials; in the passing away, on the 10th of March, of Louis-André Vallée, M.E.I.C., Chief Engineer and Director of Railways in the Department of Public Works and Labour of the Province of Quebec, and Engineer of the Quebec Public Utilities Commission.

The deceased had attained the age of 67 years and three months, and had had a notable career in this Province. He was born at Beauport, Quebec County, on November 30th, 1851. He was educated at Laval Normal School, Quebec, and entered the employ of the Sherbrooke and Eastern Townships Railway, as an apprentice engineer,

Late L. A. Vallée, M.E.I.C.

in 1869; and remained in that position for one year. From 1870 to 1876, he was employed on the North Shore Railway as rod-man, leveller, and transitman on location and construction work. From 1876 to 1882, he was assistant and divisional engineer in charge of construction and maintenance-of-way on the Quebec, Montreal, Ottawa and Occidental Railway, which was afterwards absorbed by the C.P.R. In 1862, he was appointed Government Engineer and, in 1895, was made Director of Railways for the Province of Quebec, filling both positions to the time of his death. In addition to the above he was, in 1909, appointed Engineer of the Quebec Public Utilities Commission.

Mr. Vallée was a member of the Canadian Society of Civil Engineers of Canada since its formation in 1887, and was appointed to the Council of that body in 1894, in 1903, and again in 1909. He was chairman of the Quebec Branch of *The Society* in 1909. He was also a member of many technical and scientific societies.

On April 20th, 1879, he married Marie Celina Amanda, daughter of the late Charles Boromée Genest, attorney-at-law and member of the Quebec Legislative Assembly for Three Rivers. He is survived by his wife, six sons, four daughters and nineteen grand-children. Amongst his sons is Mr. Ivan E. Vallée, who occupied the position of first Assistant Engineer and Assistant Director of Railways.

The late Mr. Vallée is said to have been the Dean of the Interior Civil Service of the Province, and, in the course of his useful career, he was widely known throughout Canada, but more particularly in this Province, where he planned and directed the construction of many railways and steel bridges.

His death is deplored by the entire community and sincere sympathy is extended to his family in the great loss they have sustained.

N. M. Thornton, M.E.I.C.

N. M. Thornton, M.E.I.C., who was until recently chairman of the Edmonton Branch died on February 23rd, 1919, at the age of 43 years. The late Mr. Thornton was born at Corbridge-on-Tyne and was connected with collieries in Cumberland, Northumberland and Durham, England, maintaining his connection with several of them after his arrival in Canada. He came to this country in 1911 as manager of the Mount Park Coal Company, Alberta. In August last year he resigned his position with the Mount Park Coal Company and opened an office as a general consulting engineer, in the City of Edmonton. He entered *The Institute* in January, 1915, and during his membership evinced a very lively interest in the affairs of the engineering profession.

George Herbert Garden, M.E.I.C.

One of the original members of *The Institute* in the person of George Herbert Garden, passed away at Rouses Point on March 29th, 1919. The late Mr. Garden was born April 5th, 1849, at Woodstock, N.B., and was a resident of Montreal for nearly twenty years. He was one of the older men in the profession and had been in poor health for many months, so that his end was not unexpected. As an engineer and as a man he was held in the highest regard. During the course of his engineering career, which covered different lines of activity, he spent nineteen years with the Canadian Pacific Railway at different periods.

Mr. Garden's engineering career started when he was 16 years of age, as an assistant to his father, who was a land surveyor. At the age of 20 he was appointed assistant engineer on location of the I.C.R. at Newcastle, N.B., He was in charge of part of the location on the Crow's Nest Pass division of the C.P.R. in British Columbia and was in charge of location and construction on the Quebec and Lake St. John Railway, now the Canadian National Railways. He was also in charge of location and construction of the greater part of Laurentian Division of the C. P. Railway and subsequently became Chief Engineer of the Alberta Railway and Coal Co., at Lethbridge, Alta., frcm 1898-1901.

Two years he was in charge of the location of part of the Transcontinental Railway, and his last work before being obliged to retire in 1914, owing to ill health, was in charge of the location of a large part of the C.P. Railway, Montreal--Toronto, (Lake Shore) line.

He is survived by Mrs. Garden and one son, H. Mackie G. Garden, J.E.I.C., of the Imperial Life Assurance Company of Montreal. Charles Garden, M.E.I.C., of Vancouver, is an only brother. The remains were brought to Montreal and were followed from the station to Mount Royal Cemetery by a large number of friends, including a number from the engineering profession.

Allan Travers Fraser, A.M.E.I.C.

Allan Travers Fraser, A.M.E.I.C., chief engineer, in the west, of the Canadian National Railways, whose home was in Winnipeg, but who, up to the time of his appointment as chief engineer, was a resident of Edmonton, Alta., was killed by a snow slide in Ellison Pass about opposite Mount Robson on March 31st. He was born at Pembroke January 13th, 1872, and entered *The Institute,* as an Associate Member, March, 1905, at which time he was divisional engineer, with McKenzie and Mann, in charge of construction on the Canadian Northern Railway. He received his education at the School of Practical Science, Toronto, and his early engineering training was with the Canadian Pacific Railway both in Ontario and during the construction of the Canadian Pacific Railway through the Crows Nest Pass. His whole career was one of promotion and advancement and his passing leaves a blank in the engineering life of the prairies. During his residence in Edmonton he made many friends and took a lively interest in the activities of the Edmonton branch.

* * *

Recommendation has been presented to the Government of Newfoundland that they lay down an 80 pound rail from St. John's to Port aux Basques, the whole length of the railway, which is owned by the Government but leased to the Reid-Newfoundland Company. It is considered probable that when this is done, the guage of the railway will also be changed to the standard guage and that the Colony will then have a railway that will compare with any railway on the American continent. This will enable cars to be ferried from North Sydney, C.B., to Port aux Basques and placed on the Newfoundland railway and transported to their destination on the Island.

Because of the development going on in Newfoundland, through private and governmental enterprise, it is reasonable to expect that not only will the trade of Canada with Newfoundland increase but the trade between Newfoundland and other countries will continue to grow and make the installation of modern means of transportation increasingly imperative.

EMPLOYMENT BUREAU

Situations Vacant

Draftsman:

A. K. Grimmer, engineer of Kipawa Fibre Company, Temiskaming, Que., requires a first-class draftsman and officeman. Will pay $175 a month and travelling expenses to Temiskaming. Apply either direct to Mr. Grimmer or to W. S. Lea of R. S. & W. S. Lea, New Birks Bldg., Montreal.

Mechanical Draftsman:

First class mechanical draftsman required by the Electric Steel and Engineering Company, Welland, Ont. A man able to design machinery. Geo. C. McKenzie, general manager.

Civil Service Commission of Canada

The Civil Service Commission of Canada hereby give public notice that applications will be received from persons qualified to fill the following positions in the Civil Service of Canada:—

A Trade Commissioner: Salary $3,000 per annum.

I. A Trade Commissioner, Department of Trade and Commerce, at an initial salary of $3,000 per annum. Candidates should be, preferable, business men of prepossessing personality, tact, fluency in conversation, facility in writing terse English and ability to investigate and get accurate commercial information. The person nominated for this post may or may not be accepted for the position.

N.B.—This is a corrected notice of the position advertised April 3. Canadidates need not be university graduates and the initial destination may not be Vladivostock, as formerly advertised.

A Deputy Registrar and Law Reporter: Salary $2,900 per annum.

II. A Deputy Registrar and Law Reporter for the Exchequer Court of Canada, Department of Justice, at a salary of $2,900 per annum, Grade B, of the First Division. Applicants must be barristers of at least 5 years standing. They must have a knowledge of both official languages in Canada and must be able to speak them with fluency. They must have a practical experience in sicence of law reporting. Familiarity both with the Common Law and the Civil Law more especially in matters of procedure and practice, will be regarded as a valuable qualification for the office. Credentials in respect of the various qualifications must be produced by candidates for the position.

A Canadian Emigration Agent: Salary $1,800 per annum.

III. A Canadian Emigration Agent for Peterborough, England, Department of Emigration and Colonization, at a minimum salary of $1,800 per annum. Candidates must be not more than 50 years of age. They must have a good education and ability as a platform lecturer. They must be well versed in Canadian matters, and must also have some journalistic ability. They must be able to carry on publicity work, not only by means of public lectures but also by the preparation of articles dealing with the various phases of farming in Canada. Familiarity with prevailing conditions in England and ability to talk intellligently to intending emigrants and also to deal in a businesslike manner with steamship booking agents is essential. Applications for this position will be received until May the 29th.

An Agricultural Engineer: Salary $1,600 per annum.

IV. An Agricultural Engineer for the Reclamation Service at Calgary, Department of the Interior, at a salary of $1,600 per annum. Applicants should be graduates in Agriculture of a university of recognized standing, and should have a practical knowledge of irrigation, and sufficient knowledge of engineering to be able to plan and lay out systems of farm ditches. Preference will be given to residents of the Province of Alberta.

An Accountant for the Welland Canal: Salary $1,500 per annum.

V. An Accountant in the Department of Railways and Canals, for the Welland Canal, at an initial salary of $1,500 per annum. An examination will be held on May the 20th in theoretical and practical bookkeeping and commercial arithmetic. A fee of $8 will be required, except in the case of returned soldiers who are exempt from paying the fee. The examination will be held in the English language only. Candidates will be notified of the examination centres. Applicants must be residents of the Province of Ontario. This position was advertised September 5, and is now re-advertised.

VI. Applications will be received from persons qualified to fill the following positions on the Welland Ship Canal Construction Staff.

A Designing Mechanical Engineer: Salary $200–$225 per month.

1. A Designing Mechanical Engineer at a salary of $200 to $225 per month. Candidates must be not less than 30 years of age. They must be graduates in Mechanical Engineering of a recognized School of Engineering. They must have had ten years' experience in the design and supervision of construction of mechanical works of considerable magnitude and have held for at least three years, a position of professional responsibility in charge of this work. They must be capable of taking charge of all calculations, estimates, preparation of plans and specifications. Preference will be given to applicants with experience on works involved in the construction of canals, harbours and hydro-electric plants.

A Mechanical Draughtsman: Salary $125–$150 per month.

2. A Mechanical Draughtsman at a salary of $125 to $150 per month. Candidates must be at least 25 years of age. They should have a High School education or its equivalent. They must have had at least four years' practical experience in the workshops of a recognized engineering construction company, including two years' experience on erectional and outside work supplemented by two years experience in the drawing office of a large bridge company in the preparation of designs, estimates, plans and specifications. Preference will be given to graduates of a recognized school of engineering and particularly to applicants with experience in works involved in the construction of canals, harbours and hydro-electric plants.

An Office Engineer: Salary $125-$150 per month.

3. An Office Engineer at a salary of $125 to $150 per month. Candidates must be not less than 27 years of age. They must be graduates of a recognized School of Engineering. They must have had at least three years' experience in filed work including experience in connection with ordinary and submarine excavation, foundation work, plain and re-inforced concrete work and timber work, and five years' experience in office work, including the preparation of plans, specifications and estimates on quantities. Preference will be given to those with recent experience on the construction of canals, harbours and hydro-electric plants.

A Chief Cost Data Clerk: Salary $175 per month.

4. A Chief Cost Data Clerk at a salary of $175 a month. Candidates must be at least 30 years of age. They must have had a High School education or its equivalent. They must have at least 7 years' practical experience on large construction works and have been 2 years in charge of cost distribution on works of some magnitude. They must be competent to institute and supervise a system for collecting the information necessary to furnish a reliable and accurate statement showing the total actual cost of various divisions of construction work and the different items entering into each.

A Private Secretary to Engineer-in-Charge: Salary $175 per month.

5. A Private Secretary to the Engineer-in-Charge at a salary of $175 per month. Candidates should be between the ages of 27 and 40. They should have a High School education or its equivalent; other things being equal, preference will be given to a university graduate. They must be expert stenographers and typists. They must have had an extensive experience in correspondence relating to construction contracts involving an appreciation of the legal effect of words. They should have a good working knowledge of the principals of bookkeeping and engineering.

* * *

Application forms, properly filled in, must be filed in the office of the Civil Service Commission not later than May the 13th, except in the case of position number III. Application forms may be obtained from the Dominion Provincial Employment Offices or the Secretary of the Civil Service Commission, Ottawa.

By order of the Commission,
W. FORAN, Secretary.
Ottawa, April 16, 1919 42–1

SECOND LIST

A Superintendent of Forest Products Laboratories; Salary $3,500 per annum.

1. A Superintendent of the Forest Products Laboratories of Canada, Montreal, P.Q., Department of the Interior, at a salary of $3,500 per annum. Applicants must be university graduates in forestry, chemistry or engineering, and must have had at least three years' experience since graduation in (a) research laboratory work in one of the above lines of study; (b) practical work in some industry or work in which wood is used as the raw material, e.g., lumbering, pulp and paper manufacture, wood distillation, etc.; or (c) practical experience in forestry administration or research. Applicants must possess a high grade of scientific ability, and capacity for research work, a broad knowledge of the technical characteristics and uses of Canadian woods, and initiative and ability in organization and administration.

Two Superintendents of Construction; Salaries $350 per month.

3. Two Superintendents of Construction, one for the Toronto Public Building and one for the Federal Building, Montreal, at salaries of $350 per month, Department of Public Works. Applicants should be thoroughly competent architects with from eight to ten years' experience as principal of an architectural firm, or have practised for themselves for a similar period, and should be accustomed to superintendence of construction. The persons appointed to these positions will be required to devote the whole of their time to this work.

A Superintendent of Construction; Salary $250 per month.

4. A Superintendent of Construction for the Hamilton Public Building, Department of Public Works, at a salary of $250 per month. Applicants should be thoroughly competent architects with from 6 to 8 years' experience as principal of an architectural firm, or have practised for themselves for a similar period, and should be accustomed to superintendence of construction. The person appointed to this position will be required to devote the whole of his time to this work.

A Superintendent of Construction; Salary $200 to $250 per month.

5. A Superintendent of Construction for the Educational Block, Royal Military College, Kingston, Department of Public Works, at a salary of $200 to $250 per month. Candidates must be thoroughly competent and experienced in reinforced concrete construction and stone work.

Selections for eligible lists of applicants qualified to fill similar vacancies which may occur in future may be made from applications for these positions.

According to law, preference is given to returned soldier applicants, possessing the minimum qualifications. Returned soldier applicants should furnish a certified copy of their discharge certificates. Preference will also be given to bona fide residents of the Provinces in which the vacancies occur.

Applicants should give full information as to their education, military service in Canada, England and France, their previous experience, the names of their previous employers, together with the nature of the work on which they were employed, and the degree of responsibility exercised.

For positions numbers 3, 4 and 5, applications by letter stating age and qualifications must reach the office of the Secretary of the Civil Service Commission not later than May the 10th. For positions numbers 1 and 2, application forms, properly filled in, must be filed in the office of the Civil Service Commission not later than May the 20th. Application forms may be obtained from the Dominion Provincial Employment Offices or the Secretary of the Civil Service Commission, Ottawa.

By order of the Commission.
Wm. Foran,
Ottawa, April 24th, 1919 Secretary.

Preliminary Notice of Application for Admission and for Transfer

20th April, 1919.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in June, 1919.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ANDERSON—GEORGE BENSON, of Ottawa, Ont. Born at Morrisburg, Ont., Dec. 26th, 1891. Educ., 3 yrs. School of Mining Kingston. 1907 (4 mos). on D.L.S. in Alta.; 1907, on O.L.S.; 1908, on D.L.S. in Sask.; 1911, transitman, etc., on traverse and subdiv'n work, on Winnipeg river; 1914-15, in chg. of hydrometric survey parties on Ottawa river, D.P.W.; 1915 (6 mos.) in chg. of Coulonge River survey; 1915 (2 mos.) completing plans on same; 1916 Feb. 1919, with Imperial Forces as flying officer, at present asst. engr., P.W.D.

References: C. R. Coutlee, S. B. Johnson, A. Gray, L. A. DesRosiers, A. Trudel.

ANREP—HENRY ALEPH, of Ottawa, Ont. Born at Moscow, Russia, Apr. 12th, 1883. Educ., Coll. of Mozing, Moscow, 1901; grad., Peat Inst. of Markaryd, Sweden, 1904. 1904-05, with eng. firm of Anrep & Hallmen on investigation of peat bogs and preparation of planes for their utilization; also acted as instructor at the Peat Institute; 1906, complete chg. of investigations of peat bogs in Ireland and mfg. peat for Chemicals Ltd., Ireland; 1907, in complete chg. of peat bogs invest'ns in England and Scotland; for Peat Industries Co., London, Eng.; 1908, asst. with E. Aystrom, Mines Branch; 1909-10, in complete chg. of erection and running of plant for Mines branch, Alfred, Ont.; 1911-18, in full chg. of investigations of peat bogs in Canada, and at present peat expert, with Geological survey.

References: R. F. Uniacke, C. R. Coutlee, J. B. Porter, A. D. Harris, H. F. J. Lambart, M. F. Cochrane.

ARCHIBALD—CHARLES LAWRENCE, of St. John, N.B. Born at Musquodoboit, N.S., Nov. 30th, 1888. Educ., high school, I.C.S. 1907-08, N.T.C.Ry., on constrn.; 1908, dftsman. dept. of Crown Lands, Halifax; 1908-09, instr'man and dftsman. on rly. constrn., I.C. Ry.; 1909-10, dftsman and surveyor; 1912-13, dftsman and transitman on rly. location, C.P.R., Lake Superior div.; 1914-15, engr. on constrn., E. G. M. Cape Co. Ltd.; 1916-17, ch. engr. on constrn. and dsgn., sulphate Mill, Bathurst Lumber Co.; 1917 to date, dftsman., Royal Can. Engrs. St. John; entering private practice as architect and civil engr.

References: A. B. Blanchard, R. H. Cushing, W. McNab, W. A. Hendry, G. S. Baxter, E. M. Archibald, A. R. Crookshank.

BARBERIE—JOHN, of Campbellton, N.B. Born at Campbellton, Sept. 24th, 1884. Educ., high school. 1902-05, rodman, I.N. Ry., 1905-07, instrument, level and transit man on location and constrn., I.N. Ry.; 1907-09, res. engr., I.N. Ry., 1910-11, topog. and transitman, G.T. Ry.; 1911 (6 mos.) bldg. constrn. and inspection; 1911 (4 mos.) transitman, Central Ry; 1911-12, in chg. of location, Cen. Ry.; 1912-13, res. engr., C.N. Ry.; 1913 (5 mos.) transitman, North Ry.; Dec. 1913 to date, transitman, in chg. of work, Can. Nat. Rys.

References: R. A. Black, D. W. Burpee, D. Lyell, R. Bickerdike, C. B. Brown, G. C. Dunn, J. S. O'Dwyer, G. Stead, J. L. Wilson.

BARIBEAU—PHILIPPE EUGENE, of Montreal. Born at St. Anne de la Perade, Que., Aug. 9th, 1886. Educ., 2 yrs. Polytech. School. During vacation worked on gen. municipal work, as dftsman, etc., with F.sC. Laberge, consl. engr.; 1908-12, transitman and leveller on sewers and supervising engr., for macadamising of Cartierville road; 1913, leveller for sidewalks, Montreal; 1913 to date, asst. with F. C. Laberge, principally on municipal work, etc.

References: F. C. Laberge, A. Vincent, A. Laframbroise, C. A. Prieur, J. A. Bernier.

BECK—EDWARD HERBERT, of Toronto, Ont. Born at Portsmouth, England, June 7th, 1885. Educ., Bonds Coll. and Weymouth Modern, England; 1899-1906, articled to E. R. Lester & Co., Govt. contractors, Plymouth, Eng. 1906-11, engr. in chg. for contractor, cordite stores and underpinning jetties (asst. engr.); in chg. elec. lighting emplacements, water supply; inspector of bridges, Can. Inspection Co.; constrn. engr. on bldgs.; dsgning and constrn. engr., Northern Aluminum Co.; dsgning bldgs. and reinforced concrete dams, Shaw. Water & Power Co.; supt. of constrn., Bishop Constrn. Co., Toronto; 1911 to date, gen. coutracting and eng., first as Edward H. Beck, later Beck & Poole.

References: A. H. Harkness, J. M. Oxley, J. R. W. Ambrose, H. L. Bucke, G. G. Powell.

BISHOP—ARTHUR LEONARD (late Capt.) of St. Catharines, Ont. Born at Brantford, Ont., Oct. 21st, 1895. Educ., 2 yrs., R.M.C., Kingston. Summer vacations 1908-09, in office and machine shop of Coniagas Mines, Cobalt; 1910-11-12, blast furnace and electrolytic refinery Coniagas Reduction Co., Thorold, Ont.; 1913, asst. to res. engr., N.T.R.; 1914, night supt., Coniagas Reduction Co.; Nov. 1914, Dec. 1918, on active service, capt., Royal Engrs., 1915, asst. to director of works, British Adriatic Mission; 1916, asst. to director of works, British Mission, Serbian Army; at present is director in Coniagas Mines Ltd., Cobalt; Coniagas Reduction Co. Ltd., Thorold; British-American Shipbuilding Co. Ltd., and Electric Steel & Engineering Co. Ltd., Welland.

References; R. W. Leonard, A. C. Macdonald, G. Grant, R. P. Rogers, C. J. Armstrong.

BOULIANE—THOMAS SIMON, of Levis, Que. Born at La Malbaie, Que., Aug. 14th, 1893. Educ., 2 yrs., industrial course, Sherbrooke Seminary; ½ R.R. Eng. course, I.C.S. 1913-16, in res. engr's office, Can. Govt. Rys., on constrn.; 1916-17, on military service, 189th Batt., C.E.F; June 1918 to date, rodman, C. G. Ry.

References: H. R. Younger, S. Desmeules, S. Bourgoing, J. E. Gibault, R. H. Emmerson, S. S. Oliver.

BRISBANE—JOHN SUTHERLAND, of Sarnia, Ont. Born at Montreal, June 6th, 1892. Educ., B.Sc. (C.E.) McGill Univ., 1915. Summers, 1910, dftsman. Phœnix Bridge & Iron Works, Montreal; 1911, rodman and foreman on erection of steel towers, Shaw. Water & Power Co.; 1912, dftsman., Dom. Bridge Co.; 1915 (4 mos.) engr's asst., Montreal Harbor Comm. Eng. staff, instrument work, dfting, gen. asst. to asst. engr.; 1915-16, dfting and desgning of bldgs., tanks, etc., Imperial Oil Ltd.; Apr. 1915 to July 1918, lieut., C.E.F.; Aug. 1918 to date, with Imperial Oil Co., as above.

References: H. M. MacKay, C. M. McKergow, E. A. A. Cowen, T. W. Harvie, E. M. Salter.

CHAMBERS—ALLISON ROBERT, of New Glasgow, N.S. Born at Halifax, N.S., Jan. 14th, 1879. Educ., B.Sc., McGill Univ., 1904. 1897-98, engr. in chg. civil dept., Nova Scotia Steel Co., Wabana, Nfld.; 1899-1900, engr. in chg. civil dept., Dom. Iron & Steel Co., Wabana; 1904 to date with N.S. Steel Co., as follows:—1904-05, mining engr.; 1906-08, res. mgr.; Wabana; 1909-11, mining engr., ore mines and quarries dept., New Glasgow, N.S., 1911 to date, asst. mgr., ore mines and quarries dept.

References: R. S. Lea, W. G. Matheson, M. A. Fullington. R. E. Chambers, G. D. Macdougall, C. H. Wright, E. S. Fraser, F. W. Forbes.

CHARLES—JOHN LESLIE (Major, D.S.O.) of Toronto, Ont. Born at Weybridge, Eng., Dec. 15th, 1892. Educ., passed all exams. required by Royal Engrs., Royal Grammar School, passed Cambridge Exam. 1908-10, articled to Hardy & Co., on minicipl work; 1910-11, rodman and dftsman., G.T.P. Ry.; 1911-12, instr'man, G.T.P.; 1912-14. transitman on location, H.B.Ry.; 1914-15 in chg. of revising location party, H.B.Ry. 1915 (8 mos.) res. engr., H.B. Ry.; Nov. 1915 to date, on active service, as lieut., and at present ch. engr., 13th Bn., Can. Ry. Troops.

References: J. V. Dillabough, C. Ewart, J. W. Porter, L. E. Silcox, L. F. Grant, D. W. McLachlan, D. Hillman, M. F. Cochrane, C. M. Steeves.

CLARK—FRANCIS WAY, of Niagara Falls, Ont. Born at St. Paul, Minn., Jan. 23rd, 1887. Educ., Toronto Univ., 1911. 1907, rodman on constrn., C.P.R.; 1909-10, instr'man in chg. of field party, Hydro Elec. Power Comm.; 1911-12, asst. engr., Internat. Waterways Comm.; 1913, field engr., Internat. Joint Comm.; 1913-17, field engr., Hydro Elec. Power Comm.; 1917 to date, asst. ch. field engr., Chippawa development, Niagara Falls, Hydro Elec. Power Comm.

References: A. C. D. Blanchard, J. B. Goodwin, H. G. Acres, F. N. Rutherford, N. R. Gibson, M. V. Sauer.

COLE—GEORGE PERCY, of Montreal. Born at Montreal, March 3rd, 1880. Educ., B.Sc., McGill Univ., 1903; 2 yrs., Art. course, McGill, 1899; proceeded to M.Sc. degree, McGill, 1906. Summer 1901, with Cape Breton Ry. Co. on rly location survey; summer 1902, won scholarship of Can. Gen. Elec. Co., with 3 mos. course in their Montreal shops; 1903-04, in eng. dept., Wagner Elec. Mfg. Co., St. Louis, Mo., in chg. of special testing in development of all kind of alternating current motors; 1904-05, motor designer, in chg. of elec. design of motors; 1905-06, asst. ch. engr., Wagner Elec. Mfg. Co.; 1906-07, transformer designer, Allis Chalmers Bullock Ltd., Montreal, designing all classes of lighting and power transformers; 1907-08, special lecturer on transformer design McGill Univ.; 1907-13, with Allis Chalmers Bullock Ltd. as follows:—1907-10, transformer dsgner and gen. estimating, in full chg. of transformer dsgning and gen. estimating on all elec. apparatus; 1907-13, ch. estimating engr., in full chg. of estimating on all products; also (5 mos.) technical advisor to gen. mgr.; 1913-14, elec. engr., motor sales dept., Can. Gen. Elec. Co. Co., Toronto, tech. advisor to gen. mgr., on all motor and control problems, etc.; 1914 to date, tech. engr., Dom. Glass Co. Ltd., in full chg. of all eng. work 1918-19, vice-pres., Montreal Metallurgical Ass'n.

References: F. S. Keith, W. S. Lea, L. A. Herdt, F. B. Brown, G. R. Kendall, G. Robertson, F. A. McKay, A. E. Foreman.

CORNWALL—CLEMENT A. K., of Victoria, B.C. Born at Ashcroft, B.C., May 23rd, 1875. Educ., B.Sc. (E.E.) 1900, M.Sc., 1901, McGill Univ. 1900, meter and transformer testing, Royal Elec. Co., Montreal; 1901-02, operator, West Kootenay Lighting & Power Co., Bonnington Falls; 1902-08, gen. elec. and mech. eng. work in car shed, meter room and generating station, B.C. Elec. Ry. Co., Vancouver; 1908 to date, asst. supt., B.C. Elec.Ry. Co., Victoria.

References: A. E. Foreman, C. H. Rust, D. O. Lewis, F. C. Gamble, R. Fowler.

COUTLEE—WILLIAM FREDERICK, of Ottawa, Ont. Born at Ottawa, July 18th, 1881. Educ., Coll. Inst., I.C.S. 1910, on gen. municipal work, with Macdonnell Gzowski Co., Vancouver; 1911, with Brooks, Scanlon & O'Brien, on timber operations; 1912, rodman and inspecting concrete, Temiskaming dam; 1912-14, level and transit man, inspecting concrete, etc. and acting as asst. to res. engr. in chg., Quinze dam, D.P.W.; 1914-15, topog., leveller, transitman, dftsman. and asst. to engr. in chg. of party, Madawaska River traverse survey; 1915-16, in chg. of outside hydrometric party and office computations, Ottawa; Mar. 1916, Dec. 1918, lieut. on active service; Dec. 1918 to date, in chg. of hydrometric parties, D.P.W., Ottawa.

References: C. R. Coutlee, L. A. DesRosiers, S. B. Johnson, R. F. Davy, A. Trudel.

CRASHLEY—JOHN WILLARD, of Toronto, Ont. Born at Toronto, Oct. 16th, 1892. Educ., B.A.Sc., Toronto Univ., 1914. 1912 (5 mos.) dfting and rodman, city surveying dept., Toronto; 1913 (4 mos.) instr'man, Ont. roads dept.; 1914-16, asst. to engr. in ch. of dredging, Toronto Harbor Comm., and ch. computer of dredging; Feb. 1916 enlisted as lieut., 14 mos. in France with 5th Can. Ry. Troops, on gauge constrn., and at present temp. capt. and adj., 9th, Mississanga Horse and sec'y of Mississanga Batt'ns Home Ass'n.

References: E. L. Cousins, N. D. Wilson, F. S. Rutherford, F. C. Mechin.

CRAWFORD—ARTHUR WESLEY, of Hamilton, Ont. Born at Point Edward, Ont., May 4th, 1892. Educ., B.A.Sc., Univ. of Toronto, 1914. 1910, with G.T.R., engr. on elec. installation; 1914-18, army signals, qualified brigade signal officer; 1918, mathematics instructor, Hamilton Technical and Art School; since March-1918 to date, dist. vocational officer, Dept. of Soldiers Civil Re-Establishment.

References: E. R. Gray, H. E. T. Haultain, P. Gillespie, C. R. Young.

DOANE—HARVEY WILLIAM LAWRENCE, of Halifax, N.S. Born at Halifax, Jan. 20th, 1892. Educ., B.Sc. (C.E.) N.S.T. ech. Coll., 1915, 3 yrs. in Arts, Dalhousie Univ., Prov., Crown Land Surveyor, N.S.; 1908, instr'man on sidewalk and sewer work, Halifax; 1909, asst. (at times in full chg.) of survey for coal leases, etc., Morien, B.C.; 1910, plotting, tracing and blueprinting, city engr's office Halifax; 1911, asst. to city engr., Halifax, in chg. of sewer work, and land surveying; 1912, surveys and designed sewer system for Springhill, N.S., also works system for Chester, N.S., etc.; 1913, dsgning and in chg. of surveys, and eng. chg. of constrn., steel water supply main, Kentville, etc.; 1914, Instructor, P.L.S., N.S. Tech. Coll., engr. and contractor, dsgn. and constrn. pumping plant, eng. chg. of constrn., concrete sidewalks, Kentville, N.S. and Sackville, N.B., in chg. of dsgn., water supply, sewer system, etc., Hazel Hill, N.S., etc.; 1915, degned sewer system, Bridgetown, N.S., prelim. report on sewer and water systems and roads, Stewiacke, N.S.; investigation of water system, Sackville, N.S. and Liverpool, N.S.; 1916-18, on active service; at present, asst. in city engr's office, Halifax.

References: F. W. W. Doane, J. W. Roland, R. McColl, J. L. Allen, W. J. De Wolfe.

ELLIOTT—CHARLES CLIFFORD, of Brooks, Alta. Born at Pictou, N.S., May 12th, 1878. Educ., one yr. Art. course, Kings Coll., Windsor, one yr. law, Dalhousie Coll., Halifax. 1897-1900, apprentice with Corliss Steam Engine Co., Providence, R.I.; 1904-06, rodman, leveller, etc., irrigation dept., C.P.R.; 1906-07, dftsman., North Coast R.R.; 1907-14, asst. engr., in chg. of topog., prelim. and location surveys, constrn. of ditches and structures on irrigation project, C.P.R.; 1914 to date canal supt., in chg. of operation and maintenance of canals and structures, C.P.R.

References: A. S. Dawson, S. G. Porter, S. H. Frame, E. N. Ridley, C. M. Arnold.

FOWLER—CHARLES, ALLISON DeWITT, of Armdale, N.S. Born at Amherst, N.S., Nov. 12th, 1890. Educ., B.Sc. N.S. Tech. Coll., 1914; P.L.S. 1914, instr'man, on hydro elec. power development and mill constrn' dftsman., Dept. of Roads, N.S.; 1915, instr'man, Halifax Ocean Terminals; 1916, field engr. N.S. Tramway & Power Co., Halifax; 1917-18, constrn. supt., and at present asst. ch. engr., Halifax Shipyards Ltd., Halifax.

References: P. A. Freeman, J. H. Holliday, R. McColl, H. Donkin, W. G. Yorston.

GLEESON—LEO, of Ottawa, Ont. Born at Kingston, Ont., Aug. 14th, 1885. Educ., B.Sc., Queen's Univ.. 1907. 1909, asst. engr., Milk & St. Mary Rivers investigations; 1910-12, hydrometric engr., on river investigations, under Dept. of Interior; 1912-13, asst. engr., prelim. location; 1913-14, on survey; 1914-15, asst. engr., on proposed division of Milk & St. Mary rivers; 1916-18, on active service with Can. Field Artillery, and at present with reclamation service, on Office work.

References: F. H. Peters, R. J. Burley, J. S. Tempest, W. C. Gillis, B. Russell.

GOSROW—ROLFE CLEVELAND, of Milwaukee, Wis. Born at Buffalo, N.Y., Nov. 12th, 1886. Educ., metallurgy and chemistry, Missouri School of Mines, 1909, 2 yrs., deftman and asst. ch. dftsman. in metallurgical and mining plants on gold, copper, lead, etc., also elec. smelting plants; 3½ yrs., metallurgist and furnace and works mgr., iron, steel and ferro alloy plant, also consulting work. Geology and development of rare metal ores and alloy making metals for steel improvements; investigations and reports for corporation operating industrial and public utilities, etc.; at present electrometallurgist and sales mgr., for steel company, making special steel by elec. furnace process, etc.

References: R. F. Hayward.

HABBEN—LAWRENCE ERNEST, of Shawinigan Falls, Que. Born at London, Eng., Aug. 24th, 1885. Educ., Finsbury Tech. Coll., (diploma mech. div'n) 1903. 1903-05, in workshop of Foster Arc Lamp Co., and Sturtevant Eng. Co., London; 1905-07, dftsman., Siemens Bros., Stafford, Eng., motor starters and switchgear; 1907-09, dftsman., Gen. Elec. Co., Birmingham, Eng., motors and generators; 1909-11, in chg. of steam turbo-alternator section of dfting office, Bruce Peebles & Co., Edinburgh, Scotland; 1911-13, in chg. of switchgear and transformer section, drafting office, Allis Chalmers Bullock, Montreal; 1914-16, manager, Electro Chemical Co., Montreal; 1916 to date, asst. designing engr., Can. Electro Products, responsible for desgn. of elec. equipment, etc.

References: F. T. Kaelin, J. Morse, G. K. McDougall, C. R. Lindsay, J. W. Hayward.

HARLAND—WILLIAM, of Toronto, Ont. Born at Sunderland, Eng., Dec. 28th, 1881. Educ., Tech. Inst., Sunderland. 1897-1902, articled pupil with G.T. Brown, civil engr. and architect, Sunderland; 1902-04, asst. to G. T. Brown, on street paving, sewers, bldgs., etc.; 1904-05, constrn. engr., with South Hetton Coal Co., dsgning and supervising all bldg. constrn., etc.; 1906-07, asst. with De Morest, Hall & Lowe, Sudbury, Ont., on town eng. work, and in chg. of party, etc.; 1908-09, private practice, Sudbury, principally architectural work; 1909-12, asst. prov'l architect, Toronto, dsgning and supervising constrn. of public bldgs.; 1912-14, asst. engr., Imperial Constrn. Co., Toronto, dsgning and supervising constrn. of bldgs.; at present, asst. in hydraulic dept., Hydro Elec. Power Comm., in chg. of squad on dsgning and preparation of drawings.

References: H. G. Acres, M. V. Sauer, T. H. Hogg, G. Hogarth, A. E. Nourse, J. R. Montague, F. E. Patterson.

KETCHEN—WILLIAM LAIRD, of Temiskaming, Que. Born at Middleshro', Eng., July 14th, 1875. Educ., 3 yrs., H. Watt Eng. Coll., 6 yrs. apprenticeship. 1899-1901, dftsman., Poyser Haywood, experimental eng. dept.; 1901, dftsman. and asst. to engr., John Dockinson & Co., paper makers, England; 1902-03, dftsman and asst. to mgr., Can. Pneumatic Tool Co., Montreal; 1904, dftsman. Dom. Pneumatic Tool Co.; 1905, dftsman, J. A. Jamieson, consl. engr.; 1906-13, ch. dftsman, Dodge Mfg. Co., Toronto; 1914-15, in chg., outside constr., under ch. engr., Riordon Pulp & Paper Co., Hawkeshury, Ont.; 1916, ch. engr., of constrn. Merritton, Ont.; 1917, ch. engr. of constrn., at Hawkesbury; 1918, to date, ch. engr., of constrn., Kipawa Co. Ltd., Temiskaming.

References: C. B. Thorne, H. S. Ferguson, W. S. Lea, E. S. M. Lovelace, A. Amos.

KITTREDGE—BERTIE LISLE, of Shawinigan Falls, Que. Born at North Stukely Que., Aug. 5th, 1885. Educ., Academy, Waterloo, Que., mech. eng., I.C.S. 1906, mech. dfting., Hart Otis Car Co.; 1907, with Northern Elec. and Mfg. Co., mech. dfting and dsgn. on telephone and fire alarm apparatus; 1909, dfting and purchasing agt. of elec. apparatus, etc., R.E.T. Pringle & Co.; 1910-13, with J. A. Jamieson; 1915, with A. W. Robinson; 1916, with Dom. Bridge Co., later with John S. Metcalf Co.; 1917, with R. S. Kelsch; 1918, American Electro Products Co., and at present mech. engr., in chg. of chemical apparatus with American Electro. Products., Shawinigan Falls, Que.

References: A. W. Robinson, J. A. Jamieson, R. S. Kelsch, F. T. Kaelin, H. Rolph.

LOUDON—ANDREW CHARLES, of Montreal. Born at Valleyfield, Que., July 7th, 1883. Educ. B.Sc., McGill Univ., 1906. 1901, Can. Govt. Survey; 1902, special apprentice, C.P.R.; 1903-05, special apprentice, G.T. Ry.; 1906-07, dftsman. Amer. Loco. Co.; 1907-08, locomotive foreman, G.T. Ry.; 1909, dftsman, D. & H. Ry. Co.; 1909-10, test dept., A. F. & S. F. Ry.; 1910-12, gen. foreman, G.T.P. Ry., Winnipeg; 1912-16, editor, mech. dept., "Railway Age"; 1916 to present date, acting asst. ch. engr., executive asst., Canadian mgr., Locomotive Super-heater Co.

References: E. J. Turley, J. T. Farmer, R. J. Durley, W. H. Winterrowd, J. A. Shaw, C. V. Christie.

MARCHAND—JOSPEH ARTHUR HENRI, of Three Rivers, Que. Born at Batiscan, Que., Sept. 2nd, 1884. Educ., B.A.Sc., (C.E.) Polytechnic School, 1910. 1910 (2 mos.) transit and level man with M. Dufresne; 1910 (3 mos.), transitman on Beauharnois Barge Canal; 1911 (3 mos.) surveying of lakes and rivers; 2 mos., private practice, hydraulic and elec. eng.; 1911-13, in responsible chg. of prelim. surveys and constrn. of railroads; March 1913 to date, asst. engr., P.W.D., Three Rivers dist.

References: C. J. H. Jette, R. Morrissette, F. X. T. Berlinquet, L. W. Bourassa, A. B. Normandin, A. R. Decary, J. Bourgeois, B. Grandmont.

McCORT—CECIL ROY, of Montreal. Born at Bolton, Ont., July 18th, 1893. Educ., B.A.Sc., Univ. of Toronto, 1915. 1912 (5 mos.) with Can. Fairbanks Morse, Toronto, testing gasoline engines and motors; 1913-14, (10 mos.) asst. engr., P.W.D., on breakwater constrn. and harbor improvements, Port Arthur, Ont.; 1915 (9 mos.) on research work, investigating strength values of structural timbers, Products Laboratory of Canada; 1916-19, with Canadian and Imperial Artillery, 1917, Capt. in France; at present in chg. of Montreal office, professional and business occupations section, Dept. of Soldiers Civil Re-Establishment.

References: J. M. R. Fairbairn, W. J. Francis, P. Gillespie, H. E. T. Haultain, F. B. Brown, C. R. Young.

McKENZIE—ROBERT DAWSON, of Winnipeg, Man. Born at Brandon, Man., Aug. 10th, 1892. Educ., B.C.E., Man. Univ., 1916. 1916 (6 mos.) with C.N.R.; 1916-17 (6 mos.) rodman, bridge dept., C.N.R.; 1917-18, not employed in civil eng. work; May 1918 to date, junior asst. engr. and dftsman, highway comm'rs office, P.W.D.

References: T. W. White, M. A. Lyons, E. E. Brydone-Jack, P. Burke-Gaffney.

MOORE—ROWLAND CHAPMAN, of Halifax, N.S. Born at Halifax, Dec. 26th, 1893. Educ., B.Sc., N.S. Tech. Coll., 1916. 2 yrs. Arts course Dalhousie Univ. Rodman on railroad survey. 1916 to date, with Foley Bros., Welch, Stewart & Fauquier, Halifax, as dftsman. on desgn and detailing of repair, etc., also in chg. of survey party, work including setting of diving bell, location of shells, etc., and at present asst. eng., work including gen. supervision of all field work, gen. dsgning, etc.

References: J. W. Roland, A. C. Brown, F. R. Faulkner, P. A. Freeman.

MOULTON—HAZEN PARKER, of Ottawa, Ont. Born at St. Stephen, N.B., July 9th, 1886. Educ., B.Sc., Univ. of N.B., 1907. D.L.S. 1912., summers 1906-07, asst. engr. on waterworks, St. Stephen, N.B.; 1908-11, asst. on geodetic survey work; 1912-13, asst. engr. and surveyor on Internat. Boundary survey, Lake of the Woods dist.; 1914-16, in chg. of precise levelling parties, in Ont., Que. and N.B.; 1917, in chg. of reconnaissance work, in N.S., Geodet. Survey; 1918-19, lieut., with Can. Engrs.; and at present in chg. of reconnaissance work, Geodet. Survey of Canada in N.S. and P.E.I.

References: N. J. Ogilvie, J. J McArthur, J. D. Craig, M. F. Cochrane, H. F. J. Lambart, L. O. Brown.

PARKER—SAMUEL RUTHERFORD, of Regina, Sask. Born in China, Aug. 25th, 1886. Educ., 3 yrs., Royal Glasgow & West of Scotland Tech. Coll. summers of 1903 to 07, apprentice, mech. and marine eng.; 1907-09, asst. in marine dept., Greenock Corp. Elec. Dept.; 1910-11, Manitoba Govt. telephones ,asst. in conslt. engrs. office and long distance trouble desk; 1911-12, light and power dept., Wpg., as industrial and later power engr.; 1912-15, Sask. govt. telephones, first asst. engr., later maintenance engr.; Sept. 1915 to Mar. 1919, military service, 1915-16 with P.P.C.L.I., 1918, elec. instructor, Seaford, England; instructional work; 1905-06, Greenock Tech. School; 1911-12, St. Johns and Kelvin Tech. Schools; 1918, School of Mil eng., and Khaki Coll. of Canada, Seaford, Eng.; Mar. 1919 to date, dept. of telephones, Regina, acting constrn. engr.

References: W. R. Warren, R. C. F. Chown, J. G. Glassco, E. V. Caton, W. A. Duff.

PEEK—ROBERT LEE, of St. Catharines, Ont. Born at South Orange, N.J., Nov. 16th, 1871. Educ., 2 yrs. Clinton Grammar School, Clinton, N.Y. 1887-95, laboratory asst., Ledoux & Co., N.Y.; 1895-1906, assayer; 1906-07, metallurgy of Cobalt ores, North America Refining Co., Hamilton; Sept. 1907 to date, supt., constrn. and operation, Coniagas Reduction Co., smelting and ref'g work, Thorold, Ont.

References: R. W. Leonard, H. E. T. Haultain, J. L. Weller, J. T. Farmer, R. P. Rogers.

PRATT—FOREST MILLEN, of Ottawa, Ont. Born at Ottawa, Mar. 21st, 1891. Educ., B.A.Sc., Toronto Univ., 1912. 1911 (5 mos.) with E. B. Eddy Co., Hull, Que., on dsgn. and assist. in erection of warehouse; 1912-14, as res. engr., on constrn. of power house, etc., responsible for correctness in detail of excavation, bld. constrn., etc.; 1914-15, on dsgn. and carrying out of. alterations and additions to bldgs. and machinery; Nov. 1915, lieut. Can. Engrs., awarded M. C. 1916; May 1918, made capt., was mentioned in despatches Jan. 1919; at present with E. B. Eddy Co., as engr., work including dsgn. and constrn. of mill bldgs., and installation , etc. of machinery.

References: W. Kennedy, Jr., J. B. McRae, G. M. Hamilton, C. R. Coutlee, J. Murphy.

RACEY—HERBERT WILLIAM (Capt.) of Westmount, P.Q. Born at Quebec, P.Q., May 11th, 1875. Educ., matric. St. Francis Coll., Richmond, began Science course, McGill Univ., but did not complete studies. 1896, with Royal Elec. Co.; 1897-1901, with Henry Atkinson, Etchemin, forestry work, mill constrn., etc.; 1902-10, dist. mgr., Price Bros. & Co., built sawmills, pulp mill, roads, dams, maintained in repair vessels, tugs, etc., dsgned and built bldgs., etc.; 1910-13, gen. mgr., Big. River Lumber Co., Big. River, Sask.; 1913-15, gen. mgr., St. Lawrence Pulp & Lumber Corp., Philadelphia, Pa., in chg. of erection of pulp and saw mill plant, town constrn., water supply, etc.; 1916-18, overseas, with Can. Forestry Corps, later with Can. Engrs , as capt., had chg. of Stover Park Camp, and constrn. of aerodromes for War Office; 1918 (6 mos.) estimating engr., Shipbuilding Co. (Fraser, Brace & Co.); Dec. 1918 to date, on eng. staff, Dom. Glass Co., Montreal.

References: E. S. M. Lovelace, G. K. Addie, C. E. Fraser, A. R. Sprenger, R. O. Sweezey.

STIDWILL—FRANCIS, of Cornwall, Ont. Born at Holsworthy, Eng., July 25th, 1880. Educ., B.Sc., Queen's Univ., 1908. 1906, transit work, etc., with W. G. McFarlane, D.L.S.; 1907-12, with Magwood & Walker, Cornwall; 1912 to present date, member of firm Magwood & Stidwill, work including dsgning and supervising municipal and railroad work, etc.; also engineer for townships of Cornwall, Lochiel, West Hawkesbury, Kenyon, Finch, Osgoode, Vankleek Hill.

References: C. D. Sargent, W. H. Magwood, F. E. Patterson, T. D. Kennedy, F. T. McArthur, J. G. Cameron.

STOKES—CHARLES WILLIAM, of Montreal. Born at Richmond, N.B., Aug. 5th, 1878. Educ., B.Sc. (E.E.) McGill Univ., 1903; 2 yrs. in Arts and C.E. course in Univ. of N.B. 1902 (3 mos.) shopwork, Northern Elec. Co.; 1903-04 (18 mos.) apprentice, Westinghouse Co., Pittsburg, Pa.; 1904-07, erecting engr., Can. Westinghouse Co., Montreal; 1907-08, supt., elec. and telephone dept., Kenora, Ont.; 1909, in chg. of sales of power apparatus, Northern Elec. Co., Toronto; 1909-10, asst. engr., Hydro Elec. Power Comm.; Aug. 1910 to date with Siemens Co. of Can. Ltd., as follows:—1910-11, salesman, Toronto; 1911-15, mgr., Wpg. branch; June 1915 to date, gen. mgr., Montreal, engaged in dealing with and installing elec. equipment.

References: F. S. Keith, F. B. Brown, W. J. Francis, G. G. Gale, L. A. Herdt, W. A. Duff.

TRIPP—GEORGE MASON, of Victoria, B.C. Born at Woodstock, Ont., Nov. 14th, 1875. Educ., Ont. public high school. 1893-98, with Can. Gen. Elec. Co., first as student, later as foreman on laying out and erection of elec. equipment, etc.; 1898-1903, installation and operation of hydro-elec. apparatus, with B.C. Elec. Ry. Co. Ltd.; 1903 to date, supt., Victoria Branch, B.C. Elec. Ry. Co., eng. supt., in chg. of all eng. work on Vancouver Island, Vancouver Island Power Co.

References: G. R. C. Conway, R. F. Hayward, C. H. Rust, F. C. Gamble, D. O. Lewis.

VOGAN—GEORGE OLIVER, of Toronto, Ont. Born at Riceville, Ont., Dec. 18th, 1892. Educ., B.Sc., Queen's Univ., 1917. 1916 (4 mos.) instr'man under Dr. E.L. Bruce, Geological Survey Ottawa; 1917 (4 mos.), field dftsman, railway dept. Hydro Elec. Power Comm.; 1917-18, hydraulic dept., on power development surveys; 1918 to date, on design of hydraulic structures, Hydro Elec. Power Comm.

References: A. E. Nourse, T. H. Hogg, H. G. Acres, G. F. Hanning, M. V. Sauer, J. Curzon.

WHITE—FRANK O., of Temiskaming, Que. Born at Orono, Maine, Dec. 17th, 1884. Educ., B.Sc. (C.E.) Univ. of Maine, 1905. 1902 (3 mos.) with Internat. Paper Co., as rodman on property surveys; 1903 (3 mos.) compassman on timber surveys; 1904 (6 mos.) instr'man, water power surveys; 1905-07, with Bodwell Water Power Co., Milford, Me., as instr'man and inspector on constrn. and equipment of hydro elec. power development; 1907-09, with Anglo Newfoundland Development Co., Grand Falls, Nfld., as asst. supt. of constrn., in executive chg. of constrn.; 1909-10, with S. M. Green, consl. engr., Springfield, Mass., as res. engr. in chg. of constrn. and equipment of industrial plants; 1911 (6 mos.) with Mississippi River Power Co., Keokok, Iowa; as office engr. on surveys; 1911 (2 mos.) as ch. of party; 1911-12, with Can. Stewart Co., asst. supt. of constrn.; 1912-18, with H. S. Ferguson, consl. engr., New York, 2 yrs. in chg. of field investigations; 2 yrs. in chg. of prelim. designs, invest'n, reports, etc., 2 yrs. in chg. of dsgns. of sulphite pulp mills., and at present with Kipawa Fibre Co. Ltd., in chg. of dsgns. for sulphite pulp mill and hydraulic development.

References: C. B. Thorne, H. S. Ferguson, R. O. Sweezy, R. F. Davy, C. R. Coutlee.

WHITMAN—KARL EWART, of Halifax, N.S. Born at Advocate Harbor, N.S., Aug. 6th, 1887. Educ., B.Sc. (C.E.) N.S. Tech. Coll. 1914. 1911 (3 mos.) surveying with Maritime Coal, Ry. & Power Co.; 1912 (3 mos.) dftsman., C.N.R., Winnipeg; 1913, (3 mos.) supt'g constrn. of wharf and cable bldgs., Western Union Telegraph Co., Halifax; 1914-16, (16 mos.) in chg. of erection of structural steel, Toronto Structural Steel Co., Toronto; 1915-16 (9 mos.) on military service in chg. of party on survey of dist. east of Halifax Fortress; 1916-17, dsgning. engr., Standard Steel Constrn. Co., Welland, Ont.; Aug. 1917-Nov. 1918, on military service; Dec. 1918 to date, instructor in surveying and structural drawing and design, Dept. of Soldiers Civil Re-Establishment at N.S. Tech. Coll.

References: R. W. McColough, J. W. Roland, O. S. Cox, F.R.Faulkner, J.F.Pringle.

WHITNEY—CLAUDE STAFFORD, of Niagara Falls, Ont. Born at Cape Rich, Ont., Jan. 19th, 1886. Educ., RR. Eng. course, I.C.S. 1905-06, rodman, etc., N.T.C. Ry.; 1906-10, instr'man, N.T.C. Ry.; 1910-14, res. engr., N.T.C. Ry.; 1914-15, inspector, roundhouse and shops, sewage, water service, etc., N.T.C. Ry., at Grant, Ont.; 1916-18, instr'man, Hydro Elec. Power Comm., and at present is res. engr.

References: H. D. Lumsden, H. L. Bucke, A. C. D. Blanchard, N. B. MacTaggart, A. M. Macgillivray, A. V. Redmond, J. B. Goodwin, W. P. Wilgar.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

BROWN—PHILIP PIGGOTT, of Vancouver, B.C. Born at Great Leighs Eng., Aug. 19th. 1881. Educ., London colleges and special tuition. 1899-1903 apprentice, M. T. Shaw & Co. Ltd., Millwall, Eng.; 1904-07, with same firm as supervising shop engr., and inspector on structural and bridge work; 1908-09, as desgning engr., on structural steel for bldgs., etc.; 1910, with several firms in Vancouver, including Cleveland & Cameron, conslt. engrs.; 1911 to date, practicing as conslt. and supervising structural engr., specializing in reinforced concrete constrn., with exception of 16 mos. (1915-16) with Imperial Munitions Board.

References: J. H. Kennedy, F. P. Wilson, L. E. Wilson, D. Cameron, E. A. Clevaland, A. D. Creer.

DeCEW—JUDSON ALBERT, of Mount Vernon, N.Y. Born at Waterford, Ont., Dec. 14th, 1874. Educ., B.A. Sc., Toronto Univ., 1901. 1901-03, erecting and advisory chemical engr., Canada Paper Co.; 1904 to date, consulting chem. engr., researches and advice in chem. and mech. problems for paper and pulp firms in Canada and United States, 1915-16, special investigations in antimony; at present is president, Process Engineers, Montreal and New York.

References: F. B. Brown, W. J. Francis, F. S. Keith, R. A. Ross, H. Holgate.

GREENE—JOHN FRANCIS, of Winnipeg, Man. Born at Boston, Mass., Mar. 4th, 1885. Educ., B.A., Boston Coll., 1905. 1906, rodman on tunnels under Hudson river, Penn. RR.; 1907-09, dftsman and bridge detailer, Spokane, Wash.; 1909-14, bridge engr., Spokane, in responsible chg. of concrete bridges, in complete, chg. of dsgn. and constrn., etc.; 1915-16, in complete chg. of dsgn. and constrn. of bridges in Calgary; 1917-19, constrn. engr., for Carter-Halls-Aldinger Co., Winnipeg, in chg. of underpenning and bridge work; and at present is member of firm C. D. Howe & Co., conslt. engrs., Port Arthur and Winnipeg.

References: G. W. Craig, F. H. Peters, S. G. Porter, A. V. Redmond, A. M. Macgillivray, A. S. Dawson.

GRIM—WALTER ATKYNS ERVINE (Capt.) of Vancouver, B.C. Born at Stratford, Ont., Nov. 11th, 1880. Educ., private tuition, R.R. eng. course, Am. School of Corr. 1906-07, res. engr., prairie div., G.T.P. Ry.; 1907-09, mountain div'n. G.T.P.; 1910, prairie-div., G.T.P.; 1911 (10 mos.) inspecting engines, Los Angeles aqueduct; 1912-13, asst. engr., Western Canada Power Co., Vancouver; 1914, asst. engr., with Geo. H. Webster, consl. engr. and contractor; 1914 to date, on active service, at present, Capt., Can. Engrs.

References: H. M. Pardee, B. Ripley, W. H. Tobey, A. H. Greenless, E. H. Pense.

HILL—BURTON M., of Fredericton, N.B. Born at St. Stephen, N.B., June 21st, 1883. Educ., B.Sc., Univ. of N.B., 1907. 1908-12, res. engr., M.T.R.; 1912-15, div. engr., St. J. & Que. Ry.; 1916-18, prov'l inspecting, ry. engr., and engr., Permanent roads, Prov. of N.B.

References: K. H. Smith, E. E. Brydone-Jack, C. O. Foss, A. R. Crookshank, L. L. Theriault, G. C. Dunn, H. Longley.

JOHNSON—SYDNEY B., of Ottawa, Ont. Born at Ottawa, Dec. 3rd, 1875. 1900-01, topographer, levelman, A.C. Ry.; 1901-04, dftsman and computer in office of Little Kanawha Ry., Parkersburg, W.Va.: 1904, dftsman and computer, G.T.P. Ry., North Bay, Ont.; 1905-08, in chg. of metering party, measuring Ottawa river, etc. and French river; 1909-19, in chg. of hydrometric surveys, P.W.D., including overseeing 100 gauge stations and computation of discharge curves for St. Lawrence and Ottawa Rivers, etc.; Mar. 1919 to date, asst. engr., in chg. of Ottawa River storage, P.W.D., and in chg. of hydrometric surveys.

References: C. R. Coutlee, J. B. McRae, A. St. Laurent, A. J. Matheson, F. B. Brown.

McLAY—DAVID BIRD, Capt. R. E. (Formerly of Vancouver, B.C.). Born at Uddingston, Scotland, Apr. 16th, 1885. Educ., B.Sc. (Eng.) Glasgow Univ., 1910; A.M.I.C.E. 1902-06, apprentice, W. L. Douglass, Scotland; 1907, (6 mos.), with Brandon Bridge Bldg. Co., Motherwell, Scot., as fitter and erector; 1908, (6 mos.), fitter, British Westinghouse Co., Manchester; 1909 (6 mos.) in office as bookkeeper; 1910-11, tester of elec. machines, British Westinghouse Elec. & Mfg. Co.; 1911 (3 mos.) in bridge and roadways dept., city engr's office, Toronto, as dftsman.; 1911 (3 mos.) res. engr. on reinforced concrete tunnel, at Illecillewaet, B.C.; 1911-15, in roadways dept., city engr's office, Vancouver, first as dftsman and ch. dftsman., later for 3 yrs., as asst. engr., in chg. of constrn. and maintenance of roads; 1915-16 (7 mos.) res. engr., in chg. of bldgs. H. M. Factory, Gretna, Scotland; 1916 (3 mos.) sapper, Royal Engrs., England; 1916 (4 mos.), 2nd lieut., R. E.; 1916-17, coy. commander and supt. of instruction, 2nd Q.V.O. Sappers & Miners, Bangalore, India; 1917-18, coy. officer, 2nd Q.V.O.S. & M., M.E.F., Mesopotamia; 1918 to date, capt.

References: F. L. Fellowes, W. H. Powell, A. D. Creer, F. S. Easton, J. R. Gosgrove, A. G. Dalzell, C. Brakenridge.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

GIBSON—JOHN McINTYRE, of Toronto, Ont. Born at Arthur, Ont., Jan. 26th, 1888. Educ., B.A.Sc., Toronto Univ., 1910. 1908 (5 mos.) on O.L.S.; 1909 (5 mos.) instr'man O.L.S.; 1910-11, instr'man D.L.S.; 1911 (9 mos.) asst. on road constrn.; 1912, on waterworks and sewers with Chipman & Power; 1912-13, dsgning engr., with C. W. Noble, on reinforced concrete bridges, etc.; 1913-15, with I.S. Osborn, conslt. engr., on dsgn. and constrn. of foundations and reinforced concrete work, etc.; 1915 (6 mos.) with R. J. Marshall in chg. of physical testing, lab., munitions; Dec. 1915-to date, on active service, 1915-16, as O.C., A. Coy., 127th Batt.; Nov. 1916 to date, major and ch. engr., 2nd Bn. Ry. Troops.

References: W. G. Swan, P. Gillespie, T. R. Loudon, C. W. Noble, F. F. Clarke, C. P. Van Norman.

KEEFER—JOSEPH ALEXANDER, of Victoria, B.C. Born at Victoria, Dec. 8th, 1886. Educ., Royal Mil. Coll. of Canada, 1908, Royal Engrs., Eng. School, Chatham, Eng. 1910. 1910-13, all eng. works under Utilities Dept. of Canada in W. Ont., including bldg. of armouries, laying out and constrn. of rifle ranges, water supply, etc.; 1913-14, railway constrn., C. N. Ry., Vancouver Island; 1914 to date, asst. engr., P.W.D., Victoria, B.C.

References: F. C. Gamble, D. O. Lewis, R. W. Macintyre, C. H. Keefer, W. M Everall, C. W. Gamble.

WYNNE—ROBERTS LEWIS WYNNE, of Toronto, Ont. Born at Carnarvon, Wales, Nov. 14th, 1891. Educ., B.Sc., honours (Eng.) London Univ., 1912. Gold Medalist, Battersea Coll. 1912-15, asst. engr., under Board of Highways Comm'rs., Sask. Govt., dsging and constr'g timber, steel and reinforced concrete bridges, etc.; 1916 (4 mos.) under Minister of Munitions, England; Apr. 1916, joined Royal Engrs., service in India, Mespotamia, and at present is Capt., Royal Engrs., in Persia.

References: R. O. Wynne-Roberts, L. A. Thornton, E. G. W. Montgomery, H. S. Carpenter, J. N. deStein, O. W. Smith, P. Linton, A. J. Macpherson, F. T. McArthur.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

GALBRAITH—ROBERT DOUGLAS (Major) of Toronto, Ont. Born at Toronto, May 28th, 1893. Educ., B.A.Sc., Toronto Univ., 1915. 6 mos., instrument work with Northern Development Branch, Ont. Govt.; 4 mos. instrument work and constrn., Foundation Co., N.Y.; 3 mos. dsgning, Curtiss Aeroplane Co., Toronto; 1915, enlisted in 75th Batt., as lieut. O.C. draft of 250 men, transferred to 23rd Bn., England, Sept. 1915; transferred to 28th Bn., France, April 1916; Aug. 1917, Capt., 2nd Can. Ry. Troops; Major, March 1918. Jan. 1919, awarded Military Cross; in chg. of broad gauge and light railway constrn., reconstrn. of bridges, in Belgium and France, and discharged from C.E.F., March 1919; at present is Toronto representative, Professional and business occupations, section, Dept. of Soldiers' Civil Re-Establishment.

References: T. K. Thomson, C. H. Mitchell, F. F. Clarke, J. M. R. Fairbairn, W. J. Francis, H. E. T. Haultain.

JOHNSON—REX PHILLIPS, of Niagara Falls, Ont. Born at Toronto, Ont., Apr. 22nd, 1892. Educ., B.A.Sc., Toronto Univ., 1914. Summer vacations 1909-10-11, rodman, etc., on railroad location and constrn; 1912, on elec. ry. location as transitman; 1913, on Welland Canal maintenance as dftsman and transitman; 1914-16, degning dftsman., Welland canal; 1916 to date, senior dftsman and asst. office engr., dsgn. of constrn. plant., Hydro Elec. Power Comm., Niagara Falls.

References: J. L. Weller, F. E. Sterns, A. C. D. Blanchard, J. B. Goodwin, H. L. Bucke, W. H. Sullivan, W. P. Near, N. R. Gibson.

JOHNSON—BRUCE ALEXANDER, of Winnipeg, Man. Born at Melita, Man., Sept. 15th, 1891. Educ., B.C.E., Man. Univ., 1915. 1911 (5 mos.) with N.T.R.; 1912-13, dftsman, C.N.R., bridge dept.; 1914 (5 mos.) rodman, hydrographic survey; 1915 (6 mos.) asst. engr. bridge dept., C.N.R.; 3 mos. ,engr. on Manitoba highways; Jan. 1916 on active service, and at present under medical treatment.

Referenees: W. Walkden, A. W. Smith, T. W. White, E. E. Brydone-Jack, G. L. Guy.

KIRKPATRICK—ALEXANDER M., of Ottawa, Ont. Born at Chatham, Ont., April 18th, 1889. Educ., B.Sc., (C.E.) Queen's Univ., 1911. 1908 (6 mos.) rodman, T.C. Ry.; 1910 (6 mos.) recorder, hydrometric survey, Ottawa River storage; 1911-12, asst. engr., Internat. Comm., River St. John; 1912 (6 mos.) asst. engr., P.W.D.; 1912 (3 mos.) chg. of survey at Carlton Point for P.E.I. Car Ferry Terminals; 1912-14, in chg. of hydrometric survey party, Ottawa River regulation; 1914-15, in chg. of survey for location of storage and dam sites, N. Sask. River; 1915 to date, asst. engr., P.W.D., Ottawa, in chg. of hydrometric survey party, etc., with exception of 8 mos., in R.A.F. 1918.

References: C. R. Coutlee, S. J. Chapleau, A. Gray, S. B. Johnson, L. A. Des-Rosiers, R. F. Davy.

MARIEN—E. RAYMOND, of Quebec, P.Q. Born at Montreal, Feb. 17th, 1893. Educ., B.A., 1912, B.A.Sc. (C.E.) 1916, L.Ph., 1916, Laval Univ. 1912, on surveys with Jos. Rielle; 1913, highway eng., Montreal-Quebec highway; 1914-15, eng. and inspecting on plants in Quebec; 1916 (3 mos.) ch. asst. to ch. testing engr., Imperial Ministry of Munitions, at McGill Univ., and Oct. 1916-19, in chg. of testing; Jan. 1919 to date, comm'r of industries, Quebec, to look after expansion and trade development, etc.

References: F. C. Laberge, J. A. Smith, G. R. Kendall, C. J. Chaplin, A. Fraser, A. Lariviere, A. B. Normandin.

MAWHINNEY—WILLIAM GEORGE, of Selkirk, Man. Born at Holland, Man., June 26th, 1892. Educ., B.C.E., Manitoba Univ., 1915. Summer 1910, on C.P.R. location; 1911, with G.T.P. Ry., on maintenance; 1912, Midland Ry. of Man., on maintenance; 1913, Dom. Govt., on N. Sask. river survey; 1916 overseas, returned March 1919, and at present is municipal engr., in chg. of road and bridge constrn., rural municipality of St. Clements, Selkirk, Man.

References: E. E. Brydone-Jack, M. A. Lyons, A. McGillivray, J. A. H. O'Reilly, G. H. Herriot, E. P. Fetherstonhaugh, R. W. Moffatt.

McPHERSON—DAVID EWEN, of Winnipeg, Man. Born at Winnipeg, Sept. 1891. Educ., B.C.E., Man. Univ., 1916. 1909 (4 mos.) with C.N.R.; 1910 (5 mos.), rodman, etc., I.J.C.; 1913 (2 mos.) rodman on topog. survey, Lake of the Woods; 1911 (6 mos.) and 1912 (6 mos.) with C.P.R.; 1913 (3 mos.) leveller and instr'man. on constrn., McColl Bors., Winnipeg; 1913 (3 mos.) levelling for topog.; 1914 (4 mos.) res. engr., E.D. & B.C.; 1915 (4 mos.) res. engr., Man. Govt.; 1916 (2 mos.) transitman, with C.N.R.; 1916-18, office or asst. engr., Winnipeg Aqueduct Constrn. Co., and at present dfting with C.N. Ry., Winnipeg.

References: E. E. Brydone-Jack, W. Smaill, G. F. Richan, J. A. H. O'Reilly, A. W. Smith.

RATZ—JOHN EARL, of Ottawa, Ont. Born at Elmira, Ont., Feb. 14th, 1892. Educ., B.A.Sc., Toronto Univ., 1912, D.L.S., passes 14 subjects for D.T.S. certificate, 1910, asst. in chg. of precise level party; 1911, asst. in chg. of triangulation party; 1912-13, ch. of party on precise levels; 1914-17, asst. in chg. of adjustments, primary triangulations, Ontario; 1917-19, sapper and lieut., Can. Engrs., and at present, geodetic engr., and geodetist, Geodet. survey.

References: N. J. Ogilvie, J. J. McArthur, J. D. Craig, M. F. Cochrane, F. B. Reid, H. F. J. Lambart.

REIDMAN—WILLIAM BRIGHTHELM, of Toronto, Ont. Born at Toronto, July 30th, 1892. Eeuc., B.A.Sc., Toronto Univ., 1915. Lieut. certificate in Mil. Eng. 1914. 1912 (2 mos.) with Toronto Harbor Comm.; 1912 (3 mos.) asst. res. engr., Sea Wall Exhibition Park, Toronto; 1913 (4 mos.) asst. (transit and level) in surveying dept., Can. Copper Co., Copper Cliff, Ont.; 1914 (3 mos.) transitman and dftsman., with E. W. Robinson, D.L.S., The Pas, Man.; Dec. 1914-Oct. 1916, sgt., Can. Engrs.; 1915, on service at the front in chg. of engr. working parties; wounded Nov. 1915, invalided to Canada; comm'd as lieut. in Can. Engrs., Oct. Oct. 1917, appointed camp engr. Exhibition Camp, installing, maintaining, heating, etc.; since Dec. 1918 also in chg. of all engr. work in Toronto armories and other military bldgs., work including structural alterations, wiring, heating systems, etc.

Referenees: T. Loudon, P. Gillespie, A. A. Putnam, F. S. Rutherford, H. N. Gzowski, C. R. Young, N. D. Wilson.

ROSCOE—HAROLD MORTON, of Anyox, B.C. Born at Centreville, N.S., Dec. 3rd, 1894. Educ., B.Sc. (honors M.E.) McGill Univ., 1918. 1913 (4 mos.) rodman, Dom. Atlantic Ry.; 1914 (4 mos.), field asst., geological survey; 1915 (4 mos.) instr'man, topog. party, geolog. survey, Elk River; 1916 (5 mos.) transitman on alignment, submarine slopes, Wabana Mine Nfld.; 1916 (3 mos.), in chg. of plane table party, geolog. survey; 1917 (5 mos.) asst. mining engr., Granby Mining Co., Anyox; Apr. 1918-Feb. 1919, lieut., Can. Engrs.; at present, asst. mining engr., Hidden Creek Mine, Granby Consolid. Mining, Smelting & Power Co., Anyox, B.C.

Referenees: F. B. Brown, J. B. Porter, D. W. Burpee, C. Batho.

STEPHENS—WILLIAM E., of London, Ont. Born at London in 1889. Educ., B.Sc., Queen's Univ., 1916. 1912 (6 mos.) rodman on topog. survey, London, Ont.; 1913, (6 mos.) diftsman and instr'man, city engr's dept., London; 1914-15 (18 mos.) instr'man on gen. municipal work, including sewers and pavements, London; 1916-19, res. eng., in chg. of constrn., of sewers and sewage disposal plant, Chipman & Power, Toronto, at present, asst. in office.

References: E. A. Stone, H. A. Brazier, W. Chipman, W. S. Harvey, G. H. Power.

ENGINEERING INDEX

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MECHANICAL ENGINEERING

AIR MACHINERY

Compressors. Up-to-date Practice in Compressor Maintenance. Elec. Ry. Jl., vol. 53, no. 12, Mar. 22, 1919, pp. 569-572, 4 figs. Methods of inspection and overhauling. Details of compressor overhauling and testing bench.

Fans. Centrifugal Fans and Their Application to Gas Engineering Practice, Frank S. Townsend. Gas Jl., vol. 145, no. 2906, Jan. 21, 1919, pp. 116-118 and discussion pp. 118-119, 15 figs. Elementary theory of fan; description of two types of centrifugal fan (radial flow and mixed flow); discussion of efficiency of fan, methods of driving and regulation; examples of recent practice in application of fan plants. Paper before Midland Junior Gas Assn.

FORGING

Heavy Forgings. Making and Heat-treating Heavy Forgings, Franklin D. Jones. Machy., vol. 25, no. 7, Mar. 1919, pp. 583-590, 12 figs. General practice of Tacony Ordnance Corporation in production of ingots and forgings for 155 and 240-mm. guns.

Turned Forgings. Making Accurate Turned Forgings. Iron Trade Rev., vol. 64, no. 13, Mar. 27, 1919, pp. 815-818, 8 figs. Details of manufacturing operations at plant of company specializing on finished marine and machine forgings.

FURNACES

Davis "Revergen" Principle of Firing. The Davis "Revergen" Principle of Firing Furnaces with Town Gas. Metal Industry, vol. 14, no. 9, Feb. 28, 1919, pp. 169-171, 2 figs. Demonstrations made of system in annealing steel billets at 870 deg. cent.; billet heating up to 1000 deg. cent and high-temperature test. Also in Gas Jl., vol. 145, no. 2911, Feb. 25, 1919, pp. 385-387, 2 figs.

Industrial Furnaces. Industrial Furnaces (Fours industrials), A. Bigot. Chimie & Industrie, vol. 2, no. 1, Jan. 1, 1919, pp. 30-36, 8 figs. Classification of various types; their uses and equipment.

Oven and Muffle Furnaces. Industrial Oven and Muffle Furnaces and Their Method of Operation, C. M. Walter. Metal Industry, vol. 14, no. 10, Mar. 7, 1919, pp. 183-185. On theoretical maximum temperatures of combustion of different fuel to be obtained in economical operation of furnaces.

FOUNDRIES

Brass Foundry. Materials and Chemicals Used in Brass Foundry Practice — IV, Charles Vickers. Brass World, vol. 15, no. 3, Mar. 1919, pp. 69-71, 2 figs. History, properties, appearance, physiological action and commercial use of the substances commonly used in brass founding.

Some Principles Involved in Melting Metals — IV, Charles Vickers. Brass World, vol. 15, no. 3, Mar. 1919, pp. 73-75. Effect of heat upon metals; action of zinc and copper; casting of yellow brass.

British. British Foundries Undergo Change, H. Cole Estep. Iron Trade Rev., vol. 64, no. 13, Mar. 27, 1919, pp. 819-823, 2 figs. Survey of conditions in Great Britain, with reference to recent improvements in shop methods.

Malleable Foundry. Uses Electric Furnace in Malleable Foundry, F. L. Prentiss. Iron Age, vol. 103, no. 9, Feb. 27, 1919, pp. 537-543, 8 figs. Features of Cleveland plant of Nat. Malleable Castings Co., designed for making castings by Kranz triplex process.

Nickel Alloy Castings. Casting Nickel Silver — a Copper-Nickel-Zinc Alloy, R. V. Hutchinson. Metal Industry, vol. 14, no. 9, Feb. 28th 1919, pp. 161-162 1 fig. Method of packing a crucible with nickel silver.

Patternmaking. Patternmaking Methods, Joseph A. Shelly. Machy., vol. 25, no. 7, Mar. 1919, pp. 631-634, 9 figs. Typical examples of pattern work and methods used in general practice. First article.

Pouring Metal. Foundry Puzzles and Their Solution, J. G. Horner. English Mechanic, vol. 109, 2816, Mar. 14, 1919, pp. 85-86. Remarks on static load and dynamic action at time of pouring due to inrush of molten metal.

Sand. Ferruginous and Other Bonds in Molding Sands, P. G. H. Boswell. Brass World, vol. 15, no. 3, Mar. 1919, pp. 81-84. Foundry practices followed in Great Britain, France, Belgium and Germany. Paper read before Am. Foundrymen's Assn.

The Practical Analysis of Molding Sand, F. Albert Hayes. Iron Age, vol. 103, no. 12, Mar. 20, 1919, pp. 739-741, 2 figs. Selection according to physical qualities and the nature of the work is advocated; sieve tests.

FUELS AND FIRING

Absorption of Gases by Coal. Absorption of Gases by Coal, S. H. Katz. Queensland Govt. Min. Jl., vol. 20, Feb. 15, 1919, pp. 60-62. Experimental research with air and with an atmosphere of nitrogen.

Blending. The "Sandwich" System of Fuel Blending, E. W. L. Nicol. Gas Jl., vol. 145, no. 2906, Jan. 21, 1919, pp. 113-115, 3 figs. Apparatus which premits the mixing of various qualities of solid fuel as they are fed to burners. Also in Natl. Engr., vol. 23, no. 4, Apr. 1919, pp. 161-164, 2 figs.

Chart for Comparing Values of Different Sizes of Coal. Chart for Finding True Value of One Size of Coal. Black Diamond, vol. 62, no. 12, Mar. 22, 1919, pp. 318, 1 fig. Gives value of one size in terms of values of other sizes.

Coal Analysis. Natural Solid Fuels (Contribution à l'étude des combustibles naturels solides), Roger Hartman. Société Industrielle de l'Est, bul. 144, Jan. 1919, pp. 7-18, 3 figs. Method of analyzing a sample of coal and calculating into its calorific value. Based on notes publisbed by The Association Alsacienne des Propriétaires d'Appareils à vapeur.

Coal Problem. Coal and Other Fuels and Substitutes, Alexander Ross. Ry. Gaz., vol. 30, no. 6, Feb. 7, 1919, pp. 202-205. Address before Retired Ry. Officers' Soc.

The Coal Problem, E. G. Bailey. Universal Engr., vol. 29, no. 1, Jan. 1919, pp. 35-49, 10 figs. Abnormal conditions in production and demand brought about by war conditions; question of future of coal industry. Second article.

The Coal Commission. Ry. Gaz , vol. 30, no. 11, Mar. 14, 1919, pp. 487-488. Facts about coal transport saving ,pooling private owners' cars, American coal competition, etc.

The Coal Commission, Iron & Coal Trades Rev., vol. 98, no. 2663, Mar. 14 1919, pp. 313-319. Laboratory tests. (Continuation of serial).

Fuel Conservation. Worcester's Fuel-Saving Campaign — III, S. E. Balcome. Power Plant Eng., vol. 23, no. 7, Apr. 1, 1919, pp. M 315-316. Personal and work of factory committees.

Fuel Conservation in Louisiana, Leo S. Weil. Proc. La Eng. Soc., vol. 4, no. 6, Dec. 1918, pp. 206-223 and (discussion) pp. 224-228. Account of work done and of plans by which it is hoped to secure increased results in future.

Lignites. Combustion of Lignites and High-Moisture Fuels, T. A. Marsh. Power, vol. 49, no. 14, Apr. 8, 1919, pp. 525-527, 5 figs. Types of stoker adaptable to burning lignites containing up to 35 per cent moisture. Predrying is considered impractical. Also in Elec. World, vol. 73, no. 6, Feb. 8, 1919, pp. 265-267, 5 figs.

Notes on Lignite, Its Characteristics and Utilization, S. M. Darling. Universal Engr., vol. 29, no. 1, Jan. 1919, pp. 27-34. Concerns particularly the utilization and storage of lignite.

Peat. Peat, Lignite and Powdered Coal F. Parkman Coffin. Steam, vol. 23, no. 3, Mar. 1919, pp. 71-78. Uses of peat in Europe as fuel; firing boilers with lignite; advantages in carbonizing lignite.

The Utilization of Peat and Its By-Products, L. H. Bacque. Power House, vol. 12, no. 3, Mar. 1919, pp. 62-65, 3 figs. Origin of peat, its properties ,the extent of Canada's deposits, and methods which have been devised for its manufacture.

Powdered Fuel. Powdered Fuel for Hammersmith. Elec. Times, vol. 55, no. 1430, Mar. 13, 1919, pp. 168-169, 2 figs. Layout of Holbeck system of powdered fuel for firing boilers.

Pulverized Coal Burners Versus Stokers, Joseph T. Foster. Elec. World, vol. 73, no. 10, Mar. 8, 1919, pp. 474-475, 1 fig. Comparative freight charges on low and high-grade fuel. Chart showing maximum amount that can be paid for pulverized coal to make it comparable with a given stoker coal..

Success in Combustion of Powdered Coal, W. G. Wilcox. Black Diamond vol. 62, no. 12, Mar. 22, 1919, pp. 328-329. Velocity of combustion; importance of mixing with air.

Smokeless Combustion. Combustion and Smokeless Furnaces, Jos. W. Hays. Steam, vol. 23, no. 2, Feb. 1919, pp. 42-46. Points out what are termed, undesirable features of the various types of smokeless furnace.

Storage. Storage of Fuel and Spontaneous Combustion, S. H. Pudney. Official Proc. Can. Ry. Club, vol. 17, no. 2, Feb. 1919, pp. 15-21 and (discussion) 22-23. Losses due to storage and causes for spontaneous combustion, verified by author's experience. Also in Contract Rec., vol. 33, no. 13, Mar. 26, 1919, pp. 291-293.

Spontaneous Combustion of Bituminous Coal in Storage (La conservation en tas des charbons bitumineux et les dangers de leur combustion spontanée), Ch. Vallet. Industrie Electrique, vol. 28, no. 640, Feb. 25, 1919, pp. 73-76. Experiments, observations and recommendation. From paper before Inst. Mar. Engrs.

Deterioration in Value During Storage, H. C. Porter and F. K. Ovitz. Black Diamond, vol. 62, no. 12, Mar. 22, 1919, pp. 322-324, 10 figs. Summary of tests to determine heat-value losses from various forms of storage.

Wood. The Use of Wood for Fuel. U. S. Dept. of Agriculture, Bul. 753, Mar. 10, 1919, 40 pp., 2 figs. Suggestions as to proper use of wood resources to prevent recurrence of fuel shortage such as occurred during winter of 1917-1918.

This index is being paged separately in order that members may bind it separately if they so desire.

GAGES

Checking. Checking Gages, Herman L. Wittstein. Factory, vol. 22, no. 3, March 1919, pp. 456-457, 3 figs. Forms for keeping gage inspection.

Gage Systems. A Practical Rings, Plug, and Snap Gauge System. Machinery, vol. 13, no. 328, Jan. 9, 1919, pp. 400-401, 10 figs. System designed to meet requirements in interchangeable manufacture.

Profile Gages. Contour of Profile Gauges. Machinery, vol. 13, no. 337, Mar. 13, 1919, pp. 649-655, 31 figs. Principles involved and procedure followed in developing gaging systems for interchangable manufacture, based upon experience of Pratt & Whitney Co. Third article.

Thread-Measuring Wires. The Manufacture of Standard Thread Measuring Wires, Fred. R. Daniels. Machy., vol. 25, no. 7, Mar. 1919, pp. 606-607, 4 figs. Table of values used for determining error in thread angle by the three-wire system.

HANDLING OF MATERIALS

Ash Handling. Raw Material and Ash Handling Equipment, Robert June. Brick & Clay Rec., vol. 54, no. 6, Mar. 25, 1919, pp. 507-509, 3 figs. Principles of power-plant requirements. Ninth article.

Foundry Trucking. Foundry Built around a Shop Truck. Iron Age, vol. 103, no. 10, Mar. 6, 1919. pp. 603-606, 10 figs. Material-handling system at new plant of Peerless Foundry, Cincinnati.

Materials. Handling Materials, F. T. Buell and Edward R. Cole. Factory, vol. 22, no. 3, March 1919, pp. 470-471, 8 figs. Seven plans as used in two plants.

Shell Shops. Handling Devices in British Shell Shops. Eng. & Indus. Management, vol. 1, no. 5, Mar. 13, 1919, pp. 157-161, 20 figs. Handling appliances for conveying objects while suspended from above. Continuation of serial.

HEAT-TREATING

Engine Parts. Heat Treatment of Steel for Small Petrol Marine Engines. Engineer, vol. 127, no. 3294, Feb. 14, 1919, pp. 159-160, 1 fig. On the building of light " chasers " in America.

Gun Forgings. Electric Heat Treatment of Gun Forgings, C. E. Wright Iron Age, vol. 103, no. 11, March 13, 1919, pp. 673-678, 12 figs. Installation at naval gun plant of Tioga Steel & Iron Co., Philadelphia. It is intended to use this plant for commercial use.

Heating Furnaces. Practical Pointers on Heating Furnaces, George J. Hagan Am. Drop Forger, vol. 5, no. 3, Mar. 1919, pp. 142-144. Deals with heating furnaces in general for treatment of both light and heavy stock. Before Engrs. Soc. Western Pa.

Annealing and Heating Furnaces Fired by Town Gas. Engineering, vol. 107, no. 2774, Feb. 28, 1919, pp. 272-276, 8 figs. Leading feature is incorporation of regenerators for heating the air supply before it enters the furnace by means of waste gases from the furnace. Development by Technical Section of the Davis Furnace Co.

Steel. Heat Treatment of Steels (Le traitement thermique des aciers). Métallurgie, vol. 51, no. 12, Mar. 19, 1919, pp. 646-647. Its influence on the quality of products.

HEATING AND VENTILATION

Air Sampling. The Effect of Sunlight on Air, William J. Maurer. Heat. & Vent. Mag., vol. 16, no. 3, Mar. 1919, pp. 27-32, 7 figs. Report on laboratory tests to determine proper technique in handling air samples.

Central-Station — Combination Heating Plants. Advantage of the Combination Central Station Heating Plant, John C. White. Heat & Vent. Mag., vol. 16, no. 3, Mar. 1919, pp. 33-37. Recommendations put forth by Bureau of Mines for combining central-station heating systems with steam-power plants.

Equivalent Temperatures, Steam-Hot Water. Equivalent Temperature of Guaranteed Steam and Hot Water Heat, Henry N. Dix. Am. Architect, vol. 115, no. 2254, Mar. 5, 1919, pp. 358-360, 6 figs. Formula and charts.

Factory Heating. Factory Heating, Alfred G. King. Domestic Eng., vol. 86, no. 11, Mar. 1919, pp. 466-468, 5 figs. Hot-water heating with forced circulation.

Foundry Ventilation. Foundry Ventilation. Iron Age, vol. 103, no. 10, Mar. 6, 1919, p. 610, 3 figs. Effect of roof design and heating systems on air circulation.

Hot-Water Central Heating Plant. Designing Data as Applied to a Large Hot Water Heating Plant, George E. Reed. Heat. & Vent. Mag., vol. 16, no. 3, Mar. 1919, pp. 17-26, 11 figs. Plant for high school of five buildings. " Unit " system followed in design and construction.

Industrial Buildings. The Mechanical Equipment of Industrial Buildings — II. Charles L. Hubbard. Power, vol. 49, no. 10. March 11, 1919, pp. 362-365. Remarks on selections of type of prime mover, systems of power distribution and methods of heating and ventilating.

Laws. Proposed Michigan Law on Furnace Heating. Metal Worker, no. 2360, Mar. 21, 1919, pp. 372-374. Bill to regulate and control the installation o fwarm-air heating plants.

Temperatures, Indoor and Outdoor. Tests for Heating Plants in Mild Weather, Henry N. Dix. Metal Worker, no. 2360, Mar. 21, 1919, pp. 365-367, 7 figs. Charts of temperature indoors with varying outdoor temperatures.

Vacuum Heating. Care of Heating and Ventilating Equipment—VIII, Harold L. Alt. Power, vol. 49, no. 9. March 4, 1919, pp. 306-308, 11 figs. Vacuum-heating systems.

HOISTING AND CONVEYING

Bucket Hoist. Bucket Carrier System (Benne preneuse continue, pour la manutention des matières pondéruses). Génie Civil, vol. 74, no. 9, Mar. 1, 1919, pp. 174-175, 3 figs. Chain belt with buckets moves continuously over material to be handled; buckets discharge on iron channel where material descends by gravity.

Cable Breakage. Breaking of Cable in Protection Shaft, Robert Dunn. Coal Age, vol. 15, no. 11, March 13, 1919, pp. 489-491, 2 figs. Tests said to indicate that breaking of rope was due to inadequate lubrication, particularly in hemp center.

Grab Bucket, Self-Discharging. Barnard's Self-Discharging Grab. Engineering, vol. 107, no. 2772, Feb. 14, 1919, pp. 200-202, 11 figs. Improvements made in design since last description published in issue of April 17, 1914, p. 524.

HYDRAULIC MACHINERY

Flow of Water. The Flow of Water in Large Pipes and Tunnels. Frederick J. Mallett and Alfred A. Barnes. Engineering, vol. 107, no. 2774, Feb. 28, 1919, pp. 288-291, 14 figs. Traces out inconsistencies met with in many of the older formulæ, and sets out the features that in practice determine the ultimate capacity of water mains. Abstracts of two papers read before Instn. Civil Engrs.

Hydroelectric Plants. Data of Hydro-Electric Plants (Sur les données actuelles en matières de construction d'usines hydro-électriques), Denis Eydoux, Annales, Ponts et Chaussées, vol. 5, no. 46, Sept. Oct., 1918, pp. 125-196, 35 figs. Installations where head exceeds 40 meters, (Concluded.)

Pelton Wheels. A Pelton Wheel Driven Centrifuge, F. J. Broadbent. Engineering, vol. 107, no. 2771, Feb. 7, 1919, pp. 161-164, 10 figs. Design based on theory outlined in article entitled Static Torque Experiments on a Pelton Wheel, Eng Sept. 11, 1914.

Tidal Power. " Blue Coal." Sci. Am. Supp., vol. 87, no. 2253, Mar. 8, 1918, pp. 156-157 and 160, 9 figs. Efforts that have been made to utilize energy of waves and tides. From Larousse Mensuel, Paris.

Wave Propagation. Determination of the Velocity of Propagation of Waves in Forced Conduits (Détermination de la vitesse de propagation des ondes dans les conduites forcées), C. Camichel. Technique Moderne, vol. 10, no. 12, Dec. 1918, pp. 537-544, 20 figs. Explains by means of de Sparre formulæ anomalies which have been pointed out by engineers in experimental determination of velocity of propagation of waves; writer believes that the apparent variations of this velocity are explicable and disappear altogether if a correct experimental method is followed.

INTERNAL-COMBUSTION ENGINES

Carburation. The Carburation Temperature of Oil Mixtures, C. A. Norman. Automotive Industries, vol. 40, no. 9, Feb. 27, 1919, pp. 490-491, 1 fig. Method of determining temperature necessary to keep in a permanent state of vaporization any oil fraction contained in a carburized mixture.

Diesel-Engine Injection. Solid-Injection Versus Air-Injection. Motorship, vol. 4, Apr. 1919, pp. 35-37, 6 figs. Technical aspect of subject in its bearing on future design and construction of high-compression marine oil engines for merchant and naval ships. Second installment.

Diesel Engines. McIntosh & Seymour Marine Diesel Engine. Power, vol. 49, no. 14, Apr. 8, 1919, pp. 528-531, 4 figs. Description of a four-stroke-cycle directly reversible engine.

High-Speed Engines. Factors in High-Speed Engine Development — I D. McCall White. Automotive Industries, vol. 40, nos. 12 and 13, Mar. 20 and 27, 1919, pp. 622-627 and 667 and 698-701, 17 figs. Roles played by forced lubrication, high mean effective pressure, valve areas, inertia, valve timing, materials, and piston material and design. Mar. 27: Application of high-speed engines to war uses; construction of Cadillac crankcase, illustrating the method of webbing up for maximum rigidity. (Continued).

New Engine for Trucks and Tractors. Motor Age, vol. 35, no. 12, Mar. 20, 1919, pp. 42-43, 2 figs. Carbureter may be mounted on either side. Main feature of design is accessibility. Golden-Belknap-Schwartz model. Also in Automotive Industries, vol. 40, no. 12, Mar. 20, 1919, pp. 645-647, 6 figs.

Hot-Bulb Engines. The British Two-stroke Motor. Engineer, vol. 127, no. 3295, Feb. 21, 1919, pp. 182-183, 3 figs. Gear of directly reversing hot-bulb engine.

Radial Engines. The Enfield-Allday Five-cylinder Radial Engine. Autocar, vol. 42, no. 1221, Mar. 15, 1919, p. 357, 1 fig. Engine in which air cooling is effected by means of aluminum fins and forced draft.

Truck and Tractor Engines. Three Hinkley Engines Built Around Class " B " Design. Automotive Industries, vol. 40, no. 11, Mar. 13, 1919, pp. 587-589, 6 figs. Models for 4 to 6-ton 1½ to 2½-ton trucks and tractors drawing 1 to 4 plows.

Valves. Small Inlet Valves Satisfactory in Overhead Valve Design — II, L. H. Pomeroy. Automotive Industries, vol. 40, no. 9, Feb. 27, 1919, pp. 471-475, 5 figs. Tests made with two engines of same size, one having a valve-in-head design and the other on L-head with valves side by side in valve pocket. Tests are said to have proven that specific fuel consumption is largely independent of r.p.m. and torque for 50 to 60 per cent of maximum hp. Paper before Instn. Automobile Engrs.

Characteristics of a High-Grade Standardized Engine, J. H. W. Kerston. Automotive Industries, vol. 40, no 10, Mar. 6, 1919, pp. 527 and 549. Effect of increasing valve size on efficiency and smoothness of run.

LUBRICATION

Air Compressors. Correct Lubrication of Air Compressors, H. V. Conrad. Iron Age, vol. 103, no. 12, Mar. 20, 1919, pp. 753-754, 1 fig. Cylinder temperatures and physical tests of oils given as guide for selecting lubricant. Paper prepared for Compressed Air Soc. Also in Eng. & Min. Jl., vol. 107, no. 9, Mar. 1, 1919, pp. 392-394, 1 fig.

Colloidal Phenomena. A Problem in Lubrication, W. B Hardy. Jl. Soc. Chem. Indus., vol. 38, no. 2, Jan. 31, 1919, p. 7T. Colloidal phenomena in lubrication.

Lubricants. Lubrication and Lubricants, G. R. Rowland. Jl. Am. Soc. Naval Engrs., vol. 31, no. 1, Feb. 1919, pp. 97-138, 7 figs. Definition, classification, testing, refining and selection.

MACHINE ELEMENTS AND DESIGN

Bearings. On Proportioning Engine Bearings, Otto M. Burkhardt. Automotive Industries, vol. 40, no. 12, Mar. 20, 1919, pp. 651-655, 10 figs. Analysis of crank-bearing loads in a 4-cylinder, 3-bearing truck engine under different conditions of operation.

Cams. Cam Design and Construction, Franklin de R. Furman. Am. Mach., vol. 50, no. 13, Mar. 27, 1919, pp. 581-586, 13 figs. Introduction; types of cams described. First article.

Gears. Toothed Gearing, Joseph Chilton. Times Eng. Supp., vol. 15, no. 532, Feb. 1919, p. 92. Manufacture and design of spur. helical. bevel, and worm gearing for transmitting motion between shafts the axes of which are either parallel or at right angles to each other. Paper before North-East Coast Instn. Engrs. & Shipbuilders.

Pistons. Pistons and Their Treatment. Motor Traction, vol. 28, no. 733, Mar. 19, 1919, pp. 246-248, 10 figs. Suggestions in regard to detaching the piston; testing the relative truth-of pistons with connecting rods.

Springs. Minimum Number of Combined Springs (Sur le nombre minimum de spiraux associés), Jules Andrade. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 3, Jan. 20, 1919, pp. 139-141. On regulation of pendulums and balance wheels for exact chronometric work.

MACHINE SHOP

Broaches. Determining the Number of Broaches to Use. Machinery, vol. 13, no. 335, Feb. 27, 1919, p. 599, 1 fig. Chart.

Crankshaft Repairs. Recent Crankshaft Repairs. Iron Age, vol. 103, no. 13, Mar. 27, 1919, pp. 812-813, 3 figs. Six-throw crankshaft made from steel billets by thermit process.

Electric Drive. Electric Drive for Punching, Shaping and Slotting Machines, C. E. Clewell. Am. Mach., vol. 50, no. 10, Mar. 6, 1919, pp. 439-444, 12 figs. Discussion on basis of machines in which duty cycle throughout given operations consists of two directions of motion.

Motor Drive as Viewed by Machine Builders and Motor Manufacturers, C. E. Clewell, Am. Mach., vol. 50, no. 11, March 13, 1919, pp. 475-478, 7 figs. Result of canvassing opinions of various machine-tool builders and electric-motor manufacturers.

Machine Tool Drives; Motors and Controllers, H. W. Tice. English Mechanic, vol. 109, no. 2816, Mar. 14, 1919, pp. 88-89, 2 figs. Service records of motors and machine tools controlled in Lehigh plant of Bethlehem Steel Co. (To be continued).

Foundations. Foundations for Various Types of Planers, Terrell Croft. Can. Machy., vol. 21, no. 2, Jan. 9, 1919, pp. 29-34, 16 figs. Suggests use of leveling blocks and recommends concrete as best material.

Grinding and Sizing. Grinding and Sizing Diagrams, Alfred T. Fry. Min. & Sci. Press, vol. 118, no. 10, March 8, 1919, pp. 324-327, 5 figs. Suggests method of drawing curve to compare and use results obtained while making tests of grinding efficiency of a given machine under varied conditions.

Cylinder Grinding, Frinaklin D. Jones. Machy., vol. 25, no. 7, Mar. 1919, pp. 615-621, 12 figs. Discussion of advantages of finishing cylinder bores by grinding; machines and auxiliary equipment used; practice in different plants manufacturing engines for automobiles and airplanes. First article.

Roller Bearings. Roller Bearings for Machine Shop Equipment — III. Machinery. vol. 13, no. 335, Feb. 27, 1919, pp. 604-607, 6 figs. Combination radial and thrust roller bearings; roller bearings with staggered rollers; lubrication.

Splitting Piston Rings. Splitting Piston Rings, Jacob Young, Machy., vol. 25, no. 7, Mar. 1919, pp. 590-591, 1 fig. Chart for determining length of section to be cut from piston ring.

Swivel Machining. Machining Front Axle Swivels, A. Thomas. Automobile Engrs., vol. 9, no. 124, Mar. 1919, pp. 72-74, 10 figs. Manufacturing operations on swivels made from nickel-steel drop-forgings.

Templets. Templets, Jigs and Fixtures, Joseph Horner. Engineering, vol. 107, no. 2772, Feb. 14, 1919, pp. 197-199, 13 figs. Describes various types. Twentieth article.

Test-Piece Manufacture. The Rapid Production of Test Pieces. Can. Machy. vol. 21, no. 9, Feb. 27, 1919, pp. 206-207, 9 figs. Making test pieces from shell.

Workshop Practice. Modern Workshop Practice — VI, W. Wilson. Commonwealth Engr., vol. 6, no. 6, Jan. 1, 1919, pp. 173-180, 15 figs. Science of quick repetition. Deals with modifications in lathes through omission of parts not required for the particular work to be done.

MACHINERY, METAL WORKING

Arresting Motion for Presses. Automatic Arresting Motion for Power Presses. Engineer, vol. 127, no. 3293, Feb. 7, 1919, p. 135, 2 figs. Mechanism can be applied to type of machine in which a flywheel revolves freely on its shaft until a positive connection is established between the two parts by a convenient device.

Die-Sinking Tools. A discussion on Die Room Conditions, F. J. Rau. Am. Drop Forger, vol. 5, no. 3, Mar. 1919, pp. 126-128, 4 figs. Sketches of diesinking tools.

Gear-Tooth Rounding Machine. Walker Automatic Gear Tooth Rounding Machine. Automotive Industries, vol. 40, no. 12, Mar. 20, 1919, pp. 648-650, 5 figs. Design to round meshing edges or to remove burrs left by cutters or hobs.

Lathe. Engine Lathes for Precision Work. Iron Trade Rev., vol. 64, no. 10, Mar. 6, 1919, pp. 633-637, 8 figs. How various lathe parts in the process of making are routed through the grinding, planing, milling, turning and assembling departments of a machine-tool plant in Cincinnati.

Niles Heavy Driving Wheel Lathe at Crewe Works, London & North Western Railway, Ry. Gaz., vol. 30, no. 7, Feb. 14, 1919, pp. 252-253, 2 figs. Turning tires of express passenger locomotives.

Milling and Gear cutting on Lathes. Making Milling and Gear Cutting Attachment — I. Robert Mawson. Can. Machy., vol. 21, no. 3, Jan. 16, 1919, pp. 51-53 and 63, 11 figs. Attachment for lathes which performs milling and gear-cutting operations. Various tools and operations used are shown.

Square Bar for Internal Planing. Square Bar for Internal Planing, W. G. D. Machinery, vol. 13, no. 335, Feb. 27, 1919, pp. 600-601, 2 figs. Formulæ and calculations.

Thread-Milling Cutter. The Cycloid Thread-Milling Cutter. Engineer, vol. 127, no. 3294, Feb. 14, 1919, p. 159, 1 fig. Design to overcome "waves" and "flats" on work.

MACHINERY, WOODWORKING

Woodworking Machines. Apparatus for Woodworking and Their Recent Improvements (Les machines-outils pour le travail du bois et leurs récents perfectionnements), E. Gay. Technique Moderne, vol. 10, no. 12, Dec. 1918, pp. 554-563, 29 figs. French types of machines for finishing patterns. (Concluded).

MACHINERY, SPECIAL

Clock Escapements. Clock Escapements. Engineering, vol. 107, no. 2775, Mar. 7, 1919, pp. 297-298, 2 figs. History of development of present combination. Paper before Roy. Instn.

Drill Sharpener. Drill Sharpener Speeds Up Shipbuilding, Letson Ballict. Mine & Quarry, vol. 11, no. 2, Mar. 1919, pp. 1130-1133, 14 figs. Marking of drift bolts, rivets, grab-iron ends, ball stanchions, etc.

Hammer Drills. Hammer Drills — Their History, Design and Operation, Henry S. Potter. Jl. South African Instn. Engrs., vol. 17, no. 6, Jan. 1919, pp. 86-98, 5 figs. Materials of construction; pistons and valves; general features of modern jack hammers; limitations in use of hammer drills for stoping. Second and concluding installment.

Lapping Machine. A Machine for Lapping Precision Gage Blocks. Am. Mach., vol. 50, no. 13, Mar. 27, 1919, p. 613, 1 fig. Design for producing gage block, of any contour, but having two opposite sides flat and parallel and a definite distance apart.

Routing Machine. Routing Machine of Special Design, Am. Mach., vol. 50, no. 11, Mar. 13, 1919, pp. 491-493, 5 figs. Machine uses tool which is rapidly rotated through several turns in one direction, then reversed and rotated as rapidly and for an equal number of turns in the opposite direction, this cycle of movement being continued so long as may be necessary to complete the operation.

Worm-Wheel Generator. G. & E. 18-In. Worm Wheel Generator. Automotive Industries, vol. 40, no. 14, Apr. 3, 1919, pp. 746-747, 3 figs. Machine designed for producing worms and worm wheels for trucks, tractors, etc., and adapted for production and experimental work.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

Aluminum. Aluminum: Its Use in the Motor Industry in England, E. Carey Hill. Metal Indus., vol. 17, no. 3, March 1919, pp. 125-127, 2 figs. Application of aluminum in replacing steel and other metals. Second and last article.

Alternating Stresses, Steel. Premature Rupture of Steel Pieces Subjected to Repeated Stresses (Cause de la rupture prématurée des pièces d'acier soumises à des efforts répétés). Ch. Fremont, Génie Civil, vol. 74, no. 3, Jan. 18, 1919, pp. 47-52, 13 figs. Survey of experiments on formation and extension of fissures. Some deductions in Wöhler's theory are held to be inexact. Also in Comptes rendus des séances de l'Académie de Sciences, vol. 168, no. 1, Jan. 6, 1919, pp. 54-56.

Beams, Reinforced-Concrete. Tests Show High Shears in Deep Reinforced-Concrete Beams, W. A. Slater. Eng. News Rec., vol. 82, no. 9, Feb. 27, 1919, pp. 430-433, 4 figs. Preliminary studies made for Emergency Fleet Corporation's concrete ship work. Higher safety units than those now permitted are advocated.

Bearing Metals. Proper Specifications for Bearing Metals, Alfred A. Greene. Iron Age, vol. 103, no. 14, Apr. 3, 1919, pp. 874-875. Functions of a lining alloy; mixing the component metals; electrically hardened lead.

Brass, Rolled Sheet. Structural Characteristics of Rolled Sheet Brass. Metal Indus., vol. 17, no. 3, March 1919, pp. 121-124, 6 figs. Thermal equilibrium diagrams of various alloys; photomicrographs of cast and annealed brass. (To be continued.)

Brickwork. Tests Determine Strength of Brickwork, W. W. Pearse. Contract Rec., vol. 33, no. 8, Feb. 19, 1919, pp. 151-155, 10 figs. Report of tests carried out at Toronto Univ. in co-operation with City Architect's Dept.

Mortars, Cement-Lime. Compressive Strength of Cement-Lime Mortars, F. A. Kirkpatrick and W. B. Orange. Jl. Am. Ceramic Soc., vol. 2, no. 1, Jan. 1919, pp. 44-46, 9 figs. Determination of factors exerting greatest control over strength of cement-lime mortars. Manner of control expressed by mathematical formula and practical application of results indicated.

PAPER TESTER. The Webb Paper Tester — A New Instrument for Testing Corrugated Fiber Boards, J. D. Malcolmson. Jl. Indus. & Eng. Chem., vol. 11, no. 2, Feb., 1919, pp. 133-138, 6 figs. Comparison with Mullen tester decides writer to prefer Webb machine.

RESISTANCE OF MATERIALS. The Resistance of Materials, G. S. Chiles and R. G. Kelly. Ry. Mech. Engr., vol. 93, no. 3, March 1919, pp. 123-126, 6 figs. Review of data relative to effect of abrupt changes of section under "static" and "dynamic" tests published by various authorities and results of experiments conducted by writers. (To be continued).

MEASUREMENTS AND MEASURING APPARATUS

AIR MEASURING INSTRUMENTS. The Determination of the Efficiency of the Turbo-Alternator, S. F. Barclay and S. P. Smith. Elecn., vol. 82, no. 2128, Feb. 28, 1919, pp. 244-246, 3 figs. Suggestions in regard to measuring air volume and temperature; diagrams plotted from pitot tube readings taken at opening of temporary discharge trunk. Before Instn. Elec. Engrs.

BOILER RECORDING INSTRUMENTS. Fuel Economy in the Boiler House — II, John B. C. Kershaw. Chem. & Metallurgical Eng., vol. 20, no. 5, March 1, 1919, pp. 241-245, 7 figs. Principles involved in operation of Sarco, Uehling, Simmance & Abady, Cambridge Bi-Meter, Auto and Mono recording instruments.

COAL-CONSUMPTION METER. Lea Coal-Consumption Meter (Appareil indicateur-totalisateur de la consommation de charbon, système Lea), P. Letheule. Génie Civil, vol. 74, no. 6, Feb. 8, 1919, pp. 101-105, 18 figs. Registers total consumption by system of levers and pinions operated by motion of stoker and controlled by volume of coal fed into burners. Details of construction and application of apparatus to Stirling and Babcock boilers are given.

FLOW METERS. An Automatic Compensating Flow Meter, G. G. Oberfell. Jl. Indus. & Eng. Chemistry, vol. 11, no. 4, Apr. 1, 1919, pp. 294-296, 1 fig. Instrument intended for accurately controlling gas concentration of gas-air mixtures.

FLUID VELOCITY AND PRESSURE. The Measurement of Fluid Velocity and Pressure, J. R. Pannel. Engineering, vol. 107, nos. 2774 and 2775, Feb. 28 and Mar. 7, 1919, pp. 295-297 and 261-263, 14 figs. Robinson cup anemometer; vane anemometer and other "moving part" instruments. (Continuation of serial). Feb. 28; Pressure tube instruments.

OIL-TANK GAGING. Scientific Gauges, B. C. Rinehart. Petroleum Age, vol. 6, no. 3, March 1919, p. 30, 1 fig. Method of gaging oil tanks.
Standards of Temperature and Means of Checking Pyrometers. Am. Mach., vol. 50, no. 12, Mar. 20, 1919, pp. 541-545, 7 figs. Directions for use of standards; chart showing relation between base-metal thermo-couple and net electromotive force.

PYROMETERS. Checking Pyrometers to Get Results. Am. Drop Forger, vol. 5, no. 3, Mar. 1919, pp. 131-137, 6 figs. Various methods are recommended for different sizes of equipment.

THERMOCOUPLES. Calibration of Base-Metal Thermocouples, G. S. Crouse. Eng. & Min. Jl. vol. 107, no. 10, March 8, 1919, pp. 442-444, 1 fig. Describes three methods of calibrating such couples.

VISCOSIMETERS. Standardization of the Saybolt Universal Viscosimeter, Winslow H. Hershel. Department of Commerce, Tech. Papers Bur. Stand., no. 112, 25 pages, 4 figs. Equation for instruments of standard dimensions.

MECHANICAL PROCESSES

BAKELITE PRODUCTS AND DIES. Making Molded Bakelite Products. Machinery, vol. 13, no. 331, Jan. 30, 1919, pp. 481-485, 9 figs. Designing and making dies with provision for heating with steam.

BOILERS. Areas of Segments of Boiler Heads, Power, vol. 49, no. 11, March 18, 1919, pp. 402-404, 2 figs. Table of areas of segments of boiler heads to be stayed.

CHAINS, CAST-STEEL. Malleable Plant Proves Versatility. Iron Trade Rev., vol. 64, no. 10, Mar. 6, 1919, pp. 623-629, 12 figs. Adaptation to manufacture of cast-steel anchor chains of plant designed and constructed for malleable foundry.

GEARS. The Manufacture and Design of Toothed Gearing, Joseph Chilton. Engineering, vol. 107, no. 2772, Feb. 14, 1919, pp. 202-206, 13 figs. Gearing employed in transmission of motion between shafts whose axes are either parallel or at right angles to each other. (To be contiuned). Read at North-East Coast Instn. Engrs. & Shipbuilders.

PUMPS. Manufacturing Rotary Suds Pumps. Machinery, vol. 13, no. 328, Jan. 9, 1919, pp. 406-408, 11 figs. Pump manufactured by Brooke Tool Co. is presented as example of interchangeable manufacture.

ROLLING MILLS. Universal Mill Rolls Strip Steel, Iron Trade Rev., vol. 64, no. 11, Mar. 13, 1919, pp. 691-695. Roughing unit is of massive construction, each housing weighing 42 tons; spring of mill when rolling high-carbon steel is 0.001 in.
Rolling Concrete Reinforcement from Old Rails, W. S. Standford. Can. Machy., vol. 21, no. 3, Jan. 16, 1919, pp. 59-61 and 65, 5 figs. Design and general layout of roughing and finishing rolls.
Large Rolling Mill Plant. Elec. Rev., vol. 84, no. 2185, Mar. 14, 1919, pp. 283-284, 4 figs. Particulars and illustrations of Siemens 19,000 hp. rolling mill motor. (To be concluded).
The Government Rolling Mill Southampton. Engineer, vol. 127, nos. 3296 and 3297, Feb. 28 and Mar. 7, 1919, pp. 191-193 and 217-219, 4 figs. Mill is being employed in melting of scrap metal and is turning out standard Government brass ingots of guaranteed analysis. Mar. 7: Power plant, and gas-producer equipment; facilities for handling coal, coke and raw materials; foundry and rolling departments.

RUBBER GOODS. Railroad Rubber Goods, G. W. Alden. Official Proc. Car Foremen's Assn., Chicago, vol. 14, no. 5, Feb. 1919, pp. 36-71. Growth and properties of crude rubber; manufacture of wrapped ply hose, belting and packings.

SHEET METAL PRODUCTS. Imagination and Sheet Metal Layout Work, F. Scriber. Can. Machy., vol. 21, no. 9, Feb. 27, 1919, pp. 199-202, 10 figs. Examples of bending sheet metal into shape.
Work of Sheet Metal Man in New Industry, W. B. Metzger. Metal Worker, vol. 41, no. 10, Mar. 7, 1919, pp. 302-304, 5 figs. Making apparatus for use in distallation of volatile oils from birch and wintergreen.

TANK LINKS. Machine Tool Adaptations for the Manufacture of Tank Links. Engineer, vol. 127, no. 3293, Feb. 7, 1919, pp. 120-123, 12 figs. Operations performed on stamping pattern of links for moving tracks of tanks.

TUBES, SEAMLESS. Making Seamless Tubes. Iron Trade Rev., vol. 64, no. 4, Jan. 23, 1919, pp. 259-264, 11 figs. Piercing and cold-drawing processes as followed at plant of Standard Seamless Tube Co.

TEXTILES. Back-Filling Process for Sheetings. Textile World Jl., vol. 55, no. 13, Mar. 29, 1919, pp. 29 and 31, 2 figs. Handling goods in finishing department; composition of mixings.

MECHANICS

ANGLES, SECTION MODULI. The Angle as a Beam, R. Fleming. Eng. News Rec., vol. 82, no. 9, Feb. 27, 1919, pp. 433-434, 5 figs. Tables comparing section moduli angles of various sizes.

AXLES, CRITICAL VELOCITY. Critical Velocity of High Speed Axles — II. Industria, vol. 33, no. 4, Feb. 28, 1919, pp. 113-114, 3 figs. On Dunkerley's theorem.

BEAMS. On the Beam of Uniform Strength Taking the Weigut of the Beam Into Consideration (in Japanese), Keiichi Aichi. Jl. Soc. Mech. Engrs., Tokyo, vol. 22, 54, Nov. 1918.

BEVEL GEARS, STRENGTH OF. Distribution of Load on Bevel Gear Teeth and Strength of Bevel Gear Teeth, W. G. Dunkley. Machinery, vol. 13, no. 337, Mar. 13, 1919, pp. 660-662, 4 figs. Investigation of variation of load in bevel-gear teeth; diagram illustrating deflection of teeth under load and graph showing distribution of load on teeth and their strength.

GEAR DRIVES. Dynamics of Gear Drive, N. W. Akimoff. Jl. Am. Soc. Naval Engrs., vol. 31, no. 1, Feb. 1919, pp. 46-52, 1 fig. Designing formula.

PIPE

CORROSION. Health Board Studies Pipe Corrosion in Buildings. Eng. News Rec., vol. 82, no. 10, March 6, 1919, pp. 469-470, 6 figs. Examinations of sewer and vent-pipe systems in buildings of various ages in Chicago business district.

COUPLINGS. Lead Pipe Couplings, John A. Jensen. Can. Engr., vol. 36, no. 1, Jan. 2, 1919, pp. 107-108. Results of examination of street leaks. Paper read before St. Louis Convention Am. Water Works Assn.

POWER GENERATION

APPALACHIAN SYSTEM. The Appalachian Power System, H. S. Slocum. Power, vol. 49, no. 12, Mar. 25, 1919, pp. 438-444, 12 figs. Features of hydroelectric and steam system supplying electric current to a large section of the South. Glen Lyn steam station.

ATLANTIC SEABOARD. Power Supply for Atlantic Seaboard. Elec. World, vol. 73, no. 13, Mar. 29, 1919, pp. 638-639, 1 fig. Scope of plan of Secretary of Interior Lane for development of super-power stations in Boston-Washington district. Paper before Boston section Am. Inst. Elec. Engrs.

AUSTRALIA. Water-Power Resources in Australia, Douglas Mawson. Commonwealth Engr., vol. 6, no. 6, Jan. 1, 1919, pp. 181-182. Figures gathered by writer show that a total of 13,722,000 hp. is available in Australasia; of this he believes 8,500,000 hp. is capable of development is Papua.

HYDRO-ELECTRIC DEVELOPMENTS, COSTS. General Factors Affecting the Cost of Constructing Hydro-Electric Development. Eng. & Contracting, vol. 51, no. 11, March 12, 1919, pp. 271-273. Investigation by Public Utilities Commission of State of Maine.

MASSACHUSETTS. Development of Massachusetts' Water Power. Elec. World, vol. 73, no. 6, Feb. 8, 1919, pp. 272-273, 1 fig. Special commission declares public ownership to be of doubtful value as a water-power policy.

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NATIONALIZATION. Nationalization of Transport and Electricity Supply. Tramway & Ry. World, vol. 45, no. 13, Mar. 13, 1919, pp. 113-115, Scheme for unification and cheapening of communication.

OIL ENGINE. Place for Oil-Engine-Driven Generators. Elec World, vol. 73, no. 11, March 15, 1919, pp. 519-520. Operating and maintenance expenses; analysis of expenses with old and new types of engines.

SOLAR ENERGY. The Utilization of Solar Energy, J. F. Heffron. Power House, vol. 12, no. 3, Mar. 1919, pp. 56-59, 5 figs. Review of attempts that have been made to utilize sun heat and indication as to what may be accomplished in future.

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POWER PLANTS

Air Heaters for Boilers. Boilers Provided with Air Heaters (Les chaudières avec réchauffeurs d'air), J. R. Revue Générale de l'Electricité, vol. 5, no. 7, Feb. 15, 1919, pp. 265-269, 8 figs. Installation by Underfeed Stoker Co. in English plant. Heat contained in the chimney gases of boilers is utilized for heating air entering the furnace.

Ash Disposal. Fast Modern Methods of Ash Disposal. Black Diamond, vol. 62, no. 12, Mar. 22, 1919, pp. 332-335, 6 figs. Comparison of methods; review of book published by Am. Steam Conveyor Corp.
Central Heating Plant of the Colorado State College. Power, vol. 49, no. 10, March 11, 1919, pp. 346-348, 6 figs. Coal and ash-handling equipment.
Power Plant Management; Coal and Ash Handling — I, Robert June. Power House, vol. 12, no. 3, Mar. 1919, pp. 60-62, 3 figs Claims that elimination of hand labor is an important element in power-plant operation. Also in Refrig. World, vol. 54, no. 3, Mar. 1919, pp. 23-25, 3 figs.

Boiler Explosion. Boiler Explosion at Mobile. Power, vol. 49, no. 12, Mar. 25, 1919, pp. 432-436, 11 figs. Particulars of explosion of two Heine boilers at plant of Mobile Electric Co.

Boiler Interconnection. New Boiler Plant of the A. S. & R. Co. at Omaha, R. N. Robertson. Power, vol. 49, no. 14, Apr. 8, 1919, pp. 514-518, 7 figs. Main feature of this underfed stoker plant is interconnection of two boilers which are baffled to utilize radiant energy from fire; superheater is placed behind bridge wall.

Boiler-Tube Ruptures. Water-Tube Boiler Tube Ruptures, Weldon Melroy. Power, vol. 49, no. 9, March 4, 1919, pp. 302-303, 5 figs. Illustrations of ruptures form various causes.

CO_2 Recorders. Fuel Economy in the Boiler House — III, J. B. C. Kershaw. Chem. & Metallurgical Eng., vol. 20, no. 6, March 15, 1919, pp. 291-295, 8 figs. Description of German types of CO_2 recorders which depend on measurements of the physical properties of flue gas.

Coal Consumption. The Consumption of Steam Power Plant, Robert H. Parsons. Elec. Rev., vol. 84, no. 2152, Feb. 21, 1919, pp. 200-202, 4 figs. Charts of coal consumption, steam consumption, coal efficiency and water efficiency.
Saving Coal in Steam Power Plants, Dept. of Interior, Bur. of Mines, Technical Paper 217, 8 pp. 1, fig. Economical principle and method of applying them to power-plant operations.

Condensers. Installation and Operation of Condensers (Remarques sur l'établissement et l'exploitation des installations de condenseurs), G. Oettinger. Revue Générale de l'Electricité, vol. 5, no. 11, Mar. 15, 1919, pp. 419-422, 5 figs. Suggestions to engineer assuming direction of condensing apparatus in steel plant.

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Hand-Fired Plants. Saving Coal in Boiler Plants, Henry Kreisinger. Universal Engr., vol. 29, no. 2, Feb. 1919, pp. 45-54, 3 figs. Suggestions given to operators of hand-fired plants.

Power Costs. Saving Coal in Steam Plants, Edward J. Willis. Natl. Engr., vol. 23, no. 4, Apr. 1919, pp. 170-172. Data of costs of production.
Emergency Shop Power and Coal Conservation, C. E. Clewell. Am. Mach., vol. 50, no. 12, Mar. 20, 1919, pp. 533-536, 6 figs. Graph showing how operating costs per unit of energy delivered may vary for different values of percentage of use.
Calculation of Plant Efficiencies and Fuel Costs, J. T. Foster. Power, vol. 49, no. 9, March 4, 1919, pp. 316-318, 2 figs. Charts.

Power-House Economy. Getting Better Economy in the Power House, G. H. Kelsay. Elec. Ry. Jl., vol. 53, no. 10, Mar. 8, 1919, pp. 455-460, 9 figs. Relation of boiler load to efficiency; increase in efficiency of steam turbines and relation of coal used to available supply; curves showing progress of combustion beyond fuel bed and effect of excess air. Abstract of paper read before Central Elec. Ry. Assn.

Power Plants. Power Plants of New Gotham Hotels. Black Diamond, vol. 62, no. 12, Mar. 22, 1919, pp. 321 and 335, 4 figs. Battery of boilers of 15,000 hp.

Stokers. Erith-Riley. Mechanical Stokers. Engineering, vol. 107, no. 2774, Feb. 28, 1919, pp. 268-269, 5 figs. Development of Erith-Riley stoker in conjunction with large boiler plants installed on the unit system.

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Water Softening. Water Softening, E. V. Chambers. Chem. News, vol. 118, no. 3066, Jan. 17, 1919, pp. 27-29. Treatment given in North of England to upland surface water intended for use in textile industry.
Water Softening, P. E. King. Chem. News, vol. 118, no. 3065, Jan. 10, 1919, pp. 14-16, Classification and description of methods.

MOTOR-CAR ENGINEERING

Carburetor Testing. Bureau of Standards Carburetor Test Plant, P. M. Heldt. Automotive Industries, vol. 40, no. 12, Mar. 20, 1919, pp. 641-644, 6 figs. Designed to determine metering qualities of different carburetors under varying conditions of atmospheric pressure an pressure drop. Fifth article.
System of Testing Fuel Jets in Zenith Carburetors. Aerial Age, vol. 9, no. 2, Mar. 24, 1919, p. 121, 4 figs. Machinery used in Zenith laboratory.

Carburetors. The Cox "Atmos" Carburator. Autocar, vol. 42, no. 1221, Mar. 15, 1919, pp. 358-360, 7 figs. Results of tests of carburator using only one jet aud having no automatic moving parts.

Fans. Radiator Cooling Fans, George W. Hoyt. Automotive Industries, vol. 40, no. 12, Mar. 20, 1919, pp. 630-633, 8 figs. Problems of design and mounting; large-diameter vs. high-speed fans; magnitude of the end thurst on fans; means for insuring continued dust-proofness of fan hubs.

Fiat. The New Fiat Light Car. Autocar, vol. 42, no. 1221, Mar. 15, 1919, pp. 355-357, 6 figs. Mechanical points in construction of engine, gear box and rear axle.

Fire Apparatus. Motor Apparatus and Equipment. Fire & Water Eng., vol. 65, no. 13, Mar. 26, 1919, pp. 649-653. Motor apparatus at Highland Park Mich., equipped with Sewell cushion wheels.

French Cars. Automotor Design and Construction of 1919. Auto, vol. 24, no. 949, Mar. 13, 1919, pp. 250-252, 5 figs. Six-cyl. 23.9-hp. Delage type being exhibited at Lyons Fair.
A Standardized French Car. Autocar, vol. 42, no. 1221, Mar. 15, 1919, pp. 368-369, 6 figs. Details of 10-hp. 4-cyl. monobloc-engine car.

Headlights. Report of 1917-18 Committee on Automobile Headlighting Specifications. Trans. Illum. Eng. Soc., vol. 14, no. 2, Mar. 20, 1919, pp. 64-77 and (discussion) pp. 77-99, 2 figs. Specificatious are based upon practical considerations and tests, and are selected in a manner to make them applicable to all devices.

Lubrication. Lubricating the Farm Tractor. Motor Age, vol. 35, no. 8, Feb. 20, 1919, pp. 28-29, 2 figs. Suggestion in regard to selection and applicatiou of lubricants.
The Lubrication of Motor Cars — H. G. W. A. Brown. Automotive Industries, vol. 40, no. 14, Apr. 3, 1919, pp. 751-754, 20 figs. Discussion of methods employed in lubrication of steering gears, drag links, rear axles, springs, spring eyes and road wheels; oil and grease-retaining devices.

Mercury. The 10-12 hp. Mercury. Autocar, vol. 42, no. 1221, Mar. 15, 1919, pp. 583-584, 6 figs. Engine and transmission details.

Military Chassis. Military-Transport Chassis — XII. Automobile Engr., vol. 9, no. 124, Mar. 1919, pp. 68-71, 5 figs. Performance under war conditions. Albion 32 H.P. (3 tons) chassis.

Napier Trucks. A New Two-Tonner. Motor Traction, vol. 28, no. 733, Mar. 19, 1919, pp. 240-242, 6 figs. Designed for reliable and inexpensive operation. Napier 40-55 cwt. chassis.

Producer Gas for Tractors. Producer Gas Driven Tractors (Tracteurs à gaz pauvre. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 1, Jan.-Feb. 1919, pp. 185-187, 2 figs. Tests with Cages truck.

Steam Cars. The Doble-Detroit Steam Car. Automobile Engr., vol. 9, no. 124, Mar. 1919, pp. 80-86, 13 figs. Water system, fuel system; engine unit. Accessories on engine.

Talbot. A New 25-50 hp. Talbot. Autocar, vol. 42, no. 1221, Mar. 15, 1919, pp. 352-354, 3 figs. Main features are: Cylinders cast in pairs; pump water circulation; forced oil circulation; electric starting and lighting; cone clutch, with fabric on flywheel.

Tanks. The French Baby Renault Tank, W. F. Bradley. Automotive Industries, vol. 40, no. 9, Feb. 27, 1919, pp. 464-470, 12 figs. Weight 6½ tons with machine gun. Driving sprocket is at rear, endless band passes around pulley at front, and between these is a series of idlers and automatic tensioning apparatus.

Tractor Attachments. The Big Auto Tractor Attachment. Automotive Industries, vol. 40, no. 10, Mar. 6, 1919, pp. 528-529, 3 figs. Conversion unit for converting large touring cars of older models into farm tractors.

Tractors. An Analysis of Tractor Specifications, P. M. Heldt. Automotive Industries, vol. 40, no. 10, Mar. 6, 1919, pp. 522-524, 6 figs. Representation of different features of design on percentage basis. Charts based on count of American-built tractors.
The Austin Farm Tractor. Automotive Industries, vol. 40, no. 9, Feb. 27, 1919, p. 484. British tractor on Fordson lines.
Southern Tractor Requirements, B. M. Ikert. Motor Age, vol. 35, no. 13, Mar. 27, 1919, p. 27. Protection of working parts from dust and sand held to be of greatest importance.
Ball Bearings in Tractor Design, H. M. Trumbull. Can. Machy., vol. 21, no. 8, Feb. 20, 1919, pp. 179-183 and 187, 20 figs. Advocates using high-grade self aligning ball bearing and illustrates its operation under various conditions of tractor service. From Tractor and Trailer.
Novel Frame in S. W. H. Tractor. Motor Age, vol. 35, no. 8, Feb. 20, 1919, pp. 46-47, 4 figs. Housing of gear set and rear axle in single casting.
Fiat Tractor Design Changes, W. F. Bradley. Automotive Industries, vol. 40, no. 10, Mar. 6, 1919, pp. 525-526, 4 figs. Secondary shaft behind axle housing; straight belt drive.

Vulcan. The Eight-Cylindered 20-25 H. P. Vulcan. Auto, vol. 24, no. 949, Mar. 13, 1919, pp. 247-250, 5 figs. Description and discussion with reference to characteristics of "eights" in general.

POWER TRANSMISSION

Belt Transmission. On the Power Transmission by Belt and Pulley (in Japanese), Chido Sugatani. Jl. Soc. Mech. Engrs., Tokyo, vol. 22, no. 54, Nov. 1918.

PRODUCER GAS

Operation. Gas Producers (Les gazogènes), G. Marconnet. Chimie & Industrie, vol. 2, no. 1, Jan. 1, 1919, pp. 6-14, 6 figs. Classification; operating data.

Theory. Elementary Theory of the Gas Producer, W. L. Badger. Mich. Technic, vol. 31, no. 1, Mar. 1918, pp. 13-17, 2 figs. Le Chatelier theorem.

REFRACTORIES

Graphite Ash Fusibility. Fusibility of Graphite Ash and Its Influence on the Refractoriness of Bond Clay, M. C. Booze. Jl. Am. Ceramic Soc., vol. 2, no. 1, Jan. 1919, pp. 65-68, From laboratory tests it is concluded that the softening point of a graphite ash is not a true criterion of its action in a crucible body.

Ovens and Kilns. Ovens and Kilns with a High Thermal Efficiency, A. Bigot. Gas Jl., vol. 145, no. 2905, Jan. 14, 1919, p. 71. Laboratory kiln with waste pipe surrounded by sheet-iron recuperator claimed by author to have increased by 200 deg. cent temperature of interior of kiln. Paper before Ceramic Soc.

Research. Refractory Materials as a Field for Research, Edward W. Washburn. Jl. Am. Ceramic Soc., vol. 2, no. 1, Jan. 1919, pp. 3-31, 1 fig. Survey of scientific aspects of subject. Report drafted under auspices of Section of Indus. Research of Nat. Research Council.

REFRIGERATION

Cold Storage Abroad. Refrigeration Abroad. Ice & Refrigeration, vol. 56, no. 3, Mar. 1919, pp. 174-175. Cold storage accommodations in Great Britain, Australia, and Russia.

Compression Refrigerating Machine. The Compression Refrigerating Machine, Gardner T. Voorhees, Ice & Refrigeration, vol. 56, nos. 2 and 3, Feb. and Mar. 1919, pp. 99-100 and 149-151, 6 figs. Comparison of types; conditions of heat flow. (To be continued).
The Ammonia Compression Refrigerating System XXXVIII, W. S. Doan. Refrig. World, vol. 54, no. 3, Mar. 1919, pp. 30-32, 4 figs. Atmospheric parallel-flow-type ammonia condenser; submerged condenser; shell-type condenser.

Fur Storage. Cold Storage of Furs, B. F. Green. Refrig. World, vol. 54, no. 3, Mar. 1919, pp. 25-26. Suggestions in regard to efficiency and safety.

Hotel Equipment. Refrigerating Equipment of the Pennsylvania Hotel. Power, vol. 49, no. 14, Apr. 8, 1919, pp. 522-524, 3 figs. Equipment has ice-making capacity of 100 tons per hr.

Refrigerating Plant Efficiency. Refrigerating Plant Efficiency, Victor J. Azbe. Mech. Eng., vol. 41, no. 4, Apr. 1919, pp. 362-368, 10 figs. General discussion of refrigerating plant economics. Abstract of paper read at Annual Meeting of A.S.M.E., December 1918.

PUMPS

Centrifugal Pumps. On the Combined Running of Centrifugal Pumps (in Japanese), Iwao Oki. Jl. Soc. Mech. Engrs., Tokyo, vol. 22, no. 54, Nov. 1918.

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England. The Government and the Organization of Scientific Research, Frank Heath. Jl. Roy. Soc. Arts, vol. 67, no. 3457, Feb. 21, 1919, pp. 206-215 and (discussion) pp. 215-219. Difficulties encountered by Department of Sci. and Industrial Research, England.
The Organization of Research in Great Britain. Science, vol. 44, no. 1262, March 7, 1919, pp. 239-241. Abstract of report of Committee of Privy Counsel for Scientific and Industrial Research.

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Rolling-Mill Research Laboratory. Rolling Mill Research Laboratory Founded. Blast Furnace & Steel Plant, vol. 7, no. 4, Apr. 1919, pp. 183-185, 2 figs. Experimental rolling mill and bureau of rolling mill recently organized in Pittsburgh by leading steel and rolling-mill manufacturers under auspices of Carnegie Inst. of Technology.

SPECIFICATIONS

Leather Belting. Specifications for Leather Belting, Harry A. Iley. Indus. Management, vol. 57, no. 4, Apr. 1919, pp. 271-281, 2 figs. Requirements to control quality from new point of view.

Steel, High-Speed. Specifications for High-Speed Steels, R. Poliakoff. Iron Age, vol. 103, no. 13, Mar. 27, 1919, pp. 827-829. Questions to take into consideration in drafting specifications, with reference to European practice.

STANDARDS AND STANDARDIZATION

Brass and Bronze Foundries. Standards for Brass and Bronze Foundries and Metal Finishing Processes, William Erskine. Metal Indus., vol. 17, no. 3, March 1919, pp. 113-117. Methods and apparatus to protect health of workers.

Marine Engines. Standardization of Marine Engines. Mar. Rev., vol. 49, no. 4, Apr. 1919, pp. 179-182, 2 figs. Composite design embodying approved features of standard types is advocated.

Standards. Standards in Engineering, R. J. Durley. Jl. Eng. Inst. Can., vol. 2, no. 3, Mar. 1919, pp. 174-182. Their importance in limiting costs of manufacture and faciliting production. Notes on attention now being given in England and U. S. to standards.

STEAM ENGINEERING

Boilers. Talbot Boilers and Engines Made in Canada. Power House, vol. 12, no. 3, Mar. 1919, pp. 66-68, 5 figs. Description of contraflow boiler and uniflow engine.

Evaporation Charts. Chart for Finding the Factor of Evaporation, G. H. Sheasley. Power, vol. 49, no. 11, March 18, 1919, p. 406, 1 fig. Chart gives required factor of any given steam-boiler performance.

Rotary Engines. Avery's Rotary Steam Engine. Natl. Engr., vol. 23, no. 4, Apr. 1919, pp. 173-174, 2 figs. Construction details and performance.

Steam-Turbine History. Steam Turbine Progress Reviewed Historically. Steam, vol. 23, nos. 2 and 3, Feb. and Mar. 1919, pp. 33-41 and 63-69, 37 figs. Review of British patent-office records. Mar. 1919: Impulse blading and blade materials Also in Railroad Herald, vol. 23, no. 3, Feb. 1919, pp. 63-65; Universal Engr., vol. 29, no. 2, Feb. 1919, pp. 34-44, 13 figs.

Steam Turbines. The Assembly and Adjustment of Steam Turbines, J. Humphrey. Machinery, vol. 13, no. 331, Jan. 30, 1919, pp. 486-492, 14 figs. Turbines considered are those working on the Parsons principle and having large number of fixed and moving blades, calked into the casing and on the periphery of the rotor.
The Large Steam Turbine, J. F. Johnson. Mech. Eng., vol. 41, no. 4, Apr. 1919, pp. 355-361, 7 figs. Development of large units to meet modern power requirements; records of performance; notes on design and construction.

WELDING

Arc-Welding Regulations. Notes on Regulations for Arc Weldong, H. M. Sayers. Can. Machy., vol. 21, no. 2, Jan. 9, 1919, pp. 39-41. Precautions to be observed for safety of operator; effects of welding load on supply mains of power station.

Blowpipe, Oxy-Acetylene. How to Choose an Oxy-Acetylene Blowpipe, C. Royer. Can. Machy., vol. 21, no. 8, Feb. 20, 1919, pp. 184-187, 1 fig. Writer considers that determining factors are character of work to be done and equipment on hand, and refers to features he estimates as of paramount importance in various classes of service.

Frog Shop. Welding in the Frog Shop, B. K. Smith. Welding Engr., vol. 4, no. 3, Mar. 1919, pp. 19-20. Reclaiming of materials.

Lead Welding. The Autogenous Welding of Lead — II, P. Rosemberg. Acetylene & Welding Jl., vol. 15, no. 178, July 1918, pp. 118-119, 6 figs. Uses of hydrogen and air blowpipe.

Rail Joints. Modern Welding and Cutting, Ethan Viall. Am. Mach., vol. 50, no. 12, Mar. 20, 1919, pp. 529-532, 11 figs. Notes on welding various types of rail joints. Sixth article.

Seam Welding, Electric. Electric Seam Welding, P. T. Van Binber. Am. Mach., vol. 50, no. 13, Mar. 27, 1919, pp. 575-580, 14 figs. Details of welding roller head; lap-seam welding machine and Thomson machine for flange-seam welding.

Thermit Welding. Modern Welding and Cutting, Ethan Viall. Am. Mach., vol. 50, no. 11, Mar. 13, 1919, pp. 479-483, 11 figs. Thermit rail welding for electric systems. (Continuation of serial).
Miscellaneous Thermit Repairs in the Nashville, Chattanooga & St. Louis Shops, Albert L. Seals. Reactions, First Quarter, 1919, pp. 18-20, 7 figs. Splice welded to main frame of engine; repair on a two-throw crankshaft.

Tires, Welded. Microscopic Study of Welded Tires. Acetylene & Welding Jl., vol. 16, no. 185, Feb. 1919, pp. 30-32, 30 figs. Structure of test pieces 3/16-in. form fracture, and tabulation of their characteristic difference according to position relative to fracture. (Concluded).

Tool-Steel and Stellite Welding. Electric Welding of High-Speed Steel and Stellite in Tool Manufacture, P. T. Van Bibber. Am Mach., vol. 50, no. 10, March 6, 1919, pp. 425-437, 80 figs. Stellite used only for vital parts is welded to shank of ordinary steel by butt-welding process. Operations, data and specifications.

WOOD

Applications. The Uses of Wood, Hu Maxwell. Am. Forestry, vol. 25, no. 303, Mar. 1919, pp. 923-930, 18 figs. Fencing materials from forests. Eleventh article.

Drying. English Methods of Lumber Drying, John Young. Wood-Worker, vol. 38, no. 1, Mar. 1919, p. 34, 1 fig. Details of English drykiln.

Seasoning. The Seasoning of Lumber, Bror L. Grondall, Sci. Am. Supp., vol. 87, no. 2253, Mar. 8, 1919, pp. 158-160. Basic facts underlying artificial drying of forest products. From West Coast Lumberman.

VARIA

Drawings, Reproduction of. Reproducing Drawings, F. G. Allen. Univ. Colo. Jl. Eng., vol. 15, no. 2, Jan. 1919, pp. 36-51. Discussion of the various methods of making duplicates of engineering drawings. Photo-chemical methods, lithographic methods, zinc etching, and half-tones, are considered.

Engineers. The Functions of the Engineer: His Education and Training, W. A. J. O'Meara. Elec. Rev., vol. 84, no. 2152, Feb. 21, 1919, pp. 219-221, 1 fig. Diagram of salaries and estimated personal qualifications.

Invention. Efficient Invention Douglas Leechman. Automobile Engr., vol. 9, no. 124, Mar. 1919, pp. 74-79. Writer suggests that if present patent fees were suitably reduced, trade of country would be benefited by increased encouragement of invention. Particular reference to patents affected by the war. Paper presented to Instn. Automobile Engrs.

Licensing Engineers. Comparison of Various Existing and Proposed License Laws, Eng. News Rec., vol. 82, no. 9, Feb. 27, 1919, pp. 423-430. States that have laws regulating practice of engineering and those which contemplate establishing such laws.

Nomography. Nomography, M. J. Eichhorn. Natl. Engr., vol. 23, no. 4, Apr. 1919, pp. 165-169, 13 figs. Reduction tables for pressures, temperatures, etc., and graphical steam tables. (Continuation of serial).

Semi-Logarithmic Paper. The Use of Semi-Logarithmic Paper in the Determination of Empirical Formulas, E. W. Lane. Cornell Civ. Engr., vol. 27, no. 1, Feb. 1919, pp. 3-8, 3 figs. Types of semi-logarithmic curves.

Steam-Distribution Charts. Charts of Steam Distribution (Abaque général pour l'étude des distributions de vapeur). Rodolphe Soreau. Mémoires et Compte rendu des Travaux de la Société des Ingénieurs Civils de France, vol. 71, nos. 11-12, Nov.-Dec. 1918, pp. 551-556, 2 figs. Chart is prepared to indicate any of three quantities, relative piston displacement, ratio of crank to connecting rod. and angle between crank and line of dead centers — when the other two are determined.

METALLURGY

BLAST FURNACES

Charging, Mechanical. Mechanical Charging of Silver-Lead Blast Furnaces, L. D. Anderson. Monthly Jl. Utah Soc. Engrs., vol. 5, no. 1, Jan. 1919, pp. 1-5, 3 figs. Practice of U. S. Smelting & Refining Co. at Midvale, Utah.

Gas Cleaning. New Blast Furnace Gas Cleaning Outfit, Blast Furnace & Steel Plant, vol. 7, no. 4, Apr. 1919, pp. 193-195, 2 figs. Ruddiman scrubber and combined cooler and dryer; cleaning apparatus combines principle of contact type of cleaner with that of scrubber type.

New Dry Cleaner for Blast Furnace Gas, J. C. Barrett. Blast Furnace & Steel Plant, vol. 7, no. 4, Apr. 1919, pp. 185-187, 1 fig. King-Weidlein dry gas clearer developed at Youngstown claims many advantages over wet process; retention of sensible heat of gas; greater steam generation and higher stove temperature.

Hot-Blast Stoves. Forced Draft for Hot Blast Stoves, Oskar Simmersbach. Iron & Coal Trades Rev., vol. 48, no. 2654, Jan. 10, 1919, p. 40, 2 figs. Combats opinion that with natural draft products of combustion are not evenly distributed over whole area of chequer work. From Stahl und Eisen.

COPPER AND NICKEL

Cupro-Nickel Alloys. Cupro-Nickel, H. A. Eastick. Metal Industry, vol. 14, no. 8, Feb. 21, 1919, pp. 141-143, 3 figs. Equilibrium diagram for cupro-nickel alloys; physical properties, tensile strength, elongation curves and characteristic graph of alloy containing 15 per cent nickel.

Nickel Refining. International Nickel Company's Refining Works at Port Colborne, Ontario, W. L. Wotherspoon. Eng. & Min. Jl., vol. 107, no. 10, March 8, 1919, pp. 429-435, 11 figs. Preliminaries incidental to erection and details relating to installation of plant. An annual output of 15,000,000 lb. of nickel is expected.

FLOTATION

Differential Flotation. Differential Flotation of Lead-Zinc (Flottage différentiel de plomb-zinc). Echo des Mines et de la Metallurgie, vol. 47, no. 2616, Mar. 9, 1919, pp. 152-155, 1 fig. Bradford differential process.

Filters. An Electrically Driven Filter E. J. Richards. Jl. Electricity, vol. 42, no. 6, Mar. 15, 1919, pp. 262-263, 2 figs. Oliver filter in use in flotation process, by Arizona Hercules Copper Company.

Wolf Patent. The Wolf Patent on Flotation. Min. & Sci. Press, vol. 118, no. 12, Mar. 22, 1919, pp. 390-392, 1 fig. Separation of metals from their ores. From text of Letters Patent No. 787,814.

IRON AND STEEL

Acid Bessemer Steel. A Technical Study of Acid Bessemer Steel, Iron Age, vol. 103, no. 10, Mar. 6, 1919, pp. 626-627. Action of manganese and its possible conservation; prevention of spitting; effect of bottom of converter. From Wisconsin Engr.

Cast Iron, Corrosion by Acids. Rupture of Cast Iron in Contact with Mixed Acid, A. C. Cumming. Jl. Soc. Chem. Indus., vol. 38, no. 3, Feb. 15, 1919, pp. 31T-32T. Experiments in connection with manufacture of trinotrotoluene.

Classification of Iron and Steel. Plan to Improve Foreign Trade Statistics, Iron Age, vol. 103, no. 11, Mar. 13, 1919, pp. 685-687. Tentative classification of iron and steel products to be used in reporting exports and imports, prepared by a committee of representatives from Bur. of Foreign and Domestic Commerce and other government organizations.

Ferrotitanium. The Beneficial Results Obtained by Introducing 25 per cent Carbonfree Ferrotitanium into Iron and Steel. Reactions, First Quarter, 1919, pp. 15-17, 7 figs. Cast-iron base of 25-ton Browning crane welded with thermit.

Flaky Steel. Observations on So-Called "Flakes" in Steel, Haakon Styri. Chem. & Metallurgical Eng., vol. 20, no. 7, Apr. 1, 1919, pp. 342-351, 41 figs. Examination of nickel-steel and carbon-steel transverse test bars showed that abnormalities in fractures were associated with impaired physical qualities and exhibited more or less minute slag inclusions.

Observations on Flaky and Woody Steel, Federico Giolitti. Chem. & Metallurgical Eng., vol. 20, no. 6, March 15, 1919, pp. 271-273, 2 figs. Discussion of causes of this defect in high-grade alloy steels.

India. The Heavy Steel Industry in India, Andrew McWilliam. Indian & Eastern Engr., vol. 44, no. 1, Jan. 1919, pp. 14a-14b. Account of historical and technical side. (To be continued).

Molybdenum Steel. Molybdenum Steel versus Gun-Erosion, Masatosi Okôchi, Masaichi Majima and Naoski Sato. Jl. Soc. Mech. Enger., Tokyo, vol. 22, no. 54, Nov. 1918, pp. 1-44, 50 figs. Experimental work to determine the resisting power of molybdenum steel against erosion. Investigation was conducted because of a report in which it was stated that steel containing three to four per cent molybdenum was employed as gun material in the German artillery. Writers found no trace in chemical analyses of specimens taken from captured German guns.

Open Hearth. Water Cooled Equipment for Open Hearths, William C. Coffin. Blast Furnace & Steel Plant, vol. 7, no. 4, Apr. 1919, pp. 188-192 and 197, 6 figs. Equipment for preventing distortion of framework and maintaining economy of refractories. Paper read before Am. Inst. Min. Engrs.

Smelting. A New Method for the Smelting of Iron Ores, Jas. W. Moffat. Canadian Min. Jl., vol. 40, no. 13, Apr. 2, 1919, pp. 207-210. Process designed for treatment of Canadian ores.

Tool Steel. The Evolution of a High Speed Tool Steel — II, T. L. Thorne. Am. Drop Forger, vol. 5, no. 3, Mar. 1919, pp. 146-149. Discussion on effects of various elements; methods of handling material when received in during production outlined; selection of furnaces important when treating finished tools.

Trumbull Steel Co. Plant. Valley Plant Produces Own Steel. Iron Trade Rev., vol. 64, no. 10, Mar. 6, 1919, pp. 641-645, 8 figs. General layout of Trumbull Steel Co.'s steel plant which includes seven 100-ton stationary open-hearth furnaces, a 36-in. blooming mill and an 18 and 21-in. bar mill.

Turbine Furnace. The "Turbine" Furnace. Iron & Coal Trades Rev., vol. 48, no. 2658, Feb. 7, 1919, p. 164, 1 fig. Aim is to insure a passage of air which shall be equal over every portion of the grate area. Air enters through fine troughs which extend over whole length.

Zirconium Steels. Zirconium Steels (Les aciers au zirconium). Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 1, Jan.-Feb. 1919, pp. 149-155. English patent in regard to uses of zirconium in metallurgy; other practices in various metallurgical works.

VARIA

Bureau of Standards. Metallurgical Work of Bureau of Standards — II, G. K. Burgess. Blast Furnace & Steel Plant, vol. 7, no. 4, Apr. 1919, pp. 195-197. Review of research work concerning welding, tin conservation, bearing metals, protective metallic coatings, sand investigations, etc.

Diseases of Metals. Decomposition of Metals — I, A. I. Krynitzky. Chem. & Metallurgical Eng., vol. 20, no. 6, March 15, 1919, pp. 277-282, 11 figs. Review of various theories which have been advanced to explain so-called "disease of metal."

FERRO-ALLOYS

Manufacture. The Manufacture of Ferro-Alloys — II, Robert M. Keeney. Automotive Eng., vol. 4, no. 3, Mar. 1919, pp. 121-124, Ores and furnaces used and methods followed to produce ferrochrome, ferromanganese, ferromolybdenum, ferrotungsten, ferrovanadiun and ferrouranium.

Testing. Metallurgy and Motor Engineering, J. B. Hoblyn. Auto, vol. 24, no. 949, Mar. 13, 1919, pp. 256-257, 9 figs. Notes on the metallurgical examination and treatment to which materials are submitted in the technical laboratory of Vauxhall Motors, Ltd.

NON-FERROUS ALLOYS

Aluminum and Copper Alloys. Aluminum and Copper Alloys. Machinery, vol. 13, no. 337, Mar. 13, 1919, pp. 656-659, 2 figs. Field for these alloys and difficulties met with in their manufacture.

Copper Alloys of High Tenacity. Copper Alloys of High Tenacity, O. F. Hudson. Metal Industry, vol. 14, no. 9, Feb. 28, 1919, pp. 163-166. Notes on strength of brasses and methods used to obtain brasses having high tensile strength. Paper before Birmingham Metallurgical Soc.

AERONAUTICS

AEROPLANE PARTS

Starters. The Liberty Starter for Aircraft Engines. Aviation, vol. 6, no. 4, Mar. 15, 1919, pp. 221-222, 3 figs. and Automotive Industries, vol. 40, no. 14, Apr. 3, 1919, p. 739, 3 figs. Combines gear reduction for hand cranking with an electric starter with high reduction ratio. Principal features and details of parts.

The Bijur Electric Starter for Aero Engines, Aerial Age, vol. 8, no. 22, Feb. 10, 1919, p. 10, 6 figs. Its application to Liberty motor.

Struts. Dimensions of Steel Tube Struts, E. S. Bradfield. Aerial Age, vol. 9, no. 2, Mar. 24, 1919, p. 112, 3 figs. Charts for computing dimensions.

AEROSTATICS

DIRIGIBLES. Airships for Commercial Purposes. Aeronautics, vol. 16, no. 277, Feb. 5, 1919, pp. 152-154. A comparison of heavier and lighter-than-air machines, and how each type may be utilized.
England's Aerial Effort (L'effort aérien de l'Angleterre). Aérophile, vol. 27, nos. 1-2, Jan. 1-15, 1919, pp. 14-15, 3 figs. Dirigibles developed during war.

MOORING GEAR. The Possibilities of Airship Transport Services. Flight, vol. 11, no. 9, Feb. 27, 1919, pp. 263-267, 2 figs. Vickers patent mooring gear for rigid airships. Concluded from p. 232.

SCHILLINO APPARATUS FOR MEASURING HYDROGEN. Utilization of Schilling Apparatus in Control of Industrial Hydrogen (Sur les conditions d'utilisation de l'appareil de Schilling, pour le contrôle de l'hydrogène industriele), F. Bourion and Ch. Courtois. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 4, Jan. 27, 1919, pp. 232-235. Reasons for preference given to Schilling apparatus over hydrogen balance, in the measure of hydrogen destined for airship service.

AIRCRAFT PRODUCTION

LIBERTY ENGINE PARTS, MANUFACTURE OF. Making Liberty Airplane Motor Parts. Machy., vol. 25, no. 7, Mar. 1919, pp. 636-641, 13 figs. Methods employed in machining cylinder inlet and exhaust elbows for the Liberty airplane motor at plant of Packard Motor Car Co.

NAVAL AIRCRAFT FACTORY. The Naval Aircraft Factory, G. W. Smith. Jl. Worcester Polytechnic Inst., vol. 22, no. 2, Jan. 1919, pp. 91-103, 2 figs. Account of war studies which led to construction and organization of factory.

TRIMMINO AIRCRAFT PARTS. Trimming Aircraft Parts, W. A. Ford. Machinery, vol. 13, no. 335, Feb. 27, 1919, pp. 597-598, 4 figs. Boring holes in metal to secure required degree of lightness.

APPLICATIONS

AERIAL PHOTOGRAPHY. Broad Field for Commercial Aerial Photography, M. A. Kinney. Flying, vol. 8, no. 3, Apr. 1919, pp. 250-255, 7 figs. Outline of possibility in scientific research, commercial endeavor and police work.

AERIAL ROUTES. First Steps in Organizing an Aerial Route, Holt Thomas. Aeronautics, vol. 16, no. 281, Mar. 5, 1919, pp. 248-249, Safety of Commercial Air Service.

CANADA. The Development and Future of Aviation in Canada, M. R. Riddell. Jl. Eng. Inst. Can., vol. 2, no. 3, Mar. 1919, pp. 200-209, 9 figs. Aero 504-k; J N-4, C, 504-K. Visualization of peace development of aeroplane.

COMMERCIAL POSSIBILITIES OF LIGHTER AND HEAVIER THAN AIR MACHINES. Commercialization of Rigid Airplanes (l'Utilisation commerciale des aéronefs rigides)' Génie Civil, vol. 74, no. 9, Mar. 1, 1919, pp. 167-169. Comparison of services given by airplanes and Zeppelines.

FOREST PATROL WORK. Use of Aeroplanes for Forest Patrol Work. Aeronautics, vol. 16, no. 277, Feb. 5, 1919, p. 155. Outlines American scheme for using aeroplanes in forest patrol work.

PREPARING FOR COMMERCIAL FLYINO. Preparing for Commercial and Pleasure Flying, Graham-White. Aeronautics, vol. 16, no. 280, Feb. 26, 1919, pp. 230-234, 2 figs. Forecast of developments and analysis of difficulties.

AUXILIARY SERVICE

RADIO SURGICAL SERVICE. Radio-Surgical Airplane (Avion radio-chirurgical), Foveau de Courmelles. Aérophile, vol. 27, nos. 1-2, Jan. 1-15, 1919, pp. 18-20, 3 figs. Fitted with radiographic and surgical laboratories and power plant which permits speed of 100 miles per hour. Named after designers "Aerochir Némirovski-Tilmant."

DESIGN

AILERONS. Some Points in Aeroplane Design, F. S. Barnwell. Flight, vol. 11, no. 533, Mar. 13, 1919, pp. 345-349, 2 figs. Investigation of controlling power of ailerons. (Concluded.)

BRISTOL FIGHTER DESIGN. Some Points in Aeroplane Design, F. S. Barnwell. Aeronautics, vol. 16, no. 281, Mar. 5, 1919, pp. 260-261. Analysis of Bristol fighters. Paper before Royal Aeronautical Society.

RADIATORS. The Principles of Cooling of Airplane Engine Radiators, H. B. Irving. Automotive Industries, vol. 40, no. 14, Apr. 3, 1919, pp. 740-742. Law of heat transmission from a surface to a fluid flowing over the surface; hp. expended in overcoming head resistance or radiator.

WING SPARS AND STABILITY. Some Points in Aeroplane Design, F. S. Barnwell. Flight, vol. 11, nos. 9 and 10, Feb. 27 and Mar. 6, 1919, pp. 275-280 and 310-313, 9 figs. Graphs and tables in reference to design of wing spars. Comparative data of tail plane required to give longitudinal stability to a monoplane, "square" biplane and "staggered" biplane. (To be concluded.)

DYNAMICS

FLATTENINO OUT FROM GLIDES. Flattening Out of Aeroplanes After Steep Glides, Genjiro Hamabe. Jl. Soc. Mech. Engrs., Tokyo, vol. 22, no. 54, Nov. 1918, pp. 45-96, 8 figs. Theoretical determination of time required to restore a machine from a steep glide and of the "wing loading" set up during this motion.

TORSIONAL LOADS IN FUSELAGE. Torsional Loads in the Fuselage of an Aeroplane, A. J. Sutton Pippard. Engineering, vol. 107, no. 2772, Feb. 14, 1919, p. 195, 1 fig. Suggests method of calculation based on assumption that deformation of fuselage is due to stretch of panel bracing wires, bulkhead bracing wires being considered as inoperative.

ENGINES

BASSE-SELVE. The 200-hp. Basse-Selve Aero Engine. Flight, vol. 11, no. 10, Mar. 6, 1919, pp. 297-305, 25 figs. Report based on examination of engine taken from remains of a German Rumpler two-seater biplane. Issued by Technical Dept. (Aircraft Production) Ministry of Munitions.

BUGATTI-KINO. The King-Bugatti Aviation Engine, G. Douglas Wardrop. Aerial Age, vol. 8, no. 22, Feb. 10, 1919, pp. 1074-1080, 32 figs. Engineering description. (To be continued.)

DESIGN. The Design of Aeroplane Engines, John Wallace. Aeronautics, vol. 16, nos. 278, 280 and 281, Feb. 12, Feb. 26 and Mar. 5, 1919, pp. 174-177, 220-222, and 251-255, 25 figs. Piston design and construction; distribution of side thrust; piston lubrication; piston rings; gudgeon-pin bearing; connecting rods; big-end bolts; twin connecting rods; Anzani arrangement; Canton system. (Continuation of serial.)

HALL-SCOTT. A Marine "Liberty," George F. Crouch. Motor Boat, vol. 16, no. 5, March 10, 1919, pp. 17-20, 10 figs. Hall-Scott 4-cyl. and 6-cyl. airplane motors modified to suit marine conditions.

MERCEDES. 200 Hp. High Compression Mercedes Engine. Aeronautics, vol. 16, no. 279, Feb. 19, 1919, pp. 204-206, 7 figs. Report on running performance, based on examination and tests carried out at R. A. E. on engine taken from Fokker D7 biplane (G/2 B/14). Issued by Technical Dept. of Air Ministry.

GERMAN MACHINES. Thermal Machines. German Aviation Motors (Machines thermiques—les moteurs de l'aviation allemande), Ed. Marcotte. Technique Moderne, vol. 10, no. 12, Dec. 1918, pp. 544-553, 29 figs. The various types are examined in reference to weight per hp., compression space, service given, and details in which they differ from French motors. (Concluded.)

"LE RHONE." The "Le Rhone" 110 H. P. Engine, G. Douglas Wadrop. Aerial Age, vol. 9, no. 3, Mar. 31, 1919, pp. 156-157 and 177, 6 figs. General data; diagrammatic sketches of oiling and ignition systems.

LIBERTY. Mechanical Details of the Liberty Engine—II. Automotive Eng., vol. 4, no. 3, Mar. 1919, pp. 117-120, 6 figs. Drawings and specifications of cast-iron cylinder forms for tank use and of steel cylinder type with sheet-metal water jackets for airplane power plants.

THOMAS-MORSE. The Thomas-Morse Model 8-90 Aero Engine. Aerial Age, vol. 8, no. 26, March 10, 1919, pp. 1348-1349, 2 figs. Characteristics of four-cycle eight-cylinder V-type engine.

UNION. The 125 Hp. Union Aircraft Engine. Aviation, vol. 6, no. 4, Mar 15, 1919, pp. 230-232, 3 figs. Engine is of vertical 6-cyl. water-cooled type with valves in head and develops its rated hp. at 1400 r.p.m. Total weight 485 lb.

INSTRUMENTS

TESTING. Tests of Aeronautic Instruments, P. M. Heldt. Automotive Industries, vol. 11, no. 13, Mar. 27, 1919, pp. 691-692, 2 figs. Mercurial standards and vacuum control of board of aeronautic-instrument test chamber. Sixth article.

MATERIALS OF CONSTRUCTION

DOPE. Fabric and Dope, F. W. Aston. Aeronautics, vol. 16, no. 279, Feb. 19, 1919, pp. 208-209. Rapidity of deterioration at different times of the year; comparison of English and German dope; influence of atmosphere surrounding fibres; methods of protecting fabric from sunlight.

MILITARY AIRCRAFT

AERIAL TACTICS. Aerial Tactics and the Defence Against Airplanes (La tactique aérienne et la défense contre avions), Jean-Abel Lefranc. Aérophile, vol. 27, nos. 1-2, Jan. 1-15, 1919, pp. 6-9. Remarks on significance of air warfare, based on records of past war.

GERMAN WAR AVIATION. Evolution of German Aviation During the War 1914-1918 (Evolution de l'aviation allemande pendant la guerre de 1914-1918). Aérophile, vol. 27, nos. 1-2, Jan. 1-15, 1919. pp. 12-13. Characteristics of reconnoitring planes, bombing and chasing machines, presented in chronological tables indicating time of their development.

LE PERE FIGHTER. The American Built Le Père Fighter. Aeronautics, vol. 16, no. 278, Feb. 12, 1919, pp. 178-179, 4 figs. Dimensions and weights.

MODELS

FORD MOTOR MACHINE. Model Aeroplane Building as a Step to Aeronautical Engineering. Aerial Age, vol. 8, no. 22, Feb. 10, 1919, p. 1089, 2 figs. Fittings for Ford-motored airplane. (Continuation of serial.)

MODEL AERO CLUB. Running a Model Aero Club XXI. Aeronautics, vol. 16, no. 279, Feb. 19, 1919, p. 203. On rulings of club, based on experience of various organizations.

MONOPLANES. A Simple Model Monoplane, J. F. Camm. Aeronatuics, vol. 16, no. 278, Feb. 12, 1919, p. 180, 1 fig. Said to be capable of circular flight 50 yd. and duration of 90 sec.

MOTORCYCLE-DRIVEN MACHINE. Elementary Aeronautics and Model Notes, John F. McMahon. Aerial Age, vol. 8, no. 26, and vol. 9, nos. 2 and 3, Mar. 10, 24 and 31, 1919, pp. 1353, 125 and 171, 4 figs. Describes light seater medium three-cylinder motorcycle-driven machine. (Continuation of serial.)

PLANES

ANSALDO. The Ansaldo Single and Two Seater Airplanes. Aviation, vol. 6, no. 4, Mar. 15, 1919, p. 223. Machine was designed with aim of including minimum head resistance and attaining maximum of efficiency. Italian type.

Bristol. Details of Bristol Aeroplane Types. Aeronautics, vol. 16, no. 280, Feb. 26, 1919, pp. 227-230, 6 figs. Fighter F.2B., with Rolls-Royce engine; triplane Braemer, with four Puma engines; fighter, single-seater scout, F, with Mercury engine; all-metal biplane, with Hispano-Suiza engine; and monoplane, M. I. C., with Clerget engine.

Curtiss Triplane. The Curtiss Model 18-T Triplane. Aerial Age, vol. 9, no. 3, Mar. 31, 1919, pp. 154-155, 5 figs. General dimensions, areas, weights and performances.

F-W-L. F-W-L Navy Flying Boat—I, II, III, S. T. Williams. Automotive Industries, vol. 40, nos. 12, 13 & 14, Mar. 20 & 27, Apr. 3, 1919, pp. 634-637, 703-707 and 755-758, 25 figs. Twin-motored tractor biplane with total flying weight of 7 tons; cruising radius as a fighter, 10½ hours; normal crew four men. Details of hull construction; design and materials of various fittings; panel and strut layout. Details of engine mountings and fuel and oil tanks: gasoline supply system.

Handley-Page. The Handley-Page Type 0-400 Bomber. Aerial Age, vol. 8, no. 22, Feb. 10, 1919, pp. 1083-1083 and 1095, 4 figs. Dimensions, weights and equipment.

NC-1 Naval. The NC-1 Naval Flying Boat. Aerial Age, vol. 9, no. 2, Mar. 24, 1919, pp. 110-111, 5 figs. General dimensions, weights and performances; machine said to be one of largest ever built.

Packard. Packard's Commercial Sport-Type Plane. Motor Age, vol. 35, no. 10, Mar. 6, 1919, pp. 22-23, 4 figs., and Automotive Industries, vol. 40, no. 10, Mar. 6, 1919, pp. 531-534, 9 figs. Specifications of two-passenger biplane Packard company purposes to build and sell at $15,000. Line of three engines; plane designed to take eight-cylinder power plant. Calculated performance charts based on previous similar designs.

Pfalz. The Pfalz Single-Seater Fighting Aeroplane. Engineer, vol. 127, no. 3292, Jan. 31, 1919, pp. 95-97, 14 figs. Official record issued by the Aircraft Production (Technical) Department, Air Ministry.

Phoenix-Cork. Some Notes on the Phoenix-Cork Flying Boat. Aeronautics, vol. 16, no. 279, Feb. 19, 1919, p. 197, 1 fig., and Engineer, vol. 127, no. 3296, Feb. 28, 1919, pp. 194-196, 10 figs. Comparison with F3; performance during war; advantages claimed for this type are lesser weight and lower air resistance.

USD-9A. The USD-9A Airplane. Aviation, vol. 6, no. 4, Mar. 15, 1919, pp. 215-217, 6 figs. Data of machine, which is a two-seater tractor biplane.

Roland. Roland D VI Biplane (Le biplan Roland D VI). Aérophile, vol. 27, nos. 1-2, Jan. 1-15, 1919, pp. 10-11, 6 figs. Principal characteristics.

Siemens. The Siemens Type D IV Single-Seater Fighter. Flight, vol. 11, no. 53, Mar. 13, 1919, pp. 332-339, 14 figs. Elevations and plans; description of Siemens & Halske rotary engine in which cylinders and crankshaft rotate in opposite directions; record of climbing.

Touring. Peace Time Aeroplanes. Flight, vol. 11, no. 10, Mar. 6, 1919, pp. 323-324, 2 figs. Sketches of proposed side-by-side touring aeroplane.

RESEARCH

Altitude Engine Test Laboratory. The Altitude Engine Test Laboratory, P. M. Heldt. Automotive Industries, vol. 40, no. 10, Mar. 5, 1919, pp. 535-539, 8 figs. Installed for Advisory Committee of Bur. of Standards to make tests on aeroplane engines under conditions duplicating those met with when flying at high altitudes.

Atmospheric Conditions. Atmospheric Conditions affecting Power, A. Johnson. Aerial Age, vol. 9, no. 3, Mar. 31, 1919, pp. 166-167, 3 figs. Table showing density and pressure percentage at different heights and its use in calculation of engine power.

Tandem Planes. Experiments with Tandem Planes, Robert Gilbert Ecob. Sci. Am. Supp., vol. 87, no. 2256, Mar. 29, 1919, pp. 204-205, 3 figs. Langley tandem monoplane, Jeansen-Calliex tandem biplane, six-plane tandem models.

PROPELLERS

Graphs of Thrust and Horse-Power. A Method of Approximating the Static Thrust and Brake Horse-Power of Air Propellers, W. Bernard Murphy. Aerial Age, vol. 9, no. 2, Mar. 24, 1919, pp. 114-115, 4 figs. Graphs of 2- and 4-bladed flat-faced sector screws.

TESTING

Radiators. Tests of Airplane Radiators, P. M. Heldt. Automotive Industries, vol. 40, no. 9, Feb. 27, 1919, pp. 479-483, 6 figs. Study by Bur. of Standards, bearing on head resistance, resistance to water flow and weight, all in relation to heat dissipated.

Rib Testing. Experimental Design and Testing of Airplane Ribs, George B. Fuller and Lessiter Milburn. Automotive Industries, vol. 40, no. 9, Feb. 27, 1919, pp. 456-460 and 489, 9 figs. Testing machine designed to distribute load as in flight.

Sand Testing. Sand Testing of Aeroplanes, Albert S. Heinrich. Aerial Age, vol. 9, no. 3, Mar. 31, 1919, pp. 158-160, 9 figs. Tests conducted at McCook Field on Victor advanced-training plane. (To be concluded.)

TRANSOCEANIC FLIGHT

Calculations. Civil Aerial Transport—Flying the Atlantic, G. Greenhill. Engineering, vol. 107, no. 2771, Feb. 7, 1919, p. 161. Calculations based on square sine law of Newton.

Transatlantic Route. A Proposed Aeroplane Route Across the Atlantic, William G. Hobbs. Flying, vol. 8, no. 3, Apr. 1919, p. 243, 1 fig. Via Newfoundland-Groenland-Iceland-Scotland.

Transoceanic Liners. Airships Practical for Commercial Use. Automotive Industries, vol. 40, no. 9, Feb. 27, 1919, pp. 461-463. Opinion is expressed that airships are valuable for transoceanic flight and that they can be supplemented by airplanes for short-haul work.

Possibilities of Airship Transport Services. Aeronautics, vol. 16, no. 279, Feb. 19, 1919, pp. 198-201, 5 figs. Scheme for service of transoceanic airship liners.

VARIA

Health Aspects. Some Health Aspects of Aeronautics As Found in Service Pilots, T. S. Rippon. Flight, vol. 11, no. 10, Mar. 6, 1919, p. 318. Experience of Roy. Air Force in selection of pilots.

Kite Flying. Notes on Kite Flying, Vincent E. Jakl. Sci. Am. Supp., vol. 87, no. 2250, Feb. 15, 1919, pp. 110-112. For meteorological observations. From Monthly Weather Rev., Supp. no. 13.

Nomenclature. Coefficient Nomenclature in Aerodynamics, C. H. Powell. Flight, vol. 11, no. 12, Mar. 20, 1919, pp. 371-373, 2 figs. Suggestions in regard to standard form for moment and force coefficients.

Photography. Taking Photographs from Airplanes and Balloons, J. A. Lefranc. Sci. Am. Supp., vol. 87, no. 2247, Jan. 25, 1919, pp. 60-62, 6 figs. Cameras developed to meet requirements. From La Nature, Paris.

Visibility of Aeroplanes. The Visibility of Airplanes, M. Luckiesch. Jl. Franklin Inst., vol. 187, no. 3, March, 1919. pp. 289-311, 11 figs. Investigation to analyze various aspects of visibility of airplanes and to effect measurements for the solutions of problems involved in obtaining low visibility. (Science and Research Division of Bureau of Aircraft Production.) To be concluded.

Wind Velocity. Influence of Wind Velocity on the Vertical Distribution of the Meterological Elements in the Lower Layers of the Atmosphere (Influence de la vitesse du vent sur la distribution verticale et les variations des éléments météorologiques dans les couches basses de l'atmosphère), C.-E. Brazier. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 3, Jan. 20, 1919, pp. 179-182. Observations made at Eiffel Tower.

MARINE ENGINEERING

AUXILIARY MACHINERY

Compasses. The Navigational Magnetic Compass Considered as an Instrument of Precision, M. B. Field. Engineering, vol. 107, no. 2771, Feb. 7, 1919, pp. 187-192, 16 figs. Problem is studied from point of view of accepted theories concerning sources of error due to magnetic disturbances and the so-called permanent magnetism hammered into the ship in the course of building. Lecture before Inst. Elec. Engrs.

Evaporators. An Improved Method of Operating Evaporators, M. C. Stuart. Jl. Am. Soc. Naval Engrs., vol. 31, no. 1, Feb. 1919, pp. 63-96, 14 figs. Essential feature of method; developed at U. S. Naval Eng. Experiment Station — is production of fresh water at constant rate and in any desired amount within capacity of evaporator.

Luffing Cranes. 4-ton "Toplis" Luffing Cranes for Shipyards. Engineering, vol. 107, no. 2772, Feb. 14, 1919, pp. 208-210, 4 figs. Example of application of this type of crane in a shipyard.

SHIPS

Boiler Mountings. Boiler Mountings, J. Purves, Mar. Engr. & Naval Architect, vol. 41, no. 498, Mar. 1919, pp. 193-195, 2 figs. Recent developments in marine-boiler-mounting design; suggestions for further safeguarding boiler. (To be continued). Paper read before Liverpool Eng. Soc.

Cargo-Vessel Design. Speed, Dimensions and Form of Cargo Vessels, G. S. Baker and J. L. Kent. Engineering, vol. 107, no. 2775, Mar. 7, 1919, pp. 306-310, 4 figs. Economics of cargo-ship propulsion so far as this is affected by speed and design of hull form; propulsive considerations in settling area of midship section; longitudinal distribution of displacement and type of level lines and body sections; notes on straight-frame ships, based upon test work carried out for British Government. Paper read before Instn. Engrs. & Shipbuilders in Scotland.

Cargo Vessels. Standard Sea-Going Cargo Vessel of 3,500-Tons Deadweight Built on the Lakes. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 206-207, 2 figs. Single-deck steamer of maximum Welland Canal size.

9,600-Ton Deadweight Cargo Vessel. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 200-203, 4 figs. Shelter-deck freighter designed by Federal Shipbuilding Co. for overseas trade longitudinal framing adopted.

Specification for 4,300-Ton Steel, Screw, Cargo Steamships for Canadian Government Merchant Marine, Ltd. Can. Ry. & Mar. World, no. 253, March 1919, pp. 146-151, 5 figs. Dominion Government has ordered 45 steel screw cargo steamships aggregating 263,850 tons d. w. Of these 6 are to be according to specifications given in article.

"Robert Dollar" Type of Cargo Vessel. Int. Mar. Eng. vol. 24, no. 4, Apr. 1919, pp. 204-206, 2 figs. Designed by Skinner & Eddy Corporation, Seattle, Wash, to carry 8800 tons deadweight at sea speed of 11½ knots.

Concrete Ships. Economic Size of Concrete Ships, E. O. Williams. Engineering, vol. 107, no. 2772, Feb. 14, 1919, pp. 195-197, 1 fig. Writer discusses theory that disadvantage of weight of concrete ships compared with steel ships diminishes with increased size of vessels.

Stone Ships cheaper than Steel. Mar. Rev., vol. 49, no. 4, Apr. 1919, pp. 190-191. Comparative costs of constructing and propelling concrete and steel tankers.

DIESEL-ENGINED MOTORSHIPS. American Diesel-Engined Motorship. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 208-211, 11 figs. Gear-reduction transmission applied to twin-screw wooden freighter equipped with high-speed Diesel engines.

Some Aspects of Large Diesel Cargo Ships, H. R. Setz. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 212-219, 6 figs. Steam and Diesel machinery installations compared.

Diesel Engines and the Merchant Marine Mech. Eng., vol. 41, no. 4, Apr. 1919, pp. 377-378. Review of developments on Pacific Coast.

ELECTRIC PROPULSION. Marine Electric Propulsion. Mar. Engr. & Naval Architect, vol. 41, no. 498, Mat. 1919, pp. 182-184. Development of system and conclusions in regard to operation from records of practice. Paper before Students' Section Instn. Elec. Engrs.

U. S. S. "New Mexico," Henderson B. Gregory. Sci. Am., vol. 120, no. 14, Apr. 5, 1919, pp. 340-341, 4 figs. General arrangement of engines and motor rooms in electrically propelled battleship.

FABRICATED SHIP. "Fabricated" and "Standardized" Ships, N. L. Van Tol. Am. Mer. Engr., vol. 14, no. 3, Mar. 1919, pp. 5-6. Outstanding points of question.

FERRYBOATS. Military French-English Ferryboats (Les ferryboats militaires francoanglais), P. C. Génie Civil, vol. 74, no. 8, Feb. 22, 1919, pp. 141-146, 16 figs. Plans, dimensions and particulars.

GEAR TURBINES, DOUBLE REDUCTION. Double-Reduction Geared Turbines for S. S. "Merida." Engineering, vol. 107, no. 2772, Feb. 14, 1919, pp. 207-208, 2 figs. Vessel is cargo steamer carrying 9100 tons on draft of 25 ft.

MARK BOATS. A Mark Boat That Will Mark, Frederick K. Lord. Motor Boating, vol. 23, no. 4, Apr. 1919, pp. 17-19 and 68, 4 figs. How to build a 10-ft. scow-type boat.

NORWEGIAN FREIGHTERS. 2400-Ton S. W. Norwegian Steamer. Shipbuilding & Shipping Rec., vol. 13, no. 11, Mar. 13, 1919, pp. 311-312, 6 figs. Details of S. S. Modemi, built and engined by Bergens Mekaniske Vaerksted.

OIL TANKERS. Oil Tank Steamer of 10,100 Tons D. W. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 196-198, 2 figs. Type of vessel authorized by Shipping Board: cargo space divided up into 18 main and 8 summer oil tanks.

Standard 7,500-Ton Oil Tanker. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 198-199, 2 figs. Single-screw vessel designed for 11 knots sea speed.

PARALLEL MIDDLE BODY. Effect of Position of Paralled Middle Body. Shipbuilding & Shipping Rec., vol. 13, no. 11, Mar. 13, 1919, pp. 317-319, 4 figs. Variation of shaft horsepower, propeller revolutions and propulsive coefficient with longitudinal position of parallel middle body in a single-screw cargo ship. Abstract of paper before Am. Soc. Naval Architects and Mar. Engrs.

SHAFT ALIGNMENT. Optical Method of Shaft Alignment, William Norris. Jl. Am. Soc. Naval Engrs., vol. 31, no. 1, Feb. 1919, pp. 56-62, 7 figs. Report of realignment of inboard propeller shaft U. S. S. Mississippi.

STRESSES IN SHIPS. Stresses in Ships, Sydney V. James, Jl. Western Soc. Engrs., vol. 23, no. 5, May 1918, pp. 356-376, 8 figs. Discussion of methods for determining principal longitudinal stresses and statement of results of application of such methods to study of ships of well-known type.

SUBMARINES. On the Equilibrium of a Submerged Submarine (Note sull' equilibrio dei sommergibili in immersione), C. de Feo V. Rivista Maritima, vol. 52, no. I, Jan. 1919, pp. 63-92, 7 figs. Mechanical laws involved in process of submerging and diagrammatic study of systems of forces acting on submarine while submerging and when fuly submerged.

TROOPSHIP. Twin-Screw Troopship of 13,000 Tons D. W. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 192-196, 5 figs. Three-deck combined passenger and cargo vessel of 20,900 tons displacement on draft of 31 ft. 9 in.

VIBRATIONLESS BOATS. A Vibrationless Cruiser. Motor Boating, vol. 23, no. 4, Apr. 1919, p. 20, 3 figs. Designed to travel at 24 miles per hour with tremble eliminated at 20-mile speed, and to go 500 miles without replenishing fuel.

YARDS

ALABAMA DRY DOCK CO. A Southern Shipbuilding and Repair Plant, G. F. S. Mann. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 251-255, 11 figs. Methods employed in yards of Alabama Dry Dock & Shipbuilding Co.

AUSTRALIA. Australian Shipbuilding. Commonwealth Engr., vol. 6, no. 6, Jan. 1, 1919, pp. 187-190, 5 figs. Shipbuilding at Government dockyards, Walsh Island, N. S. W.

CAROLINA SHIPBUILDING CORPORATION. Carolina Shipbuilding Corporation. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 240-245, 7 figs. Yard erected for building Emergency Fleet vessels. Contract calls for twelve 9,600-ton cargo ships.

CONCRETE SHIPBUILDING IN ENGLAND. Concrete Shipbuilding Work in England. Concrete Age, vol. 29, no. 4, Jan. 1919, pp. 12-15. Account of shipyards on South Coast, where eighteen concrete vessels are in course of construction. From Times Eng. Supp.

CONCRETE-VESSEL BUILDING. Shipping and Shipbuilding Indus. Australian & Min. Standard, vol. 61, no. 1580, Feb. 20, 1919, p. 323. Construction of concrete vessels. Developments in the United Kingdom.

DELAWARE WOODEN SHIPYARD. Large Wooden Shipyard on the Delaware, R. R. Shafter. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 256-259, 7 figs. Shipbuilding corporation organized to build wooden ships for Emergency Fleet.

FEDERAL SHIPBUILDING CO. Yard of the Federal Shipbuilding Company, Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 266-270, 10 figs. Steel shipyard with twelve launching ways built by subsidiary of U. S. Steel Corporation.

FORD METHODS. Ford Methods in Ship Manufacture, Fred E. Rogers. Indus. Management, vol. 57, no. 4, Apr. 1919, pp. 289-295, 12 figs. Subassembling and unit erecting. (Continuation of serial).

FOUNDATION CO., NEW ORLEANS. Foundation Company's New Orleans Yard, Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 237-239, 2 figs. General arrangement of yard.

GREAT LAKES SHIPYARDS. The Great Lakes Engineering Works. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 281-288, 14 figs. Details of shipyards and engine-building plant.

GROTON IRON WORKS. Groton Iron Works Shipbuilding Plant. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 247-250, 10 figs. Layout, construction of shipyard and methods for handling material.

LAUNCHING. Tides Terrain and Temper Play Important Parts in Launching. Motor Boating, vol. 23, no. 4, Apr. 1919, pp. 28-29, 4 figs. How a small crew can easily and safely launch a heavy cruiser of moderate size.

MANITOWOC SHIPBUILDING CO. Manitowoc Shipbuilding Company. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 271-280, 19 figs. Increase of steel shipyards on Great Lakes to meet demands of sea-going tonnage.

MERCHANT SHIPBUILDING CORPORATION, BRISTOL. Fabricated Ship Construction at Bristol Yard. Eng. News Rec., vol. 82, no. 12, Mar. 20, 1919, pp. 557-561, 8 figs. General plan and layout of plate-and-angle shop of Merchant Shipbuilding Corp.

MILWAUKEE. New Shipbuilding Enterprise in Milwaukee, Arthur F. Johnson Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 262-265, 6 figs. Yard for construction of steel and concrete vessels.

NAVAL ENGINEERING. The Achievements of Naval Engineering in this War, William L. Cathcart. Jl. Am. Soc. Naval Engrs., vol. 31, no. 1, Feb. 1919, pp. 1-45, 19 figs. Achievements of Bur. Steam Eng. during the war. Address at Annual Meeting of Am. Soc. Mech. Engrs., Dec. 1918.

NEW ORLEANS CANAL. Shipyard on New Orleans Canal for Building "Unsinkables." Eng. News Rec., vol. 82, no. 9, Feb. 27, 1919, pp. 434-438, 6 figs. Plan and details. The unsinkable ships being built are of the Le Parmentier (French) type.

NEWBURGH SHIPYARD. Construction of the Newburgh Shipyard. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 231-236, 7 figs. Description of shipyards and of accomplishments during past year.

TERMINALS

FRENCH PORTS. French Ports and the War (Les ports français et la guerre). Génie Civil, vol. 74, nos. 4 & 9, Jan. 25 and Mar. 1, 1919, pp. 73-74 and pp. 161-167, 6 figs. Organization of transport of coal across France to Italy. Description of Calais and Boulogne and notes on the traffic of these ports before and during the war.

NEW YORK-NEW JERSEY PORT. United Port of New York and New Jersey, Hjalmar E. Skougor. Freight Handling & Terminal Eng., vol. 5, no. 3, Mar. 1919, pp. 89-92. Recommends that States of New York and New Jersey be consolidated to form one state or that all such parts of these states as are immediately affected by comprehensive plan for port development be joined together to form either a separate state or a federalized district similar to the District of Columbia. Paper presented before Soc. Terminal Engrs.

RICHBOROUGH. The Richborough Transportation Depot and Train Ferry Terminus — IV, V, VI, VII. Engineer, vol. 127, nos. 3292, 3294, 3295 and 3297, Jan. 31, Feb. 14 & 21 and Mar. 7, 1919, pp. 102-104 and 106, pp. 147-150, 169-172, 219-220, 31 figs. Workshops and shipyard cover an area of 47 acres, of which 4½ acres represent the covered-in area. Launching slip for barges; self-propelled oil engined barge. Building of 58-ft. seaplace towing lighters for the Royal Naval Air Service. Design of extreme mobility, in event of enemy attack, shell fire, etc., installations could be readily withdrawn, or moved up again in case of an advance.

SINGAPORE. New Improvements in the Port of Singapore (Amélioration récentes du port de Singapour). Génie Civil, vol. 74, no. 4, Jan. 25, 1919, pp. 61-66, 18 figs. Construction of additional docks and quays.

VARIA

GRAPHIC NAVIGATION. Graphic Navigation, A. C. Knight. Motor Boating, vol. 23, no. 4, Apr. 1919, pp. 32-34 and 60, 8 figs. Determination of position (latitude and longitude) by the Marcq Saint Hilaire method from observations of the sun. Third article.

LAKE STEAMERS IN ATLANTIC. Successful Engineering Feat Opens Board Field for Lake Yards. Mar. Rev., vol. 49, no. 4, Apr. 1919, pp. 174-178, 9 figs. How large lake steamer was sent to Atlantic on beam ends.

PRATT SCHOOL OF NAVAL ARCHITECTURE. Pratt School of Naval Architecture, C. H. Peabody. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 220-222, 3 figs. Work of Dept. of Naval Architecture and Marine Engineering at the Massachusetts Inst. of Technology.

MINING ENGINEERING

BASE MATERIALS

CLAY. A Method for the Determination of Air in Plastic Clay, H. Spurrier. Jl. Am. Ceramic Soc., vol. 1, no. 10, Oct. 1918, pp. 710-713 and (discussion) pp. 714-715, 2 figs. Apparatus for quantitative determination of air.

FLUORSPAR. Fluorspar, Percy A. Wagner. South African Jl. Industries, vol. 1, no. 16, Dec. 1918, pp. 1516-1520. Manner of occurrence and sources of supply; dressing, preparation, and commercial uses; position and prospects of the South African fluorspar industry.

Fluorspar in the Ordovician Limestone of Wisconsin, Rufus Mather Bagg. Bul. Geol. Soc. Am., vol. 29, no. 3, Sept. 1918, pp. 393-397, 1 fig. Writer's findings while examining galena limestone quarries at Neenan.

LIMESTONE. Labor Saving at Limestone Quarries, Oliver Bowles. Dept. of Interior, Bureau of Mines, Technical Paper 203, 26 pp. Methods and types of equipment that have been tried and approved by quarry operators.

PHOSPHATES. Industry of Mineral Superphosphates (L'industrie des superphosphates minéraux), Chimie & Industrie, vol. 2, no. 2, Feb. 1, 1919, pp. 123-128, 4 figs. Technical study of French industry which has produced two million tons of superphosphates during the twelve months preceding August 1914.

SILICA. High-Grade Silica Materials, R. J Colony. N. Y. State Museum Bul., nos. 203, 204, Nov. and Dec. 1917, pp. 5-29, 15 figs. From field, laboratory and microscopic studies of high-silicia rock, writer concludes that within the borders of the State of New York there is rock of good quality, easy of access, capable of being readily quarried, and which may be used for glass making, ferrosilicon manufacture, silica refractories and tube mill liners and pebbles.

GEOLOGY AND MINERALS

AGE OF EARTH. The Age of the Earth, Harlow Shapley. Sci. Am. Supp., vol. 87, no. 2246, Jan. 18, 1919, pp. 34-35 and 42-43. Discussion of recent evidence from Geology, Astronomy and Physics. From Publ. Astron. Soc. of the Pacific, no. 177.

ANORTHOSITE, ADIRONDACK. Adirondack Anorthosite, William J. Miller. Bul. Geol. Soc. Am., vol. 29, no. 3, Sept. 1918, pp. 399-462. Structures, relations and origin. References are made to anorthosite of other regions and to Bowen's hypothesis, which latter writer pronounces untenable.

COLUMBIA. The Guamoco District of Columbia — I, S. Ford Eaton. Eng. & Min. Jl., vol. 107, no. 12, Mar. 22, 1919, pp. 513-515. 3 figs. History of mining in Columbia and details of travel and physical characteristics of mineral deposits.

CRYSTALLOGRAPHY. A Laboratory Method of Teaching Elementary Crystallography. Joseph E. Pogue. Am. Mineralogist, vol. 3, nos. 10 and 11, Oct. and Nov. 1918, pp. 179-182 and 193-194. Writer's practice in connection with a course in elementary crystallography at Northwestern University.

Crystallography of some Canadian Minerals. Albite, Titinite, Scapolite and Polycrase, Eugene Poitevin. Am. Mineralogist, vol. 4, nos. 2 and 3, Feb. and Mar. 1919, pp. 11-13 and 22-26, 7 figs. Specimens consisted of cavernous masses composed of association of augite, phlogopite and feldspar.

The Classification of Mimetic Crystals, Edgar T. Wherry and Elliot Q. Adams. Jl. Wash. Acad. Sci., vol. 9, no. 6, Mar. 19, 1919, pp. 153-157. Table showing types of mimetic phenomena, with three prefixtures proposed.

KANSAS CRYSTALLINE ROCKS. Geologic History of the Crystalline Rocks of Kansas, Raymond C. Moore. Bul. Am. Assn. Petroleum Geologists ,vol. 2, pp. 98-113. Material of crystalline mass is described as being for the most part a typical granite containing quartz, porphyry and chlorite schist.

DATOLITE. Famous Mineral Localities: The Datolite Locality Near Westfield, Massachusetts, Earl V. Shannon. Am. Mineralogist, vol 4, no. 1, Jan. 1919, pp. 5-6. General properties of minerals.

EARTHQUAKE WAVES. Earthquake Waves and the Interior of the Earth. Engineering, vol. 107, no. 2774, Feb. 28, 1919, pp. 266-267, 1 fig. Facts revealed by examination of seismograph and experimental work of the motion of compressional longitudinal waves in ropes.

EASTERN PENNSYLVANIA HIGHLANDS. Precambrian Sedimentary Rocks in the Highland of Eastern Pennsylvania, Edgar T. Wherry. Bul. Geol. Soc. Am., vol. 29, no. 3, Sept. 1918, pp. 375-392, 14 figs. Types described as of ultimate sedimentary origin.

GETTYSBURG. Glauberite Crystal Cavities in the Triassic-Rocks in the Vicinity of Gettysburg, Pa., George W. Stose. Am. Mineralogist, vol. 4, no. 1, Jan. 1919, pp. 1-4, 7 figs. Results of petrographic study of specimens.

GLACIAL DEPOSITS AND RESERVOIR SITES. Relation of Landslides and Glacial Deposits to Reservoir Sites in the San Juan Mountains, Colorado, Wallace W. Atwood. Department of the Interior, U. S. Geological Survey, Bul. 685, 38 pages, 25 figs. Mountain canyons and deposits commonly found in them; geological conditions associated with the lakes in the mountains.

KANSAS GEOLOGY. Geological Conditions in Central Kansas, Irving Perrine Bul. Am. Assn. Petroleum Geologists, vol. 2, pp. 70-97. Review of general geology with notes on the structural conditions.

LITCHFIELD, MAINE. Field Relations of Litchfielite and Soda-Syenites of Litchfield, Maine, Reginald A. Daly. Bul. Geol. Soc. Am , vol. 29, no. 3, Sept. 1919, pp. 463-470, 2 figs. Account of field work.

MAINE. Famous Mineral Localities; Mt. Mica, Mt. Apatite and other Localities in Maine, James G. Manchester and William T. Bather. Am. Mineralogist, vol. 3, no. 9, Sept. 1918, pp. 169-174, 5 figs. Observations made by writers in automobile trip through localities.

OOLITES IN SHALE. Oolites in Shale and Their Origin, W. A. Tarr. Bul. Geol. Soc. Am., vol. 29, no. 3, Sept. 1918, pp. 587-600, 2 figs. Oolites in shale constituting Papo Algie beds are believed to be due to direct precipitation of colloidal silica introduced into the saline, shallow waters by streams flowing from adjacent land areas.

PENEPLAINE, APPALACHIAN. Ages of Peneplaine of the Appalachian Province, Eugene Wesley Thaw. Bul. Geol. Soc. Am., vol. 29, no. 3, Sept. 1918, pp. 575-586. Examination of Appalachian peneplains in light of published and unpublished data concerning buried peneplains in Atlantic and Gulf Coastal Plains.

QUARTZ. Fibrous Quartz from Rhode Island, Alfred C. Hawkins. Am. Mineralogist, vol. 3, no. 7, July 1918, pp. 149-151. Writer disagrees with Prof. Emerson's theory concerning origin of fibrous quartz.

RIVER VIRGIN, UTAH. Oil Possibilities of the River Virgin Anticline, W. E. Calvert. Salt Lake Min. Rev., vol. 20, no. 24, Mar. 30, 1919, pp. 21-23, 4 figs. Outline of geological features of region in Southwestern Utah, which is believed possess oil deposits.

TEXAS, LOUISIANA COASTAL PLAIN. Minerals of the Saline Domes of the Texas, Louisiana Coastal Plain, Alfred C. Hawkins. Am. Mineralogist, vol. 3, no. 11, Nov. 1918, pp. 189-192, General data of sixty-three domes mapped to date in Texas and Louisiana.

TRILOBITES. The Facial Suture of Trilobites, H. H. Swinnerton. Geol. Mag., vol. 6, no. 3, Mar. 1919, pp. 103-110, 2 figs. Examination of various evidences lead writer to affirm that trilobites are a compact group, the members of which at first underwent ecdysis along marginal suture.

VIVIANITE. The Color Change in Vivianite and its Effect on the Optical Properties, Thomas L. Watson. Am. Mineralogist, vol. 3, no. 8, August 1918, pp. 159-161. Rapid change of color is said to be due to oxydation and not to inversion.

WASATCH REGION, UTAH. Relation of Ore Deposits to Thrust Faults in the Central Wasatch Region, Utah, B. S. Butler. Economic Geology, vol. 14, no. 2, Mar.-Apr. 1919, pp. 172-175, 3 figs. Writer's detail work in district.

COAL AND COKE

ASH YIELD, CALORIFIC VALUE. The Relation Between the Calorific Values and the Ash-Yields of Coal-Samples from the Same Seam, Thomas James Drakeley. Trans. Manchester Geol. & Min. Soc., vol. 36, part 1, Feb. 1919, pp. 9-20, 3 figs. Plotted calorific values and ash yields of mixtures of coal with calcium carbonate and shale. Equation expressing relation between calorific value and ash percentage.

COAL PYRITES, TENNESSEE. The Coal Pyrite Resources of Tennessee and Tests on Their Availability, E. A. Holbrook and Wilbur A. Nelson. Resources of Tennessee, vol. 9, no. 1, Jan. 1919, pp. 60-70, 1 fig. Co-operative research of State Geol. Survey with U. S. Bur. of Mines.

COAL-WASHING MACHINERY. The Draper Coal Washing Machine. Engineer, vol. 127, no. 3295, Feb. 21, 1919, pp. 180-181, 3 figs. Machine is intended to deal with fine classes of coal which are generally thrown away on account of difficulty in separating coal from its associated dirt; it is said machine will handle dust so fine that it will pass a 60-mesh screen.

COKE HANDLING. Handling of Coke, C. J. Woodhead. Gas Jl., vol. 145, no. 2912, Mar. 4, 1919, pp. 391-394, 2 figs. Figures of Huddersfield coke handling plant. Paper read before Manchester and District Junior Gas Assn.

COKE-OVEN PRACTICE, AMERICAN. Why American Coke Oven Practice Leads the Way, Richard Gunderson. Gas World Supp., vol. 70, no. 1806, Mar. 1, 1919, pp. 12-14. Three reasons are given; Application of scientific research work to industry; location of coke plants at steel works; economical conditions which give U. S. Steel Corporation control over the supplies of raw material, transportation and sales and distribution of their products.

COKE RETORTS, CENTRAL SYSTEM. A New Design of Vertical Retorts—the " Central" System. Gas Jl., vol. 145, no. 2912, Mar. 4, 1919, pp. 455-456, 2 figs. Design of type introduced by Firth Blakeley & Co. of Leeds.

ENGLAND. The Coal Resources of England, H. H. Stock. Black Diamond, vol. 62, no. 11, Mar. 15, 1919, pp. 298-300, 1 fig. Review showing importance and extent of Great Britain's coal deposits.

FATALITIES. Coal-Mine Fatalities in the United States, Albert H. Fay. Dept. of Interior, Bur. of Mines, Jan. 1919, 61 pp. Statistics of coal-mine fatalities in 1918, by states and months; details relating to chief cause of accidents; list of permissible explosives, lamps and motors tested prior to Jan. 31, 1919.

FRANCE. On the Existence of a Deep Coal Deposit at Merville (Nord) Sur l'existence du terrain houiller en profondeur, à Merville (Nord), Pierre Pruvost. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 2, Jan. 13, 1919, pp. 94-96. A sample coming from a depth of 247 meters is described as being made of a black schist of a pyritic inclusion.

The Mines of Bruay, France, Gaston Libiez. Coal Age, vol. 15, no. 12, Mar. 20, 1919, pp. 522-523, 5 figs. Deep colliery shafts tap several coal beds of varying thickness. The thinner measures are worked longwall, while the thicker ones are worked in panels.

GERMAN COAL CLASSIFICATION. The German System of Coal Classification and the Future Economic War—I & II. Colliery Guardian, vol. 117, nos. 3036 & 3037, Mar. 7 & 14, 1919, pp. 535-536 and 593-595, 10 figs. Study of efficiency in utilizing fuel value of coal by partial or complete gasification, direct combustion being reserved for exceptional instances. Utilizing separate products in preparation.

GERMAN INDUSTRIES. The German Coal, Iron and Steel Industries. Iron & Coal Trades Rev., vol. 48, no. 2654, Jan. 10. 1919, p. 39. General information given in German newspapers on conditions in these industries.

KENT. The Evolution and Development of the Kent Coalfield, A. E. Ritchie. Iron & Coal Trades Rev., vol. 48, nos. 2654, 2658 and 2663, Jan. 10, Feb. 7, and Mar. 14, 1919, pp. 35-36, 172-173 and 320-321, 2 figs. Physical characteristics; continuity with Pas de Calais coalfield; development of mining operations from 1826-1866. From 1886 to 1896. Evolution from 1906 to 1912. (Continuation of serial.)

KNOX COUNTY, IND. Knox County Mines and Their Coal. Black Diamond, vol. 62, no. 14, Apr. 5, 1919, pp. 376-377, 11 figs. Activities of Knox County (Indiana) Coal Operators Assn.

NITROGEN IN COAL. Rsearches on Coal (Recherches sur la houille), Aimé Pictet. Annales de Chimie, series 9, vol. 10, Nov.-Dec. 1918, pp. 249-330. Undertaken to determine in what form nitrogen is contained in coal. Samples from Montrambert (Loire) were treated with various acid and neutral solvents, notably boiling benzene.

Philippine Islands. The Mindanao Coal Mines, Monroe Woolley. Coal Age, vol. 15, no. 11, March 13, 1919, pp. 492-493, 3 figs. Operation of fuel beds in the Philippines.

Roll Crushers. Rolls for the Preparation of Coking Coals. Coal Age, vol. 15, no. 14, Apr. 3, 1919, pp. 612-615, 9 figs. Comparison of hammer mill and roll crusher.

Shaft Development. Modern Shaft Development of the Consolidation Coal Company—I & II, George W. Harris. Coal Age, vol. 15, nos. 11 and 12, Mar. 13 and 20, 1919, pp. 480-485 and 527-531, 6 figs. General details and dimensions of mine no 87. Operations involved in mine workings by noting location of old and new gas wells.

Training of Students. The Training of Students in Coal-Mining, with Special reference to the Scheme of the Engineering Training Organization, F. W. Hardwick. Tran. Min. Inst. Scotland, vol. 40, part 8, 1918-1919, pp. 154-162. Maintenance of Central Bureau, where parents and educationalists can obtain accurate and comprehensive information relating to engineering industry and proper course to pursue on behalf of boys who are desirous of making engineering their profession.

Utah. A One-Year Retrospect of the Coal Industry of Utah, A. C. Watts. Coal Age, vol. 15, no. 14, Apr. 3, 1919, pp. 610-611. Growth of industry.

Yellowhead Coal District. The Yellowhead Coal District, S. McVicar. Coal Age, vol. 15, no. 14, Apr. 3, 1919, pp. 608-610, 4 figs. Details of operation of two coal beds on steep pitch worked simultaneously by means of balanced plane.

COPPER

Leaching. Practical Considerations in Ammonia Leaching of Copper Bearing Ores, Lawrence Eddy, Chem. & Metallurgical Eng., vol. 20, no. 7, April 1, 1919, pp. 328-334, 4 figs. Plant installation and operation; leaching tanks; plate joinings, filters and inlets; piping and pumps; evaporators; details of operation; charging and extracting ore; chemical control; cost of leaching; labor, power and ammonia.

Copper Leaching, Percy R. Middleton. Chem. Eng. & Min. Rev., vol. 11, no. 125, Feb. 5, 1919, pp. 133-134, 2 figs. Methods applicable to Australian ores.

IRON

Australia. Australian Iron Ore Resources. Min. Mag., vol. 20, no. 3, Mar. 1919, pp. 150-156, 3 figs. Information relating to iron ore deposits in West Australia, New South Wales and Tasmania.

British Columbia. Utilization of Iron Ores of British Columbia. Canadian Min. Jl., vol. 40, no. 13, Apr. 2, 1919, pp. 212-213. Proposes asking British Columbia Legislature for authority to take from any of the iron ore properties of the Province a quantity of ore, not to exceed 10,000 tons in the aggregate for experimental uses.

Magnetic Concentration. Magnetic Concentration of Pyrrhotite Ores, J. P. Bonardi. Chem. & Metallurgical Eng., vol. 20, no. 6, March 15, 1919, pp. 266-270. Experiments and tests made with a Wetherill type magnetic separator.

Mexico. Iron in Mexico (El fiero en Mexico), Trinidad Paredes. Boletin Minero, vol. 6, no. 3, Sept. 1918, pp. 253-479, 1 fig. Official publication issued by Department of Industry and Labor of Mexican Government. Mining conditions and prospects are considered at length and legislation concerning exploitation of collieries and iron deposits is studied.

LEAD, ZINC, TIN

German Domination of Metal Markets. Report of Alien Property Custodian on the Metal Industry. Chem. & Metallurgical Eng., vol. 20, no. 7, Apr. 1, 1919, pp. 313-317, 3 figs. Regarding German domination of metal markets in Europe, particularly zinc and lead.

Lead, Osotopic. Notes on Osotopic Lead, Frank Wiggleworth Clarke. Chem. News, vol. 117, no. 3062, Dec. 6, 1918, pp. 370-373. Remarks on differences in atomic weight or ordinary lead and lead obtained from radio-active processes.

Northampton (Australia). Lead Ores. The Northampton Lead-Mining District, West Australia, C. M. Harris. Min. Mag., vol. 20, no. 3, Mar. 1919, pp. 140-143. Account of old lead-mining district in West Australia that showed renewed activity during war.

Tin-Bearing Mineral, Pleochroism. Pleochroism in a Tin-Bearing Mineral from Siam, J. B. Scrivenor. Geol. Mag., vol. 6, no. 3, Mar. 1919, pp. 123-124. From examination of heavy concentrate of course grains of dark mineral and finer grains of ilmenite, monazite, tourmaline, zircon, and tapaz.

Tin, Hydraulic Prospecting for. Hydraulic Prospecting at the Rooiberg Tin Mines, E. R. Schoch. South African Jl. & Eng. Rec., vol. 28, no. 1427, Feb. 1, 1919, pp. 501-502. Method of surface prospecting by means of hydraulic jets or monitors.

Zinc Industry. Economics of the Zinc Industry: A Prophetic Discussion, Parker C. Choate. Chem. & Metallurgical Eng., vol. 20, no. 5, March 1, 1919, pp. 237-239. Believes that expansion of zinc industry is to be obtained not alone by advertising and promoting new uses, but in addition metallurgical operations must be perfected and lower costs obtained.

Zinc Tailings, Re-treating. Retreating Zinc Tailings in Wisconsin, W. F. Boericke. Eng. & Ming. Jl., vol. 107, no. 12, Mar. 22, 1919, pp. 524-527, 2 figs. Details of 5-cell jig with settling tank.

MAJOR INDUSTRIAL MATERIALS

Manganese. Preparation of Manganese Ores, W. R. Crane and E. R. Eaton. Resources of Tennessee, vol. 9, no. 1, Jan. 1919, pp. 48-59, 2 figs. Methods employed in dry mining, washing and concentration.

The Mining and Preparation of Manganese Ores in Tennessee, W. R. Crane. Resources of Tennessee, vol. 9, no. 1, Jan. 1919, pp. 32-47, 5 figs. Different forms of deposits. Minerals found in manganese districts are pyrolusite, psilomelane and manganite.

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Canada. Mineral Production in Canada for 1918. Contract Rec., vol. 33, no. 12, Mar. 19, 1919, pp. 264-266. Report issued by Mines Branch, Department of Mines.

Drill Attachments. The Swift Drill Attachment. South African Min. & Eng., Jl., vol. 28, no. 1430, Feb. 22, 1919, pp. 604-605, 1 fig. Description of device; tests at Van Ryn Deep and Crown Mines.

Dust Sampling. Sampling of Dust in Mine Air, J. Boyd. Eng. & Min. Jl., vol. 107 no. 9, March 1, 1919, pp. 395-396, 1 fig. Air-testing suction pump as used for dust sampling by Chamber of Mines on Witwatersrand.

Excavators. Model Mining Methods (Metodas modelos de minaria), Revista Mineira e Metalurgica, vol. 1, nos. 10, 11 and 12, Oct.-Dec. 1918, pp. 88-90, 3 figs. Experiments by North West Corporation with Lubecker excavator (German type).

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Uniform Mining Law for North America, T. E. Godson. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 148, Apr. 1919, pp. 653-665. Mining laws of Canada represented as unassimilated to demands of industry.

Laws, Decrees and Decisions concerning Mines, Quarries, Sources of Mineral Waters, Railways in Operation, etc. (Lois, décrets et arrêtés concernant les mines, carrières, sources d'eaux minérales, chemins de fer en exploitation, etc.). Annales des Mines, vol. 7, no. 3, 1918, pp. 263-264. Documents publighed by Ministry of Public Works.

Details of Important Mining Bill Before the British Columbia Legislature. Robert Dunn. Coal Age, vol. 15, no. 12, Mar. 20, 1919, pp. 524-526. Provisions concerning miners' examinations, treatment of hoisting ropes and the practical elimination of all but safety lamps for miners' use.

Mining Law and Economics, David Bowen. Colliery Guardian, vol. 117, no. 3035, Feb. 28, 1919, pp. 479-480' Leases and licenses; definition of terms.

Longwall Mining. Longwall Mining in Illinois, Chester Mott. Mine & Quarry, vol. 11, no. 2, Mar. 1919, pp. 1122-1128. 6 figs. Practice in Illinois Third Vein field.

Mine Supplies. Economies in Mining Engineering Supplies, W. Elsdon-Dew. Jl. South African Instn. Engrs , vol. 17, no. 6, Jan. 1919, pp. 99-119, 18 figs. Account of economies practised in mines of Union of South Africa during years of war; illustrations of various devices intended for simplifying work and installed at some of the shops.

Ore-Dressing Laboratory. The Ore Dressing Laboratory of the Haileybury School of Mines, J. A. McRae. Can. Min. Jl., vol. 40, no. 3, Jan. 22, 1919, pp. 43-44. Summary of tests possible to carry out in plant.

Rescue Training. Rescue Training. Sci. & Art of Min., vol. 29, no. 17, Mar. 22, 1919, pp. 258-259. Fitness to undertake rescue work is said to be possessed by returning soldiers on account of their having been exposed, while in actual service to constant danger.

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Circular Shafts, H. Stuart Martin. Jl. South African Instn. Engrs., vol. 17, no. 7, Feb. 1919, pp. 136-147, 7 figs. Comparison of circular shafts with other types, particularly square and seven compartment.

Seven-Compartment Rectangular Shafts, C. E. Knecht. Jl. South African Instn. Engrs., vol. 17, no. 7, Feb. 1919, pp. 127-136, 3 figs. Discusses merits in regard to safety in sinking, normal rate of sinking, ability to cope with water and other sinking difficulties, ventilation area, hoisting capacity and cost.

Shovelling. A Study of Shovelling Applied to Mining—II, G. Townsend Harley. Eng. & Ming. Jl., vol. 107, no. 12, Mar. 22, 1919, pp. 520-522, 3 figs. Effect of shape of shovel and length of handle on amount of shoveling done. Influence of system of payment for work perfomed on individual efficiency of miners.

Notes on Rectangular Shafts at Randfontein Central G. M. Co., Ltd., and New State Areas, Ltd., W. L. White. Jl. South African Instn. Engrs., vol. 17, no. 7, Feb. 1919, pp. 148-156, 5 figs. Drawings and figures of two vertical shafts at Randfontein and at New State Area, South Africa.

Shot Drilling. Shot Drilling Around Thetford Mines. J. W. Davis. Can. Min. Jl., vol. 40, no. 3, Jan. 22, 1919, pp. 36-38, 4 figs. Prospecting work in asbestos and chromite iron deposits by Calix shot drills.

Stope Measurement. Cobar Stope Measurement Methods, W. S. Curteis. Instn. Min. & Metallurgy, Bul. 174, Mar. 13, 1919, 20 pp., 6 figs. Analysis of methods employed in measuring the stopes at Great Cobar Ltd., New South Wales, Australia. Methods were devised primarily for measurement for payment purposes.

Taxation. Principles of Mining Taxation, Thos. W. Gibson. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 148, Apr. 1919, pp. 611-620. Analysis of general systems of taxation and their application to mines, which, it is contended, have to spend part of earning in building for workers' conveniences of living in remoted regions.

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Tunnel Driving. Methods and Cost of Driving a 10 x 12 ft. Mining Tunnel at Copper Mountain, B. C., Oscar Lockmund. Eng. & Contracting, vol. 51, no. 12, Mar. 19, 1919, pp. 286-287, 1 fig. Driving of main haulage level at Copper Mountain Mines of Can. Copper Corp. Presented at Chicago meeting, Am. Inst. Min. Engrs.

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Mine Ventilating Plant. Engineer, vol. 127, no. 3292, Jan. 31, 1919, pp. 110-111, 6 figs. Arrangements in installation driven by 300 hp., 2-cyl. tandem compound engine.

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Zirconia. Zirconia. Metal Industry, vol. 14, no. 10, Mar. 7, 1919, pp. 189-190. Its occurrence and application.

OIL

Cuba. The Geology of Cuban Petroleum Deposits, E. DeGolyer. Bul. Am. Assn. Petroleum Geologists, vol. 2, pp. 133-167. Compilation of several geological stratigraphic and structural data, and comparison with North American Mid-Continent fields.

Gasoline Content in Natural Gas. Testing Natural Gas for Gasoline Content, G. G. Oberfell, S. D. Shinkle and S. B. Meserve. Jl. Indus. & Eng. Chem., vol. 11, no. 3, Mar. 1, 1919, pp. 197-200, 6 figs. Method employs use of solid absorbing medium such as charcoal and is applicable to both lean and rich natural gas.

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Louisiana. The Oil and Gas Fields of Northern Louisiana, Mowry Bates. Bul. Am. Assn. Petroleum Geologists, vol. 2, pp. 61-69. Wells are said to be costly to drill and operate in northern Louisiana and the region is not considered as attractive.

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Santa Clara, Cal. Tectonic Interpretation of Santa Clara Valley Petroliferous Region (Interprétation tectonique de la région petrolifère de la vallée de Santa Clara en Californie), Max Reinhard. Archives des Sciences Physiques et Naturelles, year 124, vol. 1, Jan.-Feb. 1919, pp. 63-78, 4 figs. Theoretical considerations on petroleum deposits, and Eldrige's and Arnold's studies have led writer to suggest interpretation of southern California formations particularly Santa Clara valley.

Storage. Petroleum Oils (Les essences de pétrole), A. Guiselin. Journal du Pétrole, no. 12, Dec. 1918, pp. 1-6, 3 figs. Losses due to storage and methods of preventing them. (Continuation of serial.)

Evaporation Losses of Crude Oil Decreases Gasoline Content, J. H. Wiggins. Natural Gas & Gasoline Jl., vol. 13, no. 3, Mar. 1919, pp. 89-90. Concerning evaporation losses of crude oil.

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Venezuela. Caribbean Petroleum's Operations in Venezuela. Oil Trade Jl., vol. 10, no. 4, Apr. 1919, p. 72, 3 figs. Transportation of well casing.

Water. The Distribution of Underground Salt Water and its Relation to the Accumulation of Oil and Gas, Roswell H. Johnson. Bul. Am. Assn. Petroleum Geologists, vol. 2, pp. 174-176. On relative roles of ascending and descending waters in oil accumulation.

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RARE MINERALS

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Famous Mineral Localities; Beryl Hill, Grafton, New Hampshire, George M. Flint. Am. Mineralogist, vol. 4, no. 3, Mar. 1919, pp. 21-22, 2 figs. Features of beryl exhibited at various museums.

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Uranium: Its Extraction from Pitchblende, Gustave Gin. Gen. Meeting Am. Electrochem. Soc., Apr. 3-5, 1919, paper 6, pp. 55-60. Discussion of occurrence and composition of pitchblende; methods of treatment by which uranium oxide is separated from it, both when it contains vanadium and when vanadium is absent; writer's proposed method for purification; involving fusion and electric furnace treatment to convert most of constituents into carbides followed by separation based on differing properties of carbides.

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Condensation Losses. Fume and Other Losses in Condensing Quicksilver from Furnace Gases, L. H. Duschak and C. N. Schuette. Dept. of Interior, Bureau of Mines, Technical Paper 96, 29 pp., 8 figs. Report of experiments conducted by Federal Bur. of Mines through its station at Berkeley, Cal.

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Abrasives. Electrothermic Abrasives (Les abrasifs electrothermiques), Jean Escard. Revue Générale de l'Electricité, vol. 5, no. 5, Feb. 1, 1919, pp. 180-190, 5 figs. Origin, manufacture; properties, and uses.

Acetylene. Acetylene and Its Generation. Times Eng. Supp., vol. 15, no. 532, Feb. 1919, p. 75. Risk of explosion; effect of impurities in carbide.

Ammonia. The Synthesis of Ammonia at High Temperatures — III, Edward Bradford Maxted. Jl. Chem. Soc., vols. 115 and 116, no. 676, Feb. 1919, pp. 113-119, 1 fig. Formation of ammonia in single-phase, 50 cycle, 375-volt arc.

Ammonium Nitrate. The United States Ammonium Nitrate Plant, Perryville, Md. Chem. & Metallurgical Eng., vol. 20, no. 7, Apr. 1, 1919, pp. 320-326, 8 figs. Description of manufacture of ammonium nitrate by the double decomposition of Chilean saltpeter and ammonium sulphate; phases, their control and application; plant operations.

Antimony Salts. Antimony in the Textile Industry, E. R. Darling. Textile World Jl., vol. 55, no. 13, Mar. 29, 1919, pp. 31, 33 and 35. Values of the various salts in printing and dyeing.

Benzol. Benzol Recovery. Times Eng. Supp., vol. 15, no. 532, Feb. 1919, p. 72. Problem of distribution from gas works; cost of recovery.

Benzol and Phenols. Separation of Benzol and Extraction of Phenols in Gas Works of Paris and Suburbs (Le débenzolage et l'extradition des phénols dans les usines à gaz de Paris et de la banlieue parisienne), L. Lindet. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 1, Jan.-Feb. 1919, pp. 133-137. Principle of Paul Mallet apparatus consists in washing gas in a liquid less volatile than the one it holds in suspension and distilling resulting mixture.

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The Relative Action of Acids on Enamels — III, E. P. Poste. Jl. Am. Ceramic Soc., vol. 2, no. 1, Jan. 1919, pp. 32-43, 9 figs. Tests of acid resistance undertaken by Sub-Committee on Enamels of Committee on Standards of Am. Ceramic Soc. Reference is made to previous investigation.

Fertilizers. Fertilizers, B. de C. Marchand, South African Jl. Industries, vol. 1, no. 16, Dec. 1918, pp. 1521-1529, 1 fig. Attempt to ascertain quantity of fertilizer of all kinds manufactured in the Union of South Africa. Seventh and concluding article.

Galvanizing. The Electro-Galvanizing of Booster Cases, Adapters and Detonator Fuse Components, T. C. Eichstatedt. Metal Industry, vol. 14, no. 10, Mar. 7, 1919, pp. 181-182. Method developed by writer.
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Gas Industry. The Gas Industry, S. W. Parr. Gas Indus., vol. 19, no. 2, Feb 1919, pp. 50-52. Present and prospective status.
Medium Pressure, A. C. Howard. Gas Indus., vol. 19, no. 2, Feb. 1919, pp. 46-48. Distribution of booster system of citizens Gas & Fuel Co. of Terre Haute.
Operation and Chemical Control, H. Vittinghoff. Gas Indus., vol. 19, no. 3, Mar. 1919, pp. 65-69. Chemical reactions which underlie gas manufacturing process in a water-gas plant.
Springfield Tests Indicate That Retort Life Is Increased by Steaming. Am. Gas Eng. Jl., vol. 110, no. 10, Mar. 8, 1919, pp. 211-213. Test were made in connection with investigation by Mass. Board of Gas & Elec. Commission relative to adoption of calorific standard for gas.
Steaming Horizontal Retorts, R. J. Rew. Gas Jl., vol. 145, no. 2905, Jan. 14, 1919, pp. 69-70. Writer believes it is best to steam very slightly during 8-hour carbonizing period, but to steam fully for an additional 40 hours.
Standard Gas. Engineering, vol. 107, no. 2775, Mar. 7, 1919, pp. 304-306, 3 figs. Tests performed and conclusions arrived at by Research Sub-Committee of Instn. Gas. Engrs.
Gasworks and the Supply of Motor Spirit Engineer, vol. 127, no. 3296, Feb. 28, 1919, pp. 196-197, 1 fig. Wilton benzol rectification plant.
Low-Temperature Carbonization in Relation to the Production of Motor Spirit, Fuel Oils. Smokeless Fuel and Power Gas; Its Aims and Objectives, F. D. Marshall. Gas Jl., vol. 145, nos. 2911 and 2912, Feb. 25, and Mar. 4, 1919, pp. 383-385 and 451-454, 5 figs. Explanation of process in view to stop waste of coal; extent of coal waste in England is given in statistical tables and possible by-product recovery is illustrated by diagrammatic sketch.
Unusual Carbonizing Method. James A. Brown. Gs: Jl., vol. 145, no. 2904, Jan. 7, 1919, p. 28. Difficulties encountered in operation of inclined ovens at Flint and Evansville, Mich. Paper before Mich. Gas Assn.
Principles of Gas Purification and Purifier Design, F. W. Steere. Gas Age, vol. 43, no. 6, Mar. 15, 1919, pp. 285-290, 8 figs. Regarding improvements in apparatus employed in removing sulphur from gas. (Continuation of serial).

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Greenstreet Cracking Plant, R. H. Kinnear. Petroleum Age, vol. 6, no. 3, March-1919, pp. 76-78, 5 figs. Details of method for making gasoline by cracking petroleum fractions.
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Properties of Motor Gasoline — II, E W. Dean. Automotive Eng., vol. 4, no. 3, Mar. 1919, pp. 132-134 and 147. Laboratory methods of testing gasoline and suggested specifications for motor gasoline.

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Kerosene. Testing Illuminating Oils, John W. Newton and F. N. Williams. Petroleum Age, vol. 6, no. 3, March 1919, pp. 81-84. Discussion of apparatus and specifications required for determining quality of kerosene and similar oils. Second article.

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Development of Mustard Gas. Jl. Indus. & Eng. Chemistry, vol. 11, no. 4, Apr. 1, 1919, pp. 287-291, 3 figs. Commercial production of ethylene apparatus and plant procedure for absorption of ethylene gas and monochloride. Purification of product.

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All-New Water Gas Plant Results at Providence, Wm. Russell. Gas Age, vol. 43, nos. 6 and 7, Mar. 15 and Apr. 1, 1919, pp. 277-282 and 364-366, 8 figs. Buildings consist of generator house, engine and pump house, washer house and purifying house. (To be continued). Before N. E. Assn. Gas Engrs.

RAILROAD ENGINEERING

FOREIGN

Berlin-Bagdad. " Berlin to Bagdad," a Study of Germany's Railway Policy. Ry. Gaz., vol. 30, no. 10, Mar. 7, 1919, pp. 445-447, 3 figs. Diagram of through railway routes between Germany, Austria, Hungary, the Balkans and the Near East.

Channel Tunnel. Railway Developments in Foreign Countries. Ry. Age, vol. 64, no. 14, Apr. 4, 1919, pp. 907-910. Discussion of Channel tuunel project to connect England and France. Condition of railways in Belgium, France, Russia, Portugal and Mexico are quoted.

European Lines After War. War Situation and Service of European Railways, Sanuel O. Dunn. Ry. Age, no. 12, Mar. 21, 1919, pp. 762-764. Physical condition of British and French lines; comparison of European and American service.

Spain. An important Development in the Railways of Spain, F. Lavis. Ry. Age, vol. 66, nos. 13 and 14, Mar. 28 and Apr. 4, 1919, pp. 825-831 and 829-894, 15 figs. General description of project for proposed new trunk line and train service from France to Straits of Gibraltar.

BRAKES

Brake Tests. Report on the Automatic Straight Air Brake. Ry. Age, vol. 66, no. 13, Mar. 28, 1919, pp. 840-842. Tests of air-brake system of Automatic Straight Air Brake Co. of N. Y., conducted by Bureau of Safety.

ELECTRIC RAILROADS

Financial Condition. Electric Railways and Investors, Francis H. Sisson. Elec. Ry. Jl., vol. 53, no. 11, Mar. 15, 1919, pp. 506-608. Discusses financial condition of electric railways, which in writer's opinion is serious and has been aggravated by large wage awards. Paper before Am. Elec. Ry. Assn.

Narrow-Gage Railways. The Electric Railway of 0.60 m. Gage (Le chemin de fer électrique à écartement de 0.60m), L. Esbran. Bulletin de la Société Française des Electriciens, vol. 9, no. 76, Jan. 1919, pp. 53-71, 4 figs. Steam locomotives vs. electric locomotives for 24-in. gage roads; transmission of power; construction of track.
High-Power Electric Locomotives for Narrow Gauge Goods Trains. Elecn., vol. 82, no. 2128, Feb. 28, 1919, pp. 250-252, 5 figs. Comparison of various electrical locomotives. (Concluded).

Single-Phase Locomotive, Swiss. The Single-Phase Locomotives of the Swiss Federal Railways and the New Oerlikon Locomotives (Las locomotoras monofasicas de los derrocarriles federales suizos y nuevos tipos de locomotoras de los taleres de construccion Oerlikon). Energia Eléctrica, vol. 21, no. 2, Jan. 25, 1919, pp. 21-23, 2 figs. General features and dimensions of types — J-C-1 and 1-BB-1. (To be continued).

ELECTRIFICATION

American. Some Possibilities of Steam Railroad Electrification, Calvert Townley. Elec. Rev., vol. 74, no. 12, Mar 21, 1919, pp. 452-454. Plea for greater cooperation between railroad and electrical interests.

French. Partial Electrification of a Great Railway System (L'électrification partielle d'un grand réseau chemins de fer), Revue Générale de l'Electricité, vol. 5, no. 11, Mar. 15, 1919, pp. 422-427, 4 figs. Economic considerations involved in electrification project of Cie. d'Orleans. Supplements article in issue of Nov. 16, 1918, p. 730. Paper before Société d'Encouragement pour l'industrie nationale.

EQUIPMENT

Dynamometer Car. Old and New Dynsmometer Cars, London & North-Western Railway. Ry. Gaz., vol. 30, no. 8, Feb. 21, 1919, pp. 304-305, 4 figs. Mechanism consists of laminated spring having 30 flat plates, each separated from next by rollers; a cast-iron bracket is bolted on the spring and moves with it, so actuating traction pen, which registers amount of pull in tons on paper record.

Motor Inspection Cars. A new Rail Motor Inspection Car. Railway Gaz., vol. 30, no. 11, Mar. 14, 1919, pp. 489-490, 1 fig. Report of tests of Modland Railway Co.

LABOR

British. The Personnel of the Railway Engineer's Department Under State Control. Ry. Gaz., vol. 30, no. 7, Feb. 14, 1919, pp. 249-250. Writer, who claims 20 years' railroad experience, takes gloomy view of British railway nationalization.

LOCOMOTIVES

Adhesion. Locomotive Adhesion, H. C. Webster. Ry. Gaz., vol. 30, no. 10, Mar. 7, 1919, pp. 447-449, 2 figs. Analysis of variation in pressure between tire and rail; graph showing resistance to slipping per wheel against co-efficient of frictiou.

Australian Locomotives. Australian Railways. Indus. Australian & Min. Standard, vol. 61, no. 1581, Feb. 27, 1919, p. 375, 2 figs. Australian types of locomotives.

Balancing. Balancing of Locomotives, S. H. Jenkinson. New Zealand Jl. Sci. & Technology, vol. 2, no. 1, Jan. 1919, pp. 19-28, 2 figs. Equtions for balancing for various defined positions of balance wheels.

Consolidation. Large Consolidation Type Locomotive for the P. & R. Ry. Age, no. 12, Mar. 21, 1919, pp. 760-762, 2 figs. With tractive effort of 61,260 lb. and small drivers, they are adapted to heavy drag service.

Electric Locomotives. See Electric Railroads, above.

History. The Evolution of the High-Speed Locomotive from 1878 to 1914 and the Influence of the Alsatian School (L'évolution de la locomotive à grande vitesse de 1878 à 1914 et l'influence de l'école alsacienne sur cette évolution), M. Herdner. Génie Civil, vol. 74, no. 6, Feb. 8, 1919, pp. 105-111, 6 figs. Development of French locomotives. Abstract of presidential address before the Société des Ingénieurs Civils.

Powdered Fuel. Powdered Fuel Burning Apparatus for an Australian Railway. Ry. Rev., vol. 64, no. 12, Mar. 22, 1919, pp. 457-459, 4 figs. Details of 50-ton, 6-wheel switching locomotive operating on powdered fuel with Fuller engineering equipment.

Standard Heavy 2-10-2. Standard Heavy 2-10-2 Locomotive. Ry. Mech. Engr., vol. 93, no. 3, March 1919, pp. 119-123, 14 figs. Plans, sections and dimensions of heaviest Administration single-unit type.
Heavy Type Locomotive for Rock Island. Ry. Jl., vol. 25, no. 4, Apr. 1919, pp. 17-18, 2 figs. Details of 2-10-2 type, designed for load of 60,000 lb. on each pair of drivers and said to be capable of traversing 16-deg. curves.

MAINTENANCE

Car Inspection. Unified Inspection and Maintenance of Car Equipment, J. J. Tatum. Ry. Rev., vol. 64, no. 13, Mar. 29, 1919, pp. 473-474. Explanation of purposes of railroad administration in its efforts to standardize railway rolling stock and in establishment of uniform rules for maintenance of already existing equipment. Also in Ry. Age, no. 12, Mar. 21, 1919, pp. 773-775.

Labor-Saving Devices. 30 Labor-Saving Devices or " Kinks " for Railway Maintenance of Way Work. Eng. & Contracting, vol. 51, no. 12, Mar. 19, 1919, pp. 288-290. Report of Committee on Labor-Saving Devices at convention of Am. Ry. Eng. Assn.

NEW CONSTRUCTION

Brazil. Railway Developments in Foreign Countries. Ry. Age, vol. 66, no. 13, Mar. 28, 1919, pp. 864-866, 1 fig. Proposed new railway in Para, Brazil.

Hetch Hetchy. The Hetch Hetchy Railroad, Rudolph W. Van Norden. Jl. Electricity, vol. 42, no. 5, Mar. 1, 1919, pp. 202-203, 3 figs. Railroad material and equipment of Hetch Hetchy water and power project. Total length of road, 68 miles.

OPERATION AND MANAGEMENT

Freight Handling. Reducing the Cost of Handling Freight. Ry. Rev., vol. 64, no. 12, Mar. 22, 1919, pp. 453-454, 4 figs. Operation of N. Y. Central freight termiual in Cleveland.

Loading, Train and Engine. Train and Engine Loading, T. H. Williams, Proc. Pacific Ry. Club, vol. 2, no. 11, Feb. 1919, pp. 3-15 and (idscussion) pp. 16-23, Definition and explanation of terms used in connection with train and engine loading.
Maximum Car Loading, Wm. H. McClymonds. Ry. Rev., vol. 64, no. 13, Mar. 29, 1919, pp. 474-475. Discusses advisability of keeping freight-car loads up to the maximum possible and consistent in the circumstances. Paper read before Pacific Ry. Club.

Railroad Problem. Compensation of Railroads Under Federal Control, J. M. Souby. Ry. Age, no. 12, Mar. 21, 1919, pp. 751-754. Writer believes that less than justice has been done by Administration in its interpretation of the law taking over the roads.
A Possible Solution of the Railroad Problem—II, F. J. Lisman. Ry. Age, vol. 64, no. 14, Apr. 4, 1919, pp. 883-889, 3 figs. Maps showing tentative combination of railway systems, indicating possibilities of combiuing strong and weak systems so that strong will easily be able to carry weak.

San Francisco. New Facilities to Eliminate Congestion in San Francisco, C. W. Geiger. Elec. Traction, vol. 15, no. 3, Mar. 15, 1919, pp. 177-180, 4 figs. Construction of extra tracks for relieving congestion at terminals of United R.R. of San Francisco.

Train Speeds, European. European Train Speeds. Ry. Gaz., vol. 30, nos. 4, 5, 7, 10 and 11, Jan. 24, 31, Feb. 14, Mar. 7 and 14, 1919, pp. 125-132, 175-179, 259-264, 450-454, and 501-503, 30 figs. Survey of highest, longest and fastest non-stop runs, speed of trains between two places and geographical distribution of important service. (Continuation of serial.)

U. S. Railroad Administration. General Orders from Railroad Administration. Ry. Jl., vol. 25, no. 4, Apr. 1919, pp. 6-10. Concerning relations between U. S. R. R. Administration and the state railroad and public-service commissions.
The Arithmetic of Railroading, W. J. Cunningham. Official Proc. N. Y. Railroad Club, vol. 29, no. 4, Feb. 21, 1919, pp. 5556-5569. Concerning operation of U. S. Ry. Administration.

PERMANENT WAY AND BUILDINGS

Pearson's Permanent Way. Pearson's Patent Permanent Way, J. D. Pearson Indian Eng., vol. 65, no. 7, Feb. 15, 1919, pp. 96-97, 7 figs. In principle it resembles longitudinal rail formerly used in 7-ft. gage. It provides continuous support for rail without use of transverse ties.

Rail Bonds. Conditions Govern the Choice of Rail Bonds, G. H. McKelway. Elec. Ry. Jl., vol. 53, no. 12, Mar. 22, 1919, pp. 591-592, 5 figs. Discussion of common types of rail bonds and their adaptation to conditions.

Surveys. Railway Right-of-Way Surveys and Descriptions, Ed. Thompson Wilkie. Can. Engr., vol. 26, no. 10, March 6, 1919, pp. 277-279, 1 fig. Suggests method of making right-of-way surveys. Presented at the Meeting of Assn. Ontario Land Surveyors.

Ties, Waterproofing. Waterproofing Railway Ties to Preserve Them. H. K. Wicksted. Ry. Age, vol. 66, no. 13, Mar. 28, 1919, pp. 849-850. Method of treatment involves thorough drying and then sealing against moisture. Paper read before Can. Ry. Club.

RAILS

Conservation. Some Results of Rail Conservation, W. R. Dunham, Jr. Elec. Ry. Jl., vol. 53, no. 12, Mar. 22, 1919, pp. 562-565, 7 figs. Aligning of old rails and elimination of low joints.

Creep. Rail Creep and Expansion, E. Capone. Tramway & Ry. World, vol. 45, no. 13, Mar. 13, 1919, pp. 115-117, 8 figs. Anchors for conductor rails. Method for anchoring sleepers.

Specifications. Change in Rail Specifications Proposed. Iron Age, vol. 103, no. 13, Mar. 27, 1919, p. 819. Results of experiments on gauging and testing rails. Presented at Convention Am. Ry. Eng. Assn.

ROLLING STOCK

Automobile Cars. Automobile Cars for the I. C. Ry. Mech. Engr., vol. 93, no. 3, March 1919, pp. 141-145, 12 figs. Design features of single-sheathed type of 80,000 lb. capacity.

Concrete Cars. Concrete Freight Car. Ry. Jl., vol. 25, no. 4, Apr. 1919, p. 25. Gondola type built for Illinois Central R.R. Claimed that tests of completed cars, both empty and loaded, demonstrated its practicability for rough service.
Gondola Car of Reinforced-Concrete Construction. Ry. Age, no. 12, Mar. 21, 1919, pp. 776-778, 3 figs. Design incorporating steel center sills with concrete floor, sides and ends.
Concrete Freight Car. Ry. Rev., vol. 64, no. 13, Mar. 29, 1919, pp. 475-476, 3 figs. Description of gondola-type car in which the body structure has been made of reinforced concrete resting upon and amalgamated with a steel center sill and body bolster assembly of usual form.

Freight Equipment. Freight Equipment as Handled Under Present-Day Interchange, T. J. O'Donnell. Official Proc. Car Foremen's Assn. Chicago, vol. 14, no. 5, Feb. 1919, pp. 78-87. Conditions, from mechanical standpoint, which determine selection and movement of freight cars.

Lighting, Electric. Electric Lighting of Railway Cars, B. H. Ehringer. Official Proc. Car Foremen's Assn., Chicago, vol. 14, no. 5, Feb. 1919, pp. 29-33 and (discussion) pp. 33-35. Ball bearings vs. brass bearings in lighting equipment, from point of view of maintenance.

Workshop Trains. 60. Cm. Workshop Trains for France. Ry. Gaz., vol. 30, no. 4, Jan. 24, 1919, pp. 135-137, 8 figs. Each train (narrow-gage road) comprises generating car, two machinery cars, tool van, stores van and officers' car. Generating car is filled with gasoline-electric generator sets in duplicate.

SAFETY AND SIGNALING SYSTEMS

Tunnel Signals. An Automatic Audible Warning for Tunnels. Ry. Gaz., vol. 30 no. 4, Jan. 24, 1919, pp. 141-142, 1 fig. Tube slung throughout length of Metropolitan Ry. 2200-ft. tunnel is struck by hammers actuated by electro magnets which train sets in operation on entering.

SHOPS

Forge Work. Buckles for Laminated Springs and Other Forge Work. Ry. Gaz., vol. 30, no. 4, Jan. 24, 1919, pp. 142-144, 5 figs. Manufacturing operation in forge department of a railway shop.

Locomotive Driving Boxes. Machining Locomotive Driving Boxes, M. H. Williams. Ry. Mech. Engr., vol. 93, no. 3, March 1919, pp. 155-159, 8 figs. Applicances designed to obtain accuracy and reduce time.

Superheater Locomotives. Shop Treatment of Superheater Locomotives, A. D. Williams. Railroad Herald, vol. 23, no. 3, Feb. 1919, pp. 67-69. Practice of Southern Pacific in converting saturated locomotives to superheated. From paper before Pacific Coast Ry. Club.

Welding. Spot Welding Railroad Tinware. Ry. Mech. Engr., vol. 93, no. 3, March 1919, pp. 151-153, 3 figs. Equipment used by I. C.

SPECIAL LINES

French Local Railroads. Present Condition and Future of French Local Railroads (L'état actuel et l'avenir de nos chemins de fer d'intérêt local), G. Mangin. Génie Civil, vol. 74, nos. 7, 8 and 9, Feb. 15, 22 and Mar. 1, 1919, pp. 129-131, 146-147 and 169-171, 16 figs. Economical aspect of rural transportation. Three systems are considered: Truck service, normal-gage, and narrow-gage railroads. Feb. 22; Schneider Electric locomotive. Mar. 1: Utilization of war narrow-gage material in agricultural railways.

TERMINALS

Akron. Modern Terminal in Akron. Elec. Traction, vol. 15, no. 3, Mar. 15, 1919, pp. 167-169, 4 figs. Prominent feature in arrangement of train shed with separate subway entrances to boarding platforms located between each pair of tracks.

Cleveland. New Plan for a Union Station at Cleveland, Ohio. Ry. Age, no. 12, Mar. 21, 1919, pp. 755-758, 5 figs. Suggested design for passenger station with a two-level street entrance. Also in Ry. Rev., vol. 64, no. 13, Mar. 29, 1919, pp. 469-472, 6 figs.

Glasgow. North British Railway Improvements at Glasgow, Frederick C. Coleman. Ry. Age, vol. 66, no. 13, Mar. 28, 1919, pp. 843-846, 6 figs. Layout of freight yard and warehouses. Said to be largest terminal in Scotland.

STREET RAILWAYS

Fares. Rate of Return in Service-at-Cost Franchises, Edwin Gruhl. Elec. Ry. Jl., vol. 53, no. 11, Mar. 15, 1919, pp. 502-505. Remarks that while commissions and courts have not established basis for fixing rate of return necessary to attract capital, nevertheless position of company, basis of fair value and various safeguards, all influence investor's demand. Before Am. Elec. Ry. Assn.
How the Public Feels About It. Elec. Ry. Jl., vol. 53, no. 13, Mar. 29, 1919, pp. 639-643. Opinions of representative public leaders of various classes regarding guarantee of return, aid through taxation, municipal vs. state ownership, and indeterminate franchise.

Car Lighting. Urban Rapid Transit Car Lighting, Clifton W. Wilder and Albert E. Allen. Tran. Illum. Eng. Soc., vol. 14, no. 1, Feb. 10, 1919, pp. 24-35 and (discussion) pp. 36-44, 16 figs. Study of problem in New York City, undertaken by writers in behalf of Public Service Commission.

Freight Traffic. Development of Freight Traffic on Interurban Lines, A. B. Cole. Elec. News, vol. 28, no. 6, Mar. 15, 1919, pp. 29-30 and 40. Considered in its relations to the law, the public, shippers, electric-railway operators, the traffic bureau, service, rates and facilities.

Maintenance. Maintenance Problems, Arthur C. Carty. Elec. Traction, vol. 15, no. 3, Mar. 15, 1919, pp. 184-186, 4 figs. Account of endurance of tramway for traveling 750,000 miles in 22 years.
Maintenance Practice of the San Francisco Municipal Railway, N. A. Eckhart. Elec. Ry. Jl., vol. 53, no. 12, Mar. 22, 1919, pp. 559-561, 3 figs. Results of five years of operation with reference to relation of construction to upkeep.
Maintenance of Door Operators, George E. Oakley. Elec. Ry. Jl., vol. 53 no. 12, Mar. 22, 1919, pp. 588-589. Writer outlines methods used for operating and controlling movement of doors and describes general methods used in inspection and overhauling of door apparatus.

Traffic Check. The Traffic Check and What it Showed on the Public Service Railway. Elec. Ry. Jl., vol. 53, no. 13, Mar. 29, 1919, pp. 644-648, 2 figs. Origin to destination check of passenger traffic, conducted during latter part of last year, and study of location of various traffic centers. Third article.

Troughwork. Troughwork and Other Protection, G. H. McKelway. Elec. Traction, vol. 15, no. 3, Mar. 15, 1919, pp. 172-176, 6 figs. Methods of installing various kinds of troughwork and protection for overhead structures and other construction above trolley wire.

Wartime, Europe. Continental Tramways in War-Time—II. Elec. Ry. & Tramway Jl., vol. 40, no. 961, Mar. 7, 1919, pp. 85-90, 2 figs. Repair shops of General Omnibus Co. and Metropolitan Railway.

Zone Systems. Zone System for New Jersey. Elec. Ry. Jl., vol. 53, no. 11, Mar. 15, 1919, pp. 523-528, 2 figs. Details of the petition of public service railways to Public Utility Commission.
How the Public Service Railway Established and Will Collect Its Zone Fare. Elec. Ry. Jl., vol. 53, no. 12, Mar. 22, 1919, pp. 598-604, 9 figs. Company proposes to put a ticket-issuing machine on front platform by which each passenger will receive a check indicating the zone in which he boards the car, then he pays the appropriate fare as he leaves by the rear platform.
The Zone Fare in Practice—Glasgow, Walter Jackson. Elec. Ry. Jl., vol. 53, nos. 10 and 13, Mar. 8 and 29, 1919, pp. 446-453, and 632-638, 15 figs. Layout of tramway system service on different lines as regards speed and headways and application of graded fare. Second article. Mar. 29: Considers standard double-deck car, the make-up of schedules, the hours and rates of pay of transportation employees and the checking and auditing of the differential system of graded fares.

ORGANIZATION AND MANAGEMENT

ACCOUNTING

Cost Accounting. Uniform Cost-Accounting. Ice & Refrigeration, vol. 56, no. 2, Feb. 1919, pp. 101-109, 8 figs. Forms covering cost accounting for production and distribution of ice, worked out by special committee of Na. Assn. Ice Industries.
Cost Accounting to Aid Production—VII, G. Charter Harrison. Indus. Management, vol. 57, no. 4, Apr. 1919, pp. 314-318, 3 figs. Expansion of application of scientific management principles. Theory illustrated by sample of firm entering field of manufacturing automobile trucks.

Inventories. Accurate Inventories Aid Output, Clifford E. Lynn. Iron Trade Rev., vol. 64, no. 13, Mar. 27, 1919, pp. 828-829, 2 figs. Form of keeping complete plant records of finished and semi-finished stocks.

Production Accounts. Systematizing Production Accounts, Ralph E. Butz. Iron Trade Rev., vol. 64, no. 12, Mar. 20, 1919, pp. 757-759. Methods for keeping records of costs in manufacturing plants. It is recommended that accounting be operated on double-entry principle.

EDUCATION

Crew Instruction at Hydroelectric Plant. Operation at Holtwood, Charles H. Bromley. Power, vol. 49, no. 12, Mar. 25, 1919, pp. 450-454, 6 figs. Methods used in instruction of crew at hydroelectric station of Pa. Water & Power Co. First article of series.

Education and Industry. Industry, Democracy, and Education, C. V. Corless. Bul. Am. Inst. Min. & Metallurgical Engrs. no. 148, Apr. 1919, pp. 621-635. Social problems developed from moral forces which found themselves released at termination of war.

Soldiers. Soldiers Civil Re-Establishment, L. Anthes. Jl. Eng. Inst. Can., vol. 2, no. 3, Mar. 1919, pp. 185-187. Notes on responsibility for soldiers' welfare placed on those who did not share their sacrifice.

Women, Training School for. Training Women in an Airplane Plant, James W. Russell. Machy., vol. 25, no. 7, Mar. 1919, pp. 593-595, 7 figs. Experiments and results in Curtiss Aeroplane & Motor Corporation's training school.

FACTORY MANAGEMENT

Credit. Mathematics of Credit Extension, Frederick Thulin. Jl. Accountancy, vol. 27, no. 4, Apr. 1919, pp. 259-267. Question of determining point of limitation to which grant of credit can go and of determining prima facie amount of capital, if any, a business requires from its proprietorship in reference to particular request of credit under consideration.

Employment System. Employment System of Cincinnati Planer Co., A. J. Schneider. Machy., vol. 25, no. 7, Mar. 1919, pp. 622-623, 8 figs. Forms of inquiry cards, record sheets and employment pass.

The Employment Department, G. L. Hostetter. Eng. & Indus. Management, vol. 1, no. 5, Mar. 13, 1919, pp. 142-143. Discusses effect of defective organization upon minds of applicants for employment and shows how first impressions generally influence the worker in the factory.

Selecting and Training Interviewers, Roy Willmarth Kelly. Indust. Management, vol. 57, no. 4, Apr. 1919, pp. 263-270, 9 figs. Analyzes knowledge and training needed by employment interviewer and points out specific information he should secure in regard to his community.

Forge-Shop Maintenance Department. Methods of Increasing Shop Efficiency, J. D. Lannon. Am. Drop Forger, vol. 5, no. 3, Mar. 1919, pp. 117-120. Schemes for sustaining maintenance department in forge shop. First article.

Human Activities, Classification of. Human Parasitism or Service, Harrington Emerson. Indus Management, vol. 57, no. 4, Apr. 1919, pp. 257-262, 1 fig. Classifies human activities into nine elements. Graphs for purpose of aiding each one to know where he belongs and what he is doing.

Human Factor in Efficiency. The Human Factor in Efficiency Methods, E. A. Pells. Elec. Rev., vol. 84, no. 2153, Feb. 28, 1919, p. 228. Social, economic, and hygenic conditions of worker as affecting efficiency.

Industrial Organization. Managing for Maximum Production—II. L. V. Estes. Indus. Management, vol. 57, no. 4, Apr. 1919, pp. 284-288, 5 figs. Theory of functions of industrial organizations. It is advanced that the industrial machine should be so built that routine work becomes compulsorily automatic.

Problems of Industrial Organization, Major Greenwood. Colliery Guardian, vol. 117, no. 3035, Feb. 28, 1919, p. 477. Remarks that while details of production, quantities of goods made, nature and powers of machines are matters which can be adequately described, such is not the case with efficiency of workers. Paper before Roy. Statistical Soc. Also abstracted in Eng. & Indus. Management, vol. 1, no. 5, Mar. 12, 1919, pp. 150-154.

Labor Turnover. Proper Systems Reduce Labor Turnover. Automotive Industries, vol. 40, no. 12, Mar. 20, 1919, pp. 619-621. Statistics of labor turnover and analysis of factory methods for handling it.

Labor Turnover and a Remedy, W. H. Weingar. Am. Mach., vol. 50, no 11, Mar. 13, 1919, pp. 497-499, 5 figs. How a munition plant has handled problem.

Layout of Works. The Thornycroft Motor Works at Basingstoke. Ry. Gaz., vol. 30, no. 5, Jan. 31, 1919, pp. 168-169, 5 figs. Layout of works and views of laboratories.

The Automobile Factory—III. Automobile Engr., vol. 9, no. 124, Mar. 1919, pp. 87-94, 18 figs. Notes on layout, construction and equipment.

Library. The Organization of a Factory Library, W. Barbour. Jl. Soc. Chem. Indus., vol. 39, no. 3, Feb. 15, 1919, pp. 35R-40R. Particulars of a system of indexing books, extracts, periodicals, manuscripts, papers, reports and charts.

Limitation of Output. The Limitation of Output, Andrew Stewart. Engineering Review, vol. 32, no. 9, Mar. 15, 1919, pp. 247-250, 6 figs. Deals with problem of restriction of output of men and machines.

Machine Tool Plant. Organization and Management of a Machine Tool Plant, Oscar Kylin and Erik Oberg. Machy., vol. 25, no. 7, Mar. 1919, pp. 608-614, 10 figs. Principles of organization and details of system used in a medium-size machine-tool manufacturing plant. First article.

Management Systems. Democracy Applied to Shop Management. Iron Age, vol. 103, no. 12, Mar. 20, 1919, pp. 743-745. Describes system adopted by Am. Multigraph Co., said to be based on American form of government.

"Efficiology" a Method of Making Profits by Universal Democracy, W. S. Rogers and Nellie M. Scott. Indus. Management, vol. 57, no. 4, Apr. 1919, pp. 299-301, 3 figs. Method of Bantam Ball Bearing Co. Charts of authority and responsibility.

Milling Calculations. Milling Calculations, Robert S. Lewis. Chem. & Metallurgical Eng., vol. 20, no. 5, March 1, 1919, pp. 224-233, 2 figs. Formulæ for determining extraction of processes, efficiency of machines, density of solids, solutions and pulps; notes on methods of testing and miscroscopic examination; bibliography of articles dealing with calculations.

Profit Sharing. A Profit-Sharing Plan for Executives, A. P. Ball. Indus. Management, vol. 57, no. 4, Apr. 1919. pp. 296-298, 3 figs. Experiment of Square D Company.

Rotation in Jobs. What is the Value of Rotation in Jobs? Harry Tipper. Automotive industries, vol. 40, no. 12, Mar. 20, 1919, pp. 628-629. Discussion whether employer or employee benefits most from shifting workers frequently.

Scientific Management. Seven Common Questions Regarding Scientific Management, Carle M. Bigelow. Indus. Management, vol. 57, no. 4, Apr. 1919, pp. 281-283. Objections that must be overcome in minds of business executives before they will consider the possibility of installing scientific management in their plants.

How I Have Applied the Taylor System (Comment j'ai mis en pratique le systéme Taylor), Serge Heryngiel. Mémoires et Compte rendu des Travaux de la Société des ingénieurs Civils de France, vol. 71, nos. 11-12, Nov.-Dec. 1918, pp. 557-559, 17 figs. Personal experiences in organization work.

Science and Industry (La science et l'industrie). Métallurgie, vol. 51, nos. 1 and 2, Jan. 1 and 8, 1919, pp. 26 and 75. Conductive industrial operations by scientific methods of organization.

Guiding the Creative Instinct, W. R. Basset. Factory, vol. 22, no. 3, March 1919, pp. 449-452. Concerning scientific management and the psychological characteristics of workers.

Shop Routing. Shop Routing System Reduces Handling Costs, F. L. Prentiss. Iron Age, vol. 103, no. 14, Apr. 3, 1919, pp. 867-870, 5 figs. Methods of Cleveland Tractor Co.

Store Room. Distribution of Materials and Supplies, B. J. Yungbluth. Elec. Ry. Jl., vol. 53, no. 10, Mar. 8, 1919, pp. 743-745. Economic aspect of methods followed in storeroom.

Keeping Track of Factory Material, J. C. Hickman. Factory, vol. 22, no. 3, March 1919, pp. 465-469, 16 figs. Remarks on specifying, receiving and inspecting purchase. First article.

Time Study. Six Fundamentals of Time Study, Samuel R. Gerber. Indus. Management, vol. 57, no. 4, Apr. 1919, pp. 308-311. How they must be handled by time-study man.

Tool Room. Modern Tool Room Organization. Machinery, vol. 13, no. 331, Jan. 30, 1919, pp. 477-479, 7 figs. Scheme of the record and costing of jigs and fixtures.

Trucks, Industrial. Conserving Labor in the Mill. Am. Miller, vol. 47, no. 4, Apr. 1, 1919, pp. 319-320, 4 figs. Suggests cutting down overhead by employing industrial truck to do work of many men.

Timken Solving Difficult Production Problem, Edward Schipper. Automotive Industries, vol. 40, nos. 13 and 14, Mar. 27 and Apr. 3, 1919, pp. 685-688 and 748-750, 13 figs. Mar. 27: Methods for scheduling work of Timken-Detroit Axle Co. Apr. 3: Practice of company in departmental communication, by using electric trucks.

Welfare. Welfare in the Factory. Times Eng. Supp., vol. 15, no 532, Feb. 1919, p. 77. Influence of the State.

FINANCE AND COST

Prices. Civil War Price Trends Compared with Those Today, Morris Knowles. Eng. News-Rec., vol. 82, no. 9, Feb. 27, 1919, pp. 414-416, 2 figs. Writer, judging by past, believes high prices will continue.

LABOR

American Conditions. American Workmen During the War (Le travail américain pendant la guerre). Revue Générale de l'Electricité, vol. 5, no. 7, Feb. 15, 1919, pp. 275-278. Survey of organization work in United States, specially of relations between workers and employers.

Crippled Soldiers. Economic Benefit to Mining Industry Illustrated by Experience with Crippled Soldiers, Douglas C. McMurtrie. Colo. School Mines Mag., vol. 9, no. 3, Mar. 1919, pp. 55-57. Studies of Red Cross Inst. for Crippled and Disabled Men.

Dilution of Labour. Dilution of Labour. Times Eng. Supp., vol. 15, no. 532, Feb. 1919, p. 76. Progress and consequences; methods of taining.

Housing. Attractive Homes for Employees, W. F. Sutherland. Can. Machy., vol. 21, no. 10, Mar. 6, 1919, pp. 234-237, 17 figs. Plan of housing development at Chippewa plant of Norton Co.

Westinghouse Village at South Philadelphia, Pa. Am. Architect, vol. 115, no. 2251, Feb. 12, 1919, pp. 223-229. 10 figs. Tract set aside for housing contains about 90 acres.

Town Housing of the Working Classes, Herbert Freyberg. Surveyor, vol. 55, no. 1409, Jan. 17, 1919, pp. 31-32. Experience of administration of part III of act of 1890. Before Soc. Architects.

Housing from the Point of View of Economy in Planning and Construction, Henry Tanner. Jl. Roy. Sanitary Inst., vol. 39, no. 2, Oct. 1918, pp. 79-84. British Government view as to what is proper accommodation to be provided for workers.

The Cost and Construction of Workmen's Dwellings, Roads, Sewers, and Water Supply in Connection with Town Planning, John Parker. Jl. Roy. Sanitary Inst., vol. 39, no. 2, Oct. 1918, pp. 75-78. Conditions and legal regulations at Hereford.

Industrial Councils, Joint. Whitley Plan for improving Labor Status, Contract Rec., vol. 33, no. 13, Mar. 26, 1919, pp. 279-280. Joint standing industrial councils recommended to provide remedy for differences between employers and employees.

The League of Labor and Capital, C. S. Robinson. Iron Age, vol. 103, no. 11, Mar. 13, 1919, pp. 683-684. Concerning co-operation in industry between employer and employee by establishing a basis for representation of workers.

Labor Representation. Labor's Representation in Plant Management the Immediate Problem, Harry Tipper. Automotive Industries, vol. 40, no. 9, Feb. 27, 1919, pp. 476-477, 2 figs. Chart illustrating representation of employees of Bethlehem Steel Corp. and subsidiary companies.

Profit Sharing. The Profit Sharing Plan of the Baker Manufacturing Co., John S. Baker. Wisconsin Engr., vol. 23, no. 6, Mar. 1919, pp. 193-201. Writer advocates plan for increased remuneration of employees with increased production, and illustrates instance of application of plan.

Psychology of Workers. The Human Machine ,Arthur P. Young. Eng. & Indus. Management, vol. 1, no. 5, Mar. 13, 1919, pp. 135-137, 2 figs. Study of psychology of workers.

Unemployment. View of Unemployment from Employer's Side. Iron Age, vol. 103, no. 12, Mar. 20, 1919, pp. 747-748. Opinion of representatives of National Associations connected with metal trades.

Wage Problem. The Wage Problem in Industry, W. L. Hichens. Colliery Guardian, vol. 117, no. 3036, Mar. 7, 1919, p. 536. Suggests ways in which increase of wages may be effective in increasing production. Paper before Roy. Soc. Arts. See also Engineer, vol. 127, no. 3297, Mar. 7, 1919, pp. 231-232, and Jl. Roy. Soc. Arts. vol. 67, no. 3458, Feb. 28, 1919, pp. 224-229 and (discussion) pp. 229-233.

Probable Wages and Supply of Construction Labor During Coming Season. Eng. & Contracting, vol. 51, no. 12, Mar. 19, 1919, pp. 284-286. Committee report of Am. Road Builder's Assn.

Wage Systems (Les différents systèmes de salaires). Métallurgie, vol. 51, no. 11, Mar. 12, 1919, p. 587. Review of systems which have been put into practice in France, America, England and Germany. (To be continued).

Problems and Formulæ for Payment of Wages (Problèmes et formules de paiement des salaires). Technique Moderne, vol. 10, no. 12, Dec. 1918, pp. 571-574, 1 fig. Includes graph for the Benedict-Stronck, Emerson, Halsey, Rowen, Taylor and Gantt systems. From Metallurgical and Chemical Eng., Mar. 1, 1918; Annales des Ponts et Chaussées, Apr.-May 1917 and previous account in Technique Moderne, vol. 10, no. 1, Jan. 1918, p. 17

Different Wage Systems (Les différents systèmes de salaires). Métallurgie, no. 12, Mar. 19, 1919, pp. 649-650, 5 figs. Different wage systems; relation of wage system to effective production. (Continuation of serial).

WOMEN. Women in the Industry, George H. Priest. Gas Indus., vol. 19, no. 3, Mar. 1919, pp. 73-75. Results from questionnaire sent out to 38 gas works.

LEGAL

BOILER LEGISLATION, LOW-PRESSURE. Low-Pressure Boiler Legislation. Official Bul. Heating & Piping Contractors Nat. Assn., vol. 26, no. 3, Mar. 1919, pp. 26-28. Quotes a number of bills now pending before legislatures of several states.

BUILDING CONTRACTS. The Building Contract of the Future, Sullivan W. Jones. Jl. Am. Inst. Architects, vol. 7, no. 3, Mar. 1919, pp. 119-122. Analysis of various forms of existing contracts and suggested changes in policy on building loans. From address before Inst. Elec. Contractors.

DISABILITY. Disability Under the Compensation Acts — I, II, III, Chesla C. Sherlock. Am. Mach., vol. 50, nos. 10, 11 and 13, Mar. 6, 13 and 27, 1919, pp. 445-448, 499-502 and 597-599. Court decisions in casesi nvolving temporary disability.

LIGHTING

GAS LIGHTING. Modern Gas Lighting, Philmer Eves. Gas Indus., vol. 19, no. 3, Mar. 1919, pp. 70-72. Practice in churches, public buildings, etc.

ILLUMINATION INTENSITY. Industrial Illumination, Geo. K. McDougall. Jl. Eng. Inst. Can., vol. 2, no. 3, Mar. 1919, pp. 210-215, 8 figs. Review of general information on subject and data of foot-candle intensity for various classes of work.

LIGHTING AND PRODUCTION. Four Conclusive Tests of Production Value of Good Factory Lighting. Elec. Rev., vol. 74, no. 12, Mar. 21, 1919, pp. 449-451, 4 figs. Details of tests conducted by Testing Department of Commonwealth Edison Company. Average increase of production ranges from 10 to 20 per cent.

RECONSTRUCTION AND EXPORT TRADE

BELGIUM. Reconstruction in Belgium. Times Eng. Supp., vol. 15, no. 532, Feb. 1919, p. 69. Requirements in tools; disorganization of transport; problem of labor.

COAL TRADE. American Opportunities in the Foreign Coal Trade. Coal Age, vol. 15, no. 11, March 13, 1919, pp. 486-488. From Colliery Guardian.

ELECTRICAL GOODS. Electrical Competition in Foreign Markets, Joseph M. Goldstein. Elec. World, vol. 73, no. 10, Mar. 8, 1919, pp. 468-471, 2 figs. How the industry in the United States may compete with Allegemeine Elektrizitaets-Gesellschaft of Berlin, which, it is asserted, has dominated the world.

Electrical Goods in Japan. Jl. Electricity, vol. 42, no. 6, Mar. 15, 1919, pp. 266-267. Possibilities of American trade.

FINANCIAL ASPECT OF RECONSTRUCTION. The Problem of Reconstruction. Southwestern Elecn., vol. 14, no. 11, Jan. 1919, pp. 14-16. Financial aspect of problem.

FRANCE. The Problem of Rebuilding the Devastated Regions of France, Jaen-Paul Alaux. Jl. Am. Inst. Architects, vol. 7, no. 3, Mar. 1919, pp. 115-117. Visualization of extent of reconstruction work to be required.

GREAT BRITAIN. Reconstruction in Great Britain Following the War, H. Babington Smith. Sci. Monthly, vol. 8, no. 4, Apr. 1919, pp. 298-305. Problems of demobilization, vocational instruction of soldiers, and disposal of property in reserve for military purposes.

LATIN AMERICA. Some Agencies in the Development of Closer Relations with the Countries of Central and South America, L. S. Rowe. Sci. Monthly, vol. 8, no. 4, Apr. 1919, pp. 320-322. Effectiveness of international organization based on moral and cultural ties between nations.

Market for Electrical Goods in South America — II, Philip S. Smith. Elec. World, vol. 73, no. 10, Mar. 8, 1919, pp. 479-481. Notes on Bolivia, Ecuador and British Guiana; résumé of South American conditions as a whole; list of central stations in Chile, Urguay, Ecuador and Peru.

NEW ENGINEERING INDUSTRIES (ENGLAND). New Engineering Industries. Chem. News, vol. 118, no. 3070, Feb. 14, 1919, pp. 80-81. Report of Committee of Ministry of Reconstruction, appointed to compile list of articles (suitable for manufacture by those with engineering trade experience) not made in United Kingdom before war.

RAILWAY BUYING. Railway Buying and Industrial Readjustment, E. B. Leigh. Ry. Age, vol. 64, no. 14, Apr. 4, 1919, pp. 879-881, 1 fig. Shows relation of railway purchases to general business conditions. Address delivered before Natl. Indus. Conference Board.

UNION OF INTERNATIONAL ASSOCIATIONS. International Associations and After-War Constructions (Les associations internationales et la reconstruction de l'aprèsguerre), Paul Otlet. Revue Générale des Sciences, no. 4, Feb. 28, 1919, pp. 114-119. Work done by the Union of International Associations organized in 1910. Probable future relations of the Union with Science and Industry.

SAFETY ENGINEERING

ACCIDENT PREVENTION. The Limits of Accident Prevention. Eng. & Indus. Management, vol. 1, no. 5, Mar. 13, 1919, pp. 139-141, 3 figs. Study of accident causes in iron and steel industry based on statistical reports.

The Economies of Safety, Lew R. Plamer. Sci. Mountly, vol. 8, no. 4, Apr. 1919, pp. 350-355, 2 figs. Plant management in relation to accident prevention. As illustration organization of Safety Dept., U. S. Steel Corp., is quoted.

ELEVATOR ACCIDENTS. Elevator Accidents and Their Causes, William J. Picard. Safety Eng., vol. 37, no. 3, Mar. 1919, pp. 117-123, 8 figs. Statistical charts and data.

Increasing Cage Safety, Thomas Price. Coal Age, vol. 15, no. 13, Mar. 27, 1919, p. 570, 2 figs. Scheme for attaching two ropes to each cage, either one of which is capable of sustaining load.

FIRE DOORS AND SHUTTERS. Covering Fire Doors and Shutters — I. Metal Worker, vol. 91, no. 13, Mar. 28, 1919, pp. 395-397 and 399, 16 figs. Infromation on size of sheets to use, method of notching and bending locks, etc., in conformance with underwriters' regulations.

STATISTICS OF ACCIDENTS. Statistics in Accident Prevention, Evelyn M. Davis. Elec. World, vol. 73, no. 10, Mar. 8, 1919, pp. 476-477, 1 fig. Analysis of 1172 cases during two-year period giving data on days lost and division of cost.

Industrial Accidents in the United States Iron and Steel Industry. Engineering, vol. 107, no. 2771, Feb. 7, 1919, pp. 164-167, 7 figs. Statistics giving frequency and severity of accidents.

SALVAGE

MOTOR SHELLS. Saving Motor Shells from the Scrap Heap by Welding. Elec. Ry. Jl., vol. 53, no. 12, Mar. 22, 1919, pp. 581-586, 15 figs. Different steps in thermit method of welding motor shells as used by large electric-railway system; suggestions for relining crucibles and keeping welding tools in proper repair.

TOOL-STEEL SCRAP. Reclaming High-Speed Steel Scrap, Edwin F. Cone. Iron Age, vol. 103, no. 13, Mar. 27, 1919, pp. 805-808, 6 figs. Detection and sorting of steel scrap from nature of sparks from special grinding wheel.

WAR MATERIAL. Salvage of War Material. Times Eng. Supp., vol. 15, no. 532, Feb. 1919, p. 70. Organization and research.

WASTE OF INDUSTRIAL MATERIALS. Common Wastes of Industrial Materials, H. E. Howe. Indus. Management, vol. 57, no. 4, Apr. 1919, pp. 303-307. Suggestions in regard to elimination of waste.

TRANSPORTATION

CRATING. Crating Automobiles for Export, J. H. Teagan. Automotive Industries, vol. 40, no. 11, Mar. 13, 1919, pp. 570-571, 4 figs. Combining security with minimum waste of space.

LIGHT AS AID TO TRANSPORTATION. Light as an Aid to the Transportation of Material, A. L. Powell and R. E. Harrington, Tran. Illum. Eng. Soc., vol. 14, no. 1, Feb. 10, 1919, pp. 1-17 and (discussion) pp. 17-23. Argues that proper lighting of stations, warehouses and piers increases their capacity which depends on speed with which material moves through them.

MINE CARS. Standardized Wagon Designs, J. R. Bazin. Colliery Guardian, vol. 117, no. 3037, Mar. 14, 1919, p. 595. Buffing and drawgear; wheels and axles; axle guards; brakes; body work. Paper read before Inst. Locomotive Engrs.

RURAL TRANSPORT. Rural Transport. Times Eng. Supp., vol. 15, no. 532, Feb. 1919, pp. 67-68. Suggestions being put forward to effect their inprovement.

SHOP HAULAGE. Shop Haulage System of New Design. Iron Trade Rev., vol. 64, no. 12, Mar. 20, 1919, pp. 760-763, 13 figs. Geometric principle employed to enable cars to trail correctly and turn sharp corners without tracks; hauling unit is tractor capable of pulling 15 trucks.

Industrial Electric Tractors (Chariots transporteurs électriques pour manutention), Jacques Deschamps. Revue Générale de l'Electricité, vol. 5, no. 5, Feb. 1, 1919, pp. 171-174, 6 figs. Describes various types and their uses, also the Edison accumulator with which industrial tractors are usually operated.

TRUCK TRANSPORTATION. Concrete Material for Army Base Hauled by Motor Trucks. Eng. News Rec., vol. 82, no. 8, Feb. 20, 1919, pp. 366-368, 4 figs. Analysis of truck performance and delivery cost. Equipment considered was utilized for stevedoring and haulage at South Brooklyn supply unit.

Economical Motor Transport. Iron Age, vol. 103, no. 11, Mar. 13, 1919, pp. 693-694, 1 fig. Experience in operation by large organization employing trucks in freight haulage.

ZONING. Industrial Zoning, Herbert S. Swan. Am. Architect, vol. 115, no. 2258, Apr. 2, 1919, pp. 500-503. Considers method of formulating zoning ordinance and of laying out several business and factory districts, in order to remove congestion in transportation.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

ELECTROLYTES. The Effect of Some Simple Electrolytes oil the Temperature of Maximum Density of Water, Robert Wright. Jl. Chem. Soc., vols. 115 and 116, no. 676, Feb. 1919, pp. 119-126, 1 fig. Reported from experiments that lowering of temperature produced by highly ionized binary electrolyte is composed of two separate, independent effects, one due to acid radical and other to basic radical of electrolyte.

Electrolytic Dissociation, S. Arrhenius. Chem. News, vol. 118, no. 3069, Feb. 7, 1919, pp. 61-64. Discussion of analytical-chemistry explanation of dissociation.

Electrolytic Conductivity in Non-Aqueous Solutions, Henry Jermain Maude Creighton. Jl. Franklin Inst., vol. 187, no. 3, March 1919, pp. 313-318. Results of measurements in 13 solvents are discussed with reference to viscosity, degree of association and dielectric constant of solvent.

ELECTROPLATING. Electro-Plating on Iron from Copper Sulphate Solution, Oliver P. Watts. Gen. Meeting Am. Electrochem. Soc., Apr. 3-5, 1919, paper 7, pp. 61-69. Arsenic antimony, bismuth, lead and tin dipping solutions were tried. Arsenic, lead and antimony solutions said to be effective in securing a good subsequent electroplating of copper. Bismuth was electro-deposited on iron using a preliminary arsenic or antimony dip, and nickel on alumimun by using a ferric chloride dipping solution.

Remarkahle Pitting of Electroplating, Oliver P. Watts. Gen. Meeting Am. Electrochem. Soc., Apr 3-5, 1919, paper 5, pp. 51-53, 1 fig. Study of irregular pitting in some lead platings led writer to attribute it to air dissolving in electrolyte while it was resting over night and cooling, which was then expelled as minute air bubbles on work when hath was heated up by passage of current.

STORAGE BATTERIES. Chemical Phenomena in Lead Storage Batteries (Recherches sur le fonctionnement chimique de l'accumulateur au plomb), Ch. Féry. Bulletin de la Société Française des Electriciens, vol. 9, no. 77, Feb. 1919, pp. 85-96. Study of what are termed inconsistencies of double-sulphate theory in the light of lows of electrolysis. Also in Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 1, Jan.-Feh. 1919, pp. 92-98.

ELECTROPHYSICS

A. C. WAVES, HARMONICS. Direct Harmonic Analysis of Alternating Current Waves by Mechanical or Electrical Resonance (Sur l'analyse harmonique directe de l'onde des courants alternatifs par résonance mécanique ou électrique), André Blondel. Annales de Physique, series 9, vol. 10, Nov.- Dec. 1918, pp. 195-354, 47 figs. Starting out to measure current measurement of tension is effected hy hranching apparatus to terminals of non-inductive rheostat placed in series in circuit. Writer states that in harmonic analysis mechanical resonance of vibrating galvanometer is less subject to errors than electrical resonance method.

ARC ELECTRODES, TEMPERATURE OF. Temperature of Arc Electrodes (Détermination de la température aux électrodes de l'arc), A. Hagenbach and K. Langhein. Archives des Sciences Physiques et Naturelles, year 124, vol. 1, Jan.-Feb. 1919, pp. 48-54. Experiments apparently show that anodes of metallic arcs (Ag, Cu, Fe, Ni, W) become heated to ebullition temperature hut not the cathodes; when oxidation of metal has taken place, temperature rises to ebullition temperature of metallic oxide.

CIRCUITS. Properties of Electrical Circuits Considered as Having No Resistance (Sur les propriétés des circuits électriques dénués de résistance), G. Lippman. Revue Générale de l'Electricité, vol. 5, no. 5, Feb. 1, 1919, pp. 163-165. Advantages of disregarding resistance in establishing general laws of electric action in long circuits. Writer concludes that the laws thus established are static laws. Before the Académie des Sciences. Also in Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 2, Jan. 13, 1919, pp. 73-78.

CABLE, ARMORED. Effective Resistance, Impedance of Self-Induction and Losses of Power in a Single-Phase Armored Cable (Etude de la résistance effective, de l'impédance de la self-induction et des pertes de pusisance dans un câble armé monophasé), R. Bouzon. Revue Générale de l'Electricité, vol. 5, no. 11, Mar. 15, 1919, pp. 403-404, 4 figs. Indicates that variations of these quantities in a cable armored with steel covering are due to magnetization of steel and therefore cease when saturation is attained. It is thus that hysteresis losses are separated from losses due to Foucault currents and Kelvin effect.

Influence of Insulation on the Effective Resistance and Reactance of Cable Armored for Third Harmonics (Sur l'influence de l'enveloppe sur les résistance et réactance effectives d'un câhle armé pour les harmoniques 3), R. Swyngedaun. Revue Générale de l'Electricité, vol. 5, nos. 5 and 8, Feh. 1 and 22, 1919, pp. 165-166 and 283-284. Experiments on similar cahles, with and without insulation. Feh. 22; Results of tests made on eables havin three conductors. Also in Comptes rendus des séances de l'Académie des Sciences, vol. 168, nos 2 and 4, Jan. 13 and 27, 1919, pp. 87-88 and 230-232.

ELECTROLYTIC SAFEGUARDS AGAINST OVERCHARGE. Electric Discharge on the Surface of a Solid Electrolyte, Was. Sulejkin. Phys. Rev., vol. 13, no. 3, Mar. 1919, pp. 197-208, 5 figs. Theory of electrolytic safeguards against overtension; dependence of value of critical tension upon the concentratiou of the electrolyte for different solutions; photomicrographs; behavior of aluminum anode up to critical tension explained.

HARMONICS. The Determination of Harmonics in Circuits, F. T. Iddings. Elec. World, vol. 73, no. 11, March 15, 1919, pp. 525-526, 1 fig. Method of determining harmonics in alternating-current power circuit which cause inductive interference with a telephone.

OVERHEAD LINES. Electrical Constants of Overhead Lines (Costanti elettriche per il calcolo delle condutture aeree), Renzo Norsa. Elettrotecnica, vol. 5, no. 33 Nov. 25, 1919, pp. 470-477, 10 figs. Diagrams and tables showing values of resistance, impedance and reactance of various circuits.

POLYPHASE CURRENTS. Theory of Polyphase Currents (Théorie des Courants polyphasés), Philippe Banneux. Société Belge des Electriciens, vol. 32, 1915-1916, 1917-1918, pp. 11-91, 8 figs. Generalization of principles involved in investigations with two-phase and three-phase currents. A trigonometric series which permits addition of sines of arcs in arithmetical progression hetween any two limits is introduced in computatious and expressions for electrical quautities are thereby developed.

SELECTIVITY OF CIRCUITS. Process and Device for Increasing the Selectivity of Electric Circuits (Procédé et dispositifs pour accroitre la sélectivité des circuits électriques), M. I. Pupin and E. H. Armstrong. Revue Générale de l'Electricité, vol. 5, no. 7, Feh. 15, 1919, pp. 270-274, 10 figs. No. 485533 and 20499. Object is to increase selectivity of circuits which are the seat of periodically variable electric vihrations, particularly of radio-telegraphic installations.

VACUUM VALVES. Schemes and Brief Description of Apparatus Using the Emission of Electrons from a Hot Filament (Schémas et description sommaire des appareils utilisant l'émission d'électrons provenant d'un filament chaud). Revue Générale de l'Electricité, vol. 5, no. 9, Mar. 1, 1919, pp. 332-334, 6 figs. Describes kenotron, tungar, pliotron, audions, dynatron, pliodynatron and other apparatus.

WEHNELT TUBE. The Relation of Potential Distribution to Hysteresis Effect in the Wehnelt Tube, R. A. Porter. Phys. Rev., vol. 13, no. 3, Mar. 1919, pp. 189-196, 7 figs. Three stages in discharge of vacuum tube with CaO cathode identified and potential distribution curves for one pressure and heating current are obtained for each stage.

FURNACES

AIR-TIGHT FURNACES. English Electric Furnace Developments, F. J. Moffett Blast Furnace & Steel Plant, vol. 7, no. 4, Apr. 1919, pp. 169-170. On high efficiency and high temperature possibilities and reduction of heat losses by air-tight furnances.

ARC FURNACES. Development of the Electric Arc Furnace (Perfezionamenti nei forni elettrici ad arco), E. Thovez. Elettrotecnica, vol. 5, no. 33, Nov. 25, 1918, pp. 477-481, 3 figs. History of various types, particularly Héroult and Bassanese.

STEEL FURNACES. Iron and Steel Electric Furnaces, J. Bibby. Electrical Review, vol. 84, no. 2150, Feb. 7, 1919, pp. 166-167, 2 figs. Writer advocates single arc for steel making. (Continuation of serial). Before Manchester Assn. Engrs.

UNIFORMITY TEMPERATURE. Temperature Uniformity in an Electric Furnace. John F. Ferguson. Chem. & Metallurgical Eng., vol. 20, no 6, March 15, 1919, pp. 283-288, 9 fig. Method of manufacturing laboratory electric furnaces producing uniform temperature from end to end of core.

GENERATING STATIONS

ALTERNATORS IN PARALLEL. Operation of Alternators Connected in Parallel (Etude sur la marche en parallèle des alternateurs), M. de Marchena. Bulletin de la Société Française des Electriciens, vol. 9, no. 76, Jan. 1919, pp. 17-42, 2 figs. Study of conditions under which existing theories, specially the researches of Cornu. Blondel and Boucherot are applicable. Also in Revue Générale de l'Electricité, vol. 5, no. 11, Mar. 15, 1919, pp. 405-415, 2 figs.

CANADA. Statistical Analysis of the Central Electric Stations of Canada. Power, vol. 49, no. 9, March 4, 1919, pp. 309-310. Figures showing amounts of power, capital iuvested, salaries and wages paid, with data on hydroelectric power.

CENTRAL STATIONS IN WEST. Data on Central Stations in the West. Jl. Electricity, vol. 42, no. 5, Mar. 1, 1919, pp. 215-216. Figures issued hy Bur. of Census, on central electric light and power stations in New Mexico, Oregon, Nevada and Utah.

HYDROELECTRIC PLANT. A Small Hydroelectrie Installation, E. P. Hollis. Min. Mag., vol. 20, no. 3, Mar. 1919, pp. 148-149, 2 figs. Plant recently laid down in Yorkshire.

NEW SOUTH WALES. Bulk Supply of Electricity. Commonwealth Engr., vol. 6, Jan. 1, 1919, pp. 185-186. Industrial development at Newcastle, N. S. W.

NEW ZEALAND. Hydro-Electric Power in New Zealand. Commonwealth Engr., vol. 6, no. 6, Jan. 1, 1919, pp. 183-184. Scheme of hjdroelectric development of North Island, involving expenditure of $67,500,000.

GENERATORS AND MOTORS

ARMATURES. Design of Small Direct-Current Armatures, C. R. Wylies. Elec. World, vol. 73, no. 12, Mar. 22, 1919, pp. 571-575, 8 figs. Methods of designing small armatures based upon both test data and theory developed for larger machines.

ASYNCHRONOUS MACHINES. Asynchronous Generators and Converters (Generatrici asincrone e macchine convertitrici), Luigi Lombardi. Elettrotecnica, vol. 6, no. 6, Feb. 25, 1919, pp. 110-114, 1 fig. Characteristic curves of Gadda converters. (Continued).

BALL BEARINGS. The Use of Ball Bearing for Electrical Machinery, H. M. Trumbull. Can. Machy, vol. 21, no. 2, Jan. 9, 1919, pp. 35-38, 12 figs. Argues that ball bearings euable builder to use smaller air gap and enhance efficiency of machines.

COMMUTATION. Phonemena of Commutation (Phénomènes de la commutation), J. Bezalman. Société Belge des Electriciens, vol. 31, Aug.-Dec. 1914, pp. 599-632, 14 figs. Experimental determination of impedance of section fordrum drum armature and its mutual induction with neighhoring sections and the fieldmagnets, under varicus conditions; oscillograms showing shane and simultaneous values of tension betweeu sections and current under hrushes, for various arrangements of brushes and under different ratios b/B.

COOLING OF MOTORS. Cooling of Electric Motors, with Special Reference to Totally-Enclosed Machines, P. A. Mossay. Tran. Min. Inst. Scotland, vol. 40, part 8, 1918-1919, pp. 163-175 and (discussion) pp. 175-177, 13 figs. Classifies and discusses efficiency of (a) cooling-devices external to totally enclosed motor; and (b) self-contained cooling devices. Writer prefers totally enclosed type, of motor for work in mines and chemical factories.

D. C. GENERATORS. Causes of Direct-Current Generators Failing to Build Up Their Voltage, Robin Beach. Power, vol. 49, no. 14, Apr. 8, 1919, pp. 519-521, 5 figs. Mentions various couses why a machine may fail to come up to voltage and proposes remedies.

Effect of Interpoles on Commutation of Direct-Current Machines, R. L. Witham. Power, vol. 49, no. 9 and 10, Mar. 4 and 11, 1919, pp. 303-305 and 358-360, 15 figs. Purpose of interpoles and how they operate to effect commutation. Mar. 11; influence of interpoles on voltage of generators, and on speed of motors.

D. C. MOTORS. The Influence of the Distribution of Losses on the Efficiency Curves of a Continuous Current Motor, Thomas Carter. Elecn., vol. 82, nos. 9 and 10, Feb. 28 and Mar. 7, 1919, pp. 247-249 and 275-277, 8 figs. Graphs of maximum efficiency and corresponding input and output against k, with various percentages of full load efficiency. Mar. 7: Maximum output which can be got from a motor and values of input and efficiency at which it occurs. (Concluded).

The Emcol D. C. Motors. Electrical Review, vol. 84, no. 2153, Feb. 18, 1919, pp. 250-251, 3 figs. General features arrangement of air circulation, and temperature-rise curves of 50-hp. motor.

High Frequency Alternators. High Frequency Alternators (Les alternateurs à haute fréquence), Marious Latour. Bulletin de la Société Française des Electriciens, vol. 9, no. 77, Feb. 1919, pp. 97-114, 18 figs. Design characteristics of machines capable of furnishing directly, without supplementary transformers, the electromotive force necessary for feeding antennæ in wireless telegraphy.

Induction Motors. Speed Regulation of Induction Motors Coupled in Cascades. (Réglage de la vitesse des moteurs d'induction par couplage en cascade), G. Darrieus. Revue Générale de l'Electricité, vol. 5, no. 7, Feb. 15, 1919, pp. 257-265, 13 figs. Survey of present designs. Suggestions to develop a more general process.

Reconnecting Induction Motors, A. M. Dudley. Power, vol. 49, no. 11, March 18, 1919, pp 393-396, 6 figs. Summary of principles brought out in a series of thirteen articles by writer.

Mill Motors. Live Roller Motors in Steel Works, W. W. Wood. Electrician, vol. 82, no. 10, Mar. 7, 1919, pp. 269-272, 4 figs. Graphs of tests made on small mill motors without ingots on the rollers and of approximation for calculating heating effect for large mill motor. From Magnet Mag.

Large Motors for Reversing Mills. Iron & Coal Trades Rev., vol. 98, no. 2663, Mar. 14, 1919, p. 311, 2 figs. Reversing mill motors of Siemens Brothers, Dynamo Works, Ltd.; with peak load of 19,000 hp. Also in Electn. vol. 82, no. 2130, Mar. 14, 1919, pp. 302-303, 4-figs.

Nomenclature. Motors for Electric Installations (Motors primaires pour installations électriques), Société Belge des Electriciens, vol. 31, Aug.-Dec. 1914, pp. 636-643, 7 figs. Hydroelectric Nomenclature proposed by the Commission Electrotechnique Internationale.

Turbo-Alternators. The Determination of the Efficiency of the Turbo-Alternator, S. F. Barclay, and S. P. Smith. Engineering, vol. 107, no. 2775, Mar. 7, 1919, pp. 322-326, 11 figs. Attempting to introduce method for establishing alternator efficiency based on mesurement of actual losses on load. Writer shows that actual losses on load can be deduced from measurements of cooling air flowing to alternator. Paper read before Instn. Elec. Engrs.

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LIGHTING AND LAMP MANUFACTURE

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Hotels. Illumination Notes. Hotel Rooms, W. F. Little and A. C. Dick. Tran. Illum. sEng. Soc., vol. 14, no. 1, Feb. 10, 1919, pp. 45-52, and (discussion) pp. 52-59. Survey of light intensities in rooms of Twelve New York City hotels. Data and measurements given in tabular forms.

Incandescent Lamp Manufacture. Present Status of the Industry of Incandescent Lamps (Etat actuel de l'industrie des lampes à incandescence), A. Larnaude. Houille Blanche, no 23-24, Nov.-Dec., 1918, pp. 356-357. Abstract from communication presented before Société Internationale des Electriciens.

Legislation. Report of Committee on Lighting Legislation, L. B. Marks. Tran. Illum. Eng. Soc., vol. 13, no. 9, Dec. 30, 1919, pp. 524-527, Digest of laws on illumination.

Nomenclature. Report of the Committee on Nomenclature and Standards of the Illuminating Engineering Society for the Year 1918. Tran. Illum. Eng. Soc., vol. 13, no. 9, Dec. 30, 1919, pp. 512-523. New and revised symbols, coefficients and definitions.

Searchlights. Searchlights, Hugh M. Gooly. Electrical Review, vol. 84, no. 2153. Feb. 28, 1919, pp. 227-228, 3 figs. Notes on the various designs of projector and control gear.

Spherical Candlepower. Apparatus for the Determination of the Spherical Candlepower of a Source of Light, J. Sahulka. Elecn., vol. 82, no. 2128, Feb. 28, 1919, pp. 255-256, 2 figs. Apparatus intended to simplify usual method by obviating necessity of constructing Rousseau curve. From Elektrotechnische Zeitschrift.

Standards. Illumination and Some of Its Fundamental Considerations, H. A. Tinson. Tran. South African Instn. Elec. Engrs., vol. 9, part 11, Dec. 1918, pp. 192-198. Standards of exterior and interior illumination for various buildings, roadways, thoroughfares, etc.

Street Lighting. Street Lighting in a City of Average Size, C. D. Gray and E. Hagenlocher. Elec. World, vol. 73, no. 12, Mar. 22, 1919, pp. 575-578, 6 figs. Features of ornamental system installed at South Norwalk, Conn., said to be operated with low maintenance expense.

Tungsten Lamps. Characteristic Equations of Tungsten Lamps and Their Application to the Heterochromous Photography. (Equations caractéristiques des lampes à filament des tungstène et leur application à la photométrie hétérochrome), G. W. Middlekauff and J. F. Skogland. Revue Générale de l'Electricité, vol. 5, no. 7, Feb. 15, 1919, pp. 252-256. Investigation conducted by the Bureau of Standards concerning comparison of standards. From Scientific Papers of the Bureau of Standards.

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Lines. Note on the Tests and Measurements of Electrical Lines (Note sur les essais et mesures relatifs aux lignes électriques), L. Mouchard. Revue Générale de l'Electricité, vol. 5, no. 9, Mar. 1, 1919, p. 352, 1 fig. Arrangement suggested in L. Puget's scheme given in R. G. E. Oct. 19, 1918, pp. 563-565, to eliminate ϵ, which is not considered in that scheme.

Magnetic Testing. Frequency of Current Reversals in Magnetic Testing, A. W. Smith. Mich, Technic, vol. 31, no. 1, Mar. 1918, pp. 18-24, 3 figs. Effect of various methods for demagnetization.

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Repairmen's Testing Apparatus. Curing Electric Troubles. Motor Age, vol. 35, no. 12, Mar. 20, 1919, pp. 22-24, 11 figs. General testing apparatus for repairmen.

Transformers, Instrument. Field Testing of Instrument Transformers, H. M. Crothers. Elec. World, vol. 73, no. 11, March 15, 1919, pp. 516-519, 2 figs. Experiences with the Agnew method are said to have shown it to be valuable for tests conducted at place of installation.

POWER APPLICATIONS

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Difficulties in Electric House Heating, Joseph F. Merrill. Jl. Electricity, vol. 42, no. 5, Mar. 1, 1919, pp. 212-214. Figures showing comparative cost of central steam heating and electric heating. Writer concludes electric house heating is not a practicable load for the average power company.

Principles of Inductive Heating With High Frequency Currents, E. F. Northrup. Gen. Meeting Am. Electrochem. Soc., Apr. 3-5, 1919, paper 8, pp. 71-159, 29 figs. Theory of this method of heating and accounts of methods employed and actual results obtained in tests and experiments conducted at Palmer Phys. Lab., Princeton Univ.

Hospital. Some Electrical Features of New San Francisco Hospital. Elec. Rev., vol. 74, no. 13, Mar. 29, 1919, pp. 493-496, 5 figs. Municipal institution with power plant, silent-call signals, electric elevators, electric clocks, modern laundry and kitchen equipment electrotherapeutic and laboratory apparatus, etc.

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Paper Making. Making Paper by Electricity. Jl. Electricity, vol. 42, no. 6, Mar. 15, 1919, pp. 260-261, 3 figs. Outline of reservoir, penstock and power plant.

Quarrying. Quarrying and Working Stone by Electricity. Stone, vol. 40, no. 3, Mar. 1919, pp. 120-122, 2 figs. Detail of Westinghouse quarry equipment.

Steel Plants. Electric Steel Plant; Features of Plant Design, W. F. Sutherland. Can. Machy., vol. 21, no. 10, Mar. 6, 1919, pp. 225-228, 8 figs. Layout of electrical apparatus in a large electric-steel plant.

STANDARDS

Lightning Rods. New Standards of the Swiss Association of Electricians (Les nouvelles normes de l'association suisse des électriciens), S. Frid. Industrie Electrique, vol. 28, no. 640, Feb. 25, 1919, pp. 72-73. Relates to installation and maintenance of lightning rods.

Polyphase Voltages. The Standardisation of Polyphase Voltages, R. Rudenberg. Elecn., vol. 82, no. 10, Mar. 7, 1919, pp. 272-273, 2 figs. Comparison of rcent suggestions for standardized voltages. From Elektrotechnische Zeitschrift, Nov. 24, 1918.

TELEGRAPHY AND TELEPHONY

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Vacuum-Tube Amplifiers, MacC. Batsel. Elec. World, vol. 73, no. 12, Mar. 22, 1919, pp. 568-570, 9 figs. Detection by use of vacuum-tube amplifiers of weak telegraphic ground currents and stray telephonic currents.

Antenna. Note on the Fundamental Wave and the Harmonics in a Homogenous Antenna and also a Non-Homogenous Antenna (Note sur l'onde fondamentale et les harmoniques dans une antenne homogène et dans une antenne non homogène), L. Dubar. Revue Générale de l'Electricité, vol. 5. no. 8, Feb. 22, 1919' pp. 284-289, 5 figs. Conclusions of the question derived on article R. G. E., vol. 4, no. 11, Sept. 14, 1918, p. 363.

Call Letters. International Wireless Administration. Wireless World, vol. 6, no. 71, Feb. 1919, pp. 609-610. Suggestion in regard to allocation of station call letters.

Direction Finders. Radio Direction-Finding Apparatus, A. S. Blatterman Elec. World, vol. 73, no. 10, Mar. 8, 1919, pp. 464-467, 11 figs. Use of loop antanna in guiding airplane flight and general principles affecting design of receiving loops.

Field Stations. Recent Development is Field Station Apparatus. Wireless World, vol. 6, no. 72, Mar. 1919, pp. 656-662, 7 figs. Technical details of damped and continuous wave transmitters and receivers.

FIRES. Fires Caused by Hertzian Waves (Incendies provoqués par les ondes hertziennes), Georges Le Roy. Génie Civil, vol. 74, no. 7, Feb. 15, 1919, pp. 133-134, 1 fig. Industrie Electrique, vol. 28, no. 640, Feb. 25, 1919, pp. 78-79, and Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 4, Jan. 27, 1919, pp. 224-227, 1 fig. Specially constructed Hertzian resonator with which writer studied possibilities of fire being produced by wireless waves traversing iron bodies accidentally disposed in form of resonator.

GERMAN. German Wireless in Metz. Wireless World, vol. 6, no. 72, Mar. 1919, pp. 672-675, 6 figs. Particulars of a captured enemy installation.

HELIOGRAPH. Donath Electric Signaling Mirror (Miroir de signalisation électrique du Docteur Donath). Société Belge des Electriciens, vol. 31, Aug.-Dec. 1914, pp. 633-635, 3 figs. Morse signals sent out by periodic lighting and extinction of electric lamp provided with reflector, which it is said, permit message to be sent to distance of 7 km.

LAND SETS. Continuous-Wave Land Radio Sets, Paul T. Weeks and Donald G. Little. Elec. World, vol. 73, no. 13, Mar. 29, 1919, pp. 627-630, 7 figs. It is claimed that present development in radio-telegraphy points to usefulness of continuous-wave sets on account of freedom from interference.

MARCONI EQUADOR STATION. Equatorial Wireless, P. Eisler. Wireless World, vol. 6, no. 72, Mar. 1919, pp. 649-653, 5 figgs. Equatorial wireless and Marconi station erected at Sta. Elena, Ecuador.

MILITARY RADIO. Military Radio Communication, A. D. Cameron. Elec. World, vol. 73, no. 11, March 15, 1919, pp. 521-525, 3 figs. Organization of a wireless telephone and telegraph system of the signal corps.

NORWEGIAN STATIONS. Great Wireless Stations of the World, Julius Galster. Wireless World, vol. 6, no. 71, Feb. 1919, pp. 591-595, 6 figs. Norwegian radio station.

PHOTOGRAPHS. The Design and Construction of Apparatus for the Wireless Transmission of Photographs. Wireless World, vol. 6, no. 72, Mar. 1919, pp. 685-690, 16 figs. Details of the various apparatus used. (Continuation of serial).

POULSEN SYSTEM. Poulsen System of Radiotelegraphy (Il sistema di radiotelegrafia "Poulsen"), G. Pession. Elettrotecnica, vol. 6, no. 7, Mar. 5, 1919, pp. 126-134, 18 figs. System is based on property of electric arc to determine electrical oscillations in circuit comprising capacity and self-inductance.

RECEIVERS. Super-Sensitive Receivers. Wireless World, vol. 6, no. 71, Feb. 1919, pp. 598-600, 2 figs. Types 50 and 55 evolved by Marconi Company.

TELEGRAPHS. Ground Telegraphy in the World War, Willis L. Winter. Jl. Electricity, vol. 42, no. 5, Mar. 1, 1919, pp. 210-211, 3 figs. Principles of ground telegraphy and conditions of operation.

TELEPHONES. The Sonority of Telegraph and Telephone Lines and a New Type of Damper (La Sonorita dei Fili telegrafici e telefonici e un nuovo tipo di sordina). Elettricista, vol. 8, no. 4, Feb. 15, 1919, pp. 25-28, 7 figs. Instrument which grips hanging wire at predetermined point in its length.

System Protecting Telephone Lines Against Trolley Wires (Los sistemas de proteccion contra la caida de los hilos telefonicas sobre las lineas de los tranvias eléctricos), Eng. Aigouy. Energia Eléctrica, vol. 21, no. 2, Jan. 25, 1919, pp. 17-20. Answers to questionnaire sent out to railway companies by International Union of Brussels. (To be continued). From Electricien, Paris.

Cricuits with Zero Mutual Induction, William W. Crawford. Telephony, vol. 76, no. 13, Mar. 29, 1919, pp. 15-18, 11 figs. Reduction of inductive interference in telephone circuits; forms of constructions and calculations and tentative design for greatest refinement of balance against induction. Paper before Am. Inst. Elec. Engrs.

The Multiple Interurban Telephone of Strassburg (Le multiple téléphonique interurbain de Strasbourg). Revue Générale de l'Electricité, vol. 5, no. 9, Mar. 1, 1919, pp. 335-339, 2 figs. Schemes of connections and account of construction.

TRANSMITTERS. Radio Transmitters of Synchronous Rotary Spark-Gap Type, Millard C. Spencer. Elec. Rev., vol. 74, nos. 12 and 13, Mar. 21 and 29, 1919, pp. 456-458 and 409-499, 11 figs. Theory of simple transmitter; diagram of equivalent circuit of radio transmitter; use of Vector diagram for analyzing test results. First and second articles.

UNDAMPED OSCILLATIONS. Undamped Electrical Oscillations of Short Wave Length (Oscillations électriques non amorties de courte longueur d'onde), Gutton and Touly. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 5, Feb. 3, 1919, pp. 271-274, 1 fig. and Revue Générale de l'Electricité, vol. 5, no. 11, Mar. 15, 1919, pp. 415-416, 1 fig. Apparatus developed at laboratories of military radio-telegraphy, while examining application of lamp-valves with three electrodes for the generation of long waves employed in wireless telegraphy.

VACUUM BULB. On Reading on Mr. Nozoje's "Vacuum Bulb" (in Japanese), T. Kikuchi. Denki Gakkwai Zasshi, no. 367, Feb. 10, 1919.

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

RECTIFIER. An Electro-Magnetic Alternating Current Rectifier, George F. Haller Sci. Am. Supp., vol. 87, no. 2248, Feb. 1, 1919, pp. 76-87, 15 figs. Type designed for construction in amateur laboratory.

TRANSFORMER CONNECTIONS. Transformer Connections for Power Transmission, Gordon Kribs. Power House, vol. 12, no. 3, Mar. 1919, pp. 69-73, 19 figs. Transformer connections in common use and characteristics of resulting circuits.

TRANSFORMER MOUNTING. Standardization of Transformer Mounting, W. C. Blackwood. Elec. World, vol. 73, no. 12, Mar. 22, 1919, pp. 578-581, 9 figs. Tables and drawings specifying methods of hanging and spacing the units mounted on poles or on consumers' premises.

TRANSMISSION, DISTRIBUTION, CONTROL

ELECTRICITY SUPPLY. A New Era in Power Transmission, Louis Bell. Elec. World, vol. 73, no. 13, Mar. 29, 1919, pp. 631-632. Believes that development of water power, establishment of stations at mines and wider interconnection are necessary for proper industrial development of the country for the social betterment of labor.

The Past, Present, and Future of Electricity Supply. Electrical Review, vol. 84, no. 2150, Feb. 7, 1919, pp. 163-165. Problem dealt with on a national basis. Discussion at meeting of Manchester Assn. Engrs.

Projects of Great Distribution Systems of Electrical Energy in Germany, Holland and Sweden (Les projets de création de très grands réseaux de distribution d'énergie électrique en Allemagne, Hollande et Suède). Revue Générale de l'Electricité, vol. 5, no. 9, Mar. 1, 1919, pp. 353-354. Official communication of the French Government.

Electricity Supply at Birmingham. Elec. Rev., vol. 84, no. 2154, Mar. 7, 1919, pp. 255-257, 4 figs. Installation of additional generating plant of two 5000-kw. B.T.H. turbo-alternators.

LINE. Reliability on a Transmission Line (in Japanese), M. Shibuzawa. Denki Gakkwai Zasshi, no. 367, Feb. 10, 1919.

POLES. Extending the Life of Wood Poles, Charles R. Harte. Elec. Ry. Jl., vol. 53, no. 12, Mar. 22, 1919, pp. 554-559, 13 figs. Description of various methods used and discussion of their relative advantages, based on manner in which different preservatives keep out and destroy germs.

POTENTIAL REGULATORS. Compensated-Typo Poteutial Regulators, Arthur H. Ford, Paul E. Mead and Guy W. Thomas. Elec. World, vol. 73, no. 13, Mar. 29, 1919, pp. 620-623, 13 figs. Connections for using compensated potential regulators for power factor aud voltage correction at load; tests to determine dependence of action of regulator upon influence of line constants.

POWER CIRCUITS. Determination of Econmical Power Circuits, P. O. Reyneau. Elec. World, vol. 73, no. 10, Mar. 8, 1919, pp. 471-473, 3 figs. Method of deriving curves showing when two circuits become more economical than one as load increases. Fixed charges are balanced against saving of line loss when new conductors are added.

SUBSTATIONS. A Year of the Automatic Substation at Butte, E. J. Nash. Elec. Ry. Jl. vol. 53, no. 12, Mar. 22, 1919, pp. 565-567, 6 figs. Maintenance cost of first year.

Static Condenser Installation at the Soughton Sub-Station of the Brockton Edison Company, W. A. Forbush. Stone & Webster Jl., vol. 24, no. 3, Mar. 1919, pp. 195-199, 3 figs. How Edison Electric Illuminating Co. solved the problem of feeding new sections in district supplied by system already loaded to capacity.

IGNITION APPARATUS

IGNITION OF GASES. The Ignition of Explosive Gases by Electric Sparks. John David-Morgan. Jl. Chem. Soc., no 675, Jan. 1919, pp. 94-104, 6 figs. Experiments with low-tension sparks under various magnetic conditions.

PLUGS. Tests of Ignition Apparatus, P. M. Heldt. Automotive Industries, vol. 40, no. 11, March 13, 1919, pp. 578-579, 3 figs. Resistance to thermo-craking and shock and gas-tightness of plugs.

Spark Gaps. Sci. Am. Supp., vol. 87, no. 2256, Mar. 29, 1919, p. 198. Suggestions concerning the construction and use of the plugs. From The Auto.

The Operation and Design of Sparking Plugs — II, H. Warren. Automobile Engrs., vol. 9, no. 124, Mar. 1919, pp. 94-97, 24 figs. Details of manufacture of various types.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION. The International Electrotechnical Commission (La comision electrotécnica internacional), German Niebuhr. Boletin de la Asociacion Argentina de Electro-Técnicos, vol. 4, no. 10, Oct. 1918, pp. 840-850, 1 fig. History development and work. (Continuation of serial).

PHYSIOLOGICAL EFFECTS OF CURRENTS. Physiological Ability to Stand Alternating Current of High Frequencies Up to 100,000 Cycles per Second (La tolérance physiologique à l'intensité des courants alternatifs iaissé à la fréquence de 100,000 cycles par seconde), A. E. Kennelly and E. F. W. Alexanderson. Société Belge des Electriciens, vol. 32, 1919-1917-1918, pp. 92-100, 2 figs. Tests are reported as indicating that a person can stand 30 milliamperes at 11,000 cycles and increasigly up to 590 milliamperes at 100,000 cycles between 60 and 11,000 cycles no marked difference was found and from 5 to 30 milliamperes are quoted as expressing general results obtained.

MUNITIONS AND MILITARY ENGINEERING

ABERDEEN ORDNANCE PROVING GROUND. History of the Ordnance Proving Ground—III, F. P. Lindh. Am. Mach., vol. 50, no. 13, Mar. 27, 1919, pp. 607-611, 4 figs. Development of railway artillery, meteorological work and airplane bombing. Concluding article.

CONSTRUCTION DIVISION. The Construction Division of Our Army, George W. Fuller. Eng. News-Rec., vol. 82, no. 9, and 10, Feb. 27 and Mar. 20, 1919, pp. 416-419 and 562-564. Organization and work accomplished. Mar. 20: Details of Organization; plea-for continuance as independent unit of military establishment.

TRAINS, ARMORED. Armored Trains for Coast Defense. Engineer, vol. 127, no. 3294, Feb 14, 1919, pp. 150-162, 6 figs. Engine is in middle of traim, infantry vans on either side of engine, and gun carriage at ends.

ENGINEERING ACTIVITIES. Civil Engineering in the War, George K. Scott-Moncrieff. Times Eng. Supp., vol. 15, no. 532, Feb. 1919, pp. 65-66. Rapidity in erecting of construction work.

Engineering Achievements of the Army, Mech. Eng., vol. 41, no. 4, Apr. 1919, pp. 372-374, 5 figs. Activities in railroading bridges, searchlights, map production and forestry operations.

Fire Control. On a New Application of Viscosity (sur une application nouvelle de la viscosité), Georges Claude. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 5, Feb. 3, 1919, pp. 274-276, 2 figs. Apparatus utilizing viscous liquid for regulating firing of projectiles.

Gas Water. The Development Division, Chemical Warfare Service, U.S.A., F. M. Dorsey. Jl. Indus. & Eng. Chemistry, vol. II, no. 4, Apr. 1, 1919, pp. 281-287, 8 figs. How development division developed gas masks for protection of American soldiers.

Production of Gas Defense Equipment for the Army, Bradley Dewey, Jl. Indus. & Eng. Chem., vol. II, no. 3, Mar. 1, 1919, pp. 185-197, 20 figs. Plant, organization, divisions and operations involved in manufacture of gas masks.

Gun Manufacture. How the 155-Mm. Howitzer Is Made — VII, J. V. Hunter. Am. Mach., vol. 50, no. 13, Mar. 27, 1919, pp. 587-593, 23 figs. Methods used in producing breech mechanism, with reference to tolerances permitted.

Making the U. S. 75-Millimeter Field Gun, Erik Oberg. Machy., vol. 25, no. 7, Mar. 1919, pp. 624-630, 27 figs. Methods developed by Wisconsin Gun Co. in producing light field artillery. First article.

Manufacturing the 4.5-inch British Howitzer — III, J. H. Garnett. Machinery, vol. 13, no. 335, Feb. 27, 1919, pp. 589-596, 22 figs. Austin Motor Company's methods of production.

Gunnery. Notes on Gunnery, O. A. Randolph. Univ. Colo, Jl. Eng., vol. 15, no. 2, Jan. 1919, pp. 20-28, 6 figs. Classification of guns and projectiles; interior ballistics; factors which influence the trajectory.

Guns, Long-Range. A 121-Mile Gun, J. Bernard Walker. Sci. Am., vol. 120, no. 13, Mar. 29, 1919, pp. 312-313 4 figs. Theoretical study of a 10-in. gun with a range of 121.3 miles.

Guns, Naval. Heavy Naval Gun is Given Field Mounting, C. M. McCrea. Iron Trade Rev., vol. 64, no. 11, Mar. 13, 1919, pp. 707-709, 3 figs. Caterpillar mounting of 7-in. naval gun.

Illuminating Engineering. The Illuminating Engineer at War, George H. Stickney. Tran. Illum. Eng. Soc., vol. 13, no. 9, Dec. 30, 1918, pp. 439-447. Reviews work of society during war.

Monitors. The British Monitors Engineer, vol. 127, no. 3294, Feb. 14, 1919, pp. 143-145, 7 figs. Purpose and details of ships.

Mounts for Large Guns. Heavy Field Pieces with Mobile Mount C. L. McCrea. Mech. Eng., vol. 41, no. 4, Apr. 1919, pp. 375-376, 1 fig. On design and construction of caterpillar mount of high-power 7-in gun by Navy Bureau of Ordnance.

Railway Mounts for Large Naval Guns. Ry. Rev., vol. 64, no. 13, Mar. 29, 1919, pp. 477-480, 5 figs. History of organization, construction details and work of naval batteries in France.

Making Naval Gun Mounts, Franklin D. Jones. Machy., vol. 25, no. 7, Mar. 1919, pp. 600-605, 12 figs. Special tools, gages and fixtures used at the plant of the Mead-Morrison Mfg. Co. for construction of 1000 complete mounts for 4-in. guns U. S. Navy. Second installment.

Munition Plants. How a Munitions Plant Was Built and Operated in Canada, Using Tons of Copper and Zinc Each Day. Brass World, vol. 15, no. 3, Mar. 1919, pp. 71-73, 3 figs. Organization work of Imperial Munitions Board.

Paravane. The Protection of Ships. Against Mines, Engineer, vol. 127, no. 3297, Mar. 7, 1919, pp. 222-224, 5 figs. Arrangement of Paravanes, or towed devices for cutting mine mooring wires, on a merchant ship. First article.

The Mysterious Paravane, William Washburn Nutting. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 289-293, 7 figs. How machine countered German mines.

Projectiles, Special. Curious Projectiles. Sci. Am. Supp., vol. 87, no. 2245, Jan. 11, 1919, pp. 28-29, 6 figs. Specimens of German and Austrian production, such as Gebauer projectile that discharges small shells to rear, Burst projectile for use on masked batteries, etc. From Science et Vie.

Psychological Service. The Measurements and Utilization of Brain Power in the Army. Science, vol. 44, no. 1262, March 7, 1919, pp. 221-226. History of psychological service; methods of measuring intelligence; summary of results. (To be concluded).

Railway Troops. Work of American Railway Forces in France, O. C. F. Randolph. Ry. Age, vol. 64, no. 14, Apr. 4, 1919, pp. 889-890. Review of problems encountered by Sixteenth Engineers in building transportation facilities.

The Canadian Railway Troops' Work on the Western Front, Herbert Forder. Can. Ry. & Mar. World, no. 253, March, 1919, pp. 117-120, 3 figs. Army organization with particular reference to duties and achievements of railway troops.

Shell Manufacture. Manufacture of Steel Shells (La fabrication des obus allongés en acier), Ch. Dantin. Génie Civil, vol. 74, no. 3, Jan. 18, 1919, pp. 41-45, 19 figs. Heat-treating process at Couzon foundry, near Rive-de-Gier (Loire). Other processes in manufacture of shells have been described in Génie Civil, vol. 72, no. 21, Nov. 20, 1915, p. 321.

Sound Detectors. Hunting Submarines with a Sound Detector, Brewster S. Beach. Sci. Am., vol. 120, no. 14, Apr. 5, 1919, pp. 335 and 353-354, 3 figs. Device which permits detection of direction of a sound by shifting it from one ear to the other. Also in Elec. Rev., vol. 74, no. 13, Mar. 29, 1919, pp. 500-505, 5 figs.

Supply Bases. The Boston Army Supply Base.— General Features of Project, Frederic H. Fay. Jl. Boston Soc. Civil Engrs., vol. 6, no. 3, Mar. 1919, pp. 67-76. Historical account of development.

The Boston Army Supply Base.— Construction Features, Charles R. Gow. Jl. Boston Soc. Civil Eng., vol. 6, no. 3, Mar. 1919, pp. 77-113, 31 figs. Warehouse, wharves, wharf shed, pier shed, power plant, administration building, railroads, road and underground work.

The Boston Army Supply Base.— General Data, Charles M. Spofford. Jl. Boston Soc. Civil Engrs., vol. 6, no. 3, Mar. 1919, pp. 125-137. Purpose, location, area of site and buildings.

The Brooklyn Army Base. Freight Handling & Terminal Eng., vol. 5, no. 3, Mar. 1919, pp. 94-97. Considerations influencing selection of site and construction features.

Swords. On Japanese Swords (in Japanese), Kuiichi Tawara. Jl. Soc. Mech. Engrs., Tokyo, vol. 22, no. 54, Nov. 1918.

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CIVIL ENGINEERING

BRIDGES

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Concrete Slab Bridge. Re-Inforced Concrete Slab Bridge Design, Based on Tests of Full-Sized Slabs, A. T. Goldbeck. Can. Engr., vol. 26, no. 10, March 6, 1919, pp. 280-281, 2 figs. Tests were conducted at Bureau of Public Roads. From Public Roads.

Design. Bridge Engineering Surveyor, vol. 55, no. 1412, Feb. 7, 1919, pp. 129-130. On future loads and dangers of faulty design.

Erection. Cantilever Erection of Draw in Open Position While Old Draw Serves as Fixed Span, Eng. News Rec., vol. 82, no. 12, Mar. 20, 1919, pp. 567-569, 6 figs. Swing-span part of Union Pacific Bridge over Missouri at St. Joseph; old span during work carried traffic.

Bridge Substructure Construction with Concrete Caissons Sunk by Open Excavation Method, L. W. Scov. Eng. & Contracting, vol. 51, no. 13, Mar. 26, 1919, pp. 317-319, 3 figs. Experiences of Chicago, Burlington & Quincy R. R. Paper presented before Western Soc. Engrs.

Highway. Concrete and Steel Bridges, John W. Towle. Better Roads & Streets, vol. 8, no. 10, Oct. 1918, pp. 371-372. Economic advantages of good roads. Address delivered before North Carolina Good Roads Assn.

Painting. Maintenance and Painting of Highway Bridges, Charles D. Snead. Eng. & Contracting, vol. 51, no. 13, Mar. 26, 1919, pp. 306-307. Classification of structures according to structural conditions; maintenance and cost of painting.

Railway and Highway Bridge. Move Bridge Spans 136 Feet Endwise on Car Trucks, Eng. News Rec., vol. 82, no. 11, Mar. 13, 1919, pp. 530-532, 4 figs. Combined railway and highway bridge of the Union Pacific Ry.

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Automobile Storage Structure. The New Automobile Centre, Social Hall Avenue, Salt Lake City. Am. Architect, vol. 115, no. 2252, Feb. 19, 1919, pp. 281-287, 13 figs. Reinforced-concrete 3-story structure used for storage of automobiles.

Barracks. A Barracks Built in a Hurry, Parker R. Whitney. Univ. Colo. Jl. Eng., vol. 15, no. 2, Jan. 1919, pp. 11-19, 4 figs. Main barracks built for Students' Army Training Corps to accommodate 350 men.

Brick. Shallow Brick Stand Up Well on Cement-Sand Base. Eng. News Rec., vol. 82, no. 8, Feb. 20, 1919, pp. 378-379, 4 figs. Service given by patching bricks on ramps of Pa. Station, N.Y.

Dry Dock. Building a Floating Dry Dock in Well Laid Out Yard. Eng. News Rec., vol. 82, no. 12, Mar. 20, 1919, pp. 552-554, 6 figs. Cableway assisted by whirler and derrick car keeps heavy timbers ready for carpenter crews; large band saws and cutoff's; frame handled on two-way roller system.

Elevators. Floating Pneumatic Grain Elevators. Engineer, vol. 127, no. 3296, Feb. 28, 1919, pp. 206-208, 7 figs. Elevators have a maximum capacity of about 100 tons per hour each, when working in wheat.

Chicago & North Western Ry. Co's Grain Elevator, W. H. Finley. Eng. World, vol. 14, no. 6, Mar. 15, 1919, pp. 15-19, 5 figs. Handling capacity in 1,766,000 bu. per day. Location permits grain to be received and shipped both by rail and water.

ENGINE HOUSE. A Rectangular Reinforced Concrete Engine House. Ry. Age. vol. 64, no. 14, Apr. 4, 1919, pp. 891-892, 3 figs. Design to replace old brick and timber building in location where space for expansion was restricted.

FACTORY. Modern Factory Construction, B. A. Williams. Aeronautics, vol. 16, no. 280, Feb. 26, 1919, pp. 226-227, 3 figs. Example illustrates use of Reliance standard steel sashes.
Building a Home for an Industry. Am. Architect, vol. 115, no. 2257, Mar. 26, 1919, pp. 467-475, 15 figs. Studies and projected design of buildings of dye-manufacturing concern are presented as illustration of procedure in designing an industrial structure.

FLAT-SLAB CONSTRUCTION. Design of Exterior Panels in Flat Slab Construction, Albert M. Wolf. Eng. World, vol. 14, no. 6, Mar. 15, 1919, pp. 11-14, 5 figs. Details of spandrel strips in flat-slab floors; examples of typical interior and exterior panels in accordance with Acme design standards.

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FONDATIONS. Anchor Bolts for Foundations, Terrell Croft. Natl. Engr., vol. 23, no. 4, Apr. 1919, pp. 175-179, 11 figs. Dimensions and weights of materials used. (To be continued).

HOTELS. The Hotel Pensylvania, New York. Am. Architect, vol. 115, no. 2253, Feb. 26, 1919, pp. 297-306, 14 figs. Said to be largest in world.

HOUSING. Quantity House Production Methods, Construction Branch, Emergency Fleet Corporation. Am. Architect, vol. 115, no. 2254, Mar. 5, 1919, pp. 533-358, 20 figs. Organization of Housing Section. (To be continued).
Suggested Solution of Housing Problem. Contract Rec., vol. 33, no. 6, Feb. 5, 1919, pp. 119-121. Advanced by British Roy. Sanitary Inst.
Tilbury Housing — Present and Future. Surveyor, vol. 55, no. 1415, Feb. 28, 1919, pp. 159-161, 9 figs. Scheme providing for building worker's homes rapidly.
The Preparation of Housing Schemes, A. G. Wheeler. Surveyor, vol. 55, no. 1415, Feb. 28, 1919, p. 162. Suggestions to Municipal engineers and surveyors. (Concluded).
A Chepstow Housing Scheme, William Dunn and W. Curtis Green. Jl. Roy. Inst. British Architects, vol. 26, no. 2, Dec. 1918, pp. 25-38 and (discussion) pp. 38-43, 6 figs. Site is about 28 acres in extent. Details of layout of streets, number of housing per acre and other particulars are given.
Housing: The Architects' Contribution, Raymond Unwin. Jl. Roy. Inst. British Architects, vol. 26, no. 3, Jan. 1919, pp. 49-59 and (discussion) pp. 60-64, 13 figs. Various types of houses are examined from point of view of convenience and comfort.
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The Preparation of Housing Schemes, A. G. Wheeler. Surveyor, vol. 55, nos. 1412 and 1413, Feb. 7 and 14, 1919, pp. 127-128 and 144. Recommendations to municipal engineers and surveyors. (To be concluded).

MORTAR UNDER PRESSURE. Injecting Mortar Under Pressure (Les appareils pour l'Injection du mortier sous pression), L. Biette. Génie Civil, vol. 74, no. 7, Feb. 15, 1919, pp. 121-126, 15 figs. Features and operation of various types with reference to their utilization in the construction of Paris subway.
Hotel Lincoln, Indianapolis, Ind. Am Architect, vol. 115, no. 2251, Feb. 12, 1919, pp. 238-240, 11 figs. Situated on triangular lot measuring 150 ft. and 187 ft. street fronts.

ROOFS. Zinc as a Roof Covering, William Hutton. Metal Worker, no. 2360, Mar. 21, 1919, pp. 370-371, 5 figs. Suggestions based upon practice in European contries.

SCHOOL. The Scarboro-on-Hudson School, Welles Bosworth. Am. Architect, vol. 115, no. 2258, Apr. 2, 1919, pp. 477-480, 4 figs. Architectural features.
Methods, Economies and Standardization in Preparation of Plans for School Buildings, Clarence E. Dobbin. Eng. & Contracting, vol. 51, no. 13, Mar. 26, 1919, pp. 313-314, 1 fig. Plea for uniform practice. From paper presented before Mun. Engrs. of City of N. Y.

SHEET STEEL. A Structural Material Made of Thin Sheet Steel. Am. Architect, vol. 115, no. 2251, Feb. 12, 1919, pp. 249-254, 12 figs. Describes joists studs, sills and caps made of said material embedded in concrete.

STANDARDIZATION. The Standardization of Building Products, Robert D. Kohn. Am. Architect, vol. 115, no. 2258, Apr. 2, 1919, pp. 498-500. Advocated as means to insure production speed in housing work.

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Design and Construction Features of Concrete Oil Storage Tanks, C. W. Van Dyke. Eng. & Contracting, vol. 51. no. 13, Mar. 26, 1919, pp. 304-305, 4 figs. Particulars of 182,000-gal. fuel-oil tank of American Brakeshoe Co.

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SWIMMING POOLS. Swimming Pools for Public Schools, C. E. Dobbin. Am. Architect, vol. 115, no. 2253, Feb. 26, 1919, pp. 319-328, 8 figs. Arrangement and details.

WAREHOUSE. Industrial Building Construction in Trafford Park. Engineer, vol. 127, no. 3292, Jan. 31, 1919, pp. 98-100, 11 figs. Warehouse with capacity of 10,000 tons of frozen produce, erected to comply with the requirements of Ministry of Food.

CEMENT AND CONCRETE

BLENDED PORTLAND CEMENT. An Investigation of Blended Portland Cement, School of Mines & Metallurgy, University of Missouri, vol. 4, no. 4, May. 1918, pp. 1-76, 33 figs. Study of behavior of sand blended cement. From tests at Mo. School of Mines.

CEMENT GUN. Tests on Cement Gun Products, Bryan C. Collier. Contract Rec., vol. 33, no. 10, March 5, 1919, pp. 216-218. Modulus of rupture determined for slabs having various ages.

CONSISTENCY MEASUREMENT. Concrete Consistency Measured by New Device, Herbert A. Davis. Eng. News Rec., vol. 82, no. 13, Mar. 27, 1919, pp. 603-605, 6 figs. Method developed for construction of concrete ships determines amount of water to use in field operations.

FLUE DUST. Double Salts of Calcium and Potassium and Their Occurrence in Leaching Cement Mill Flue Dust, E. Anderson. Jl. Indus. & Eng. Chemistry, vol. 11, no. 4, Apr. 1, 1919, pp. 327-332, 3 figs. Formation of potassium penta-calcium sulfate.

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MIXING. Effect of Quantity of Mixing Water and Curing Conditions on the Strength and Wear of Concrete. Eng. & Contracting, vol. 51, no. 13, Mar. 26, 1919, pp. 309-312, 9 figs. Deductions obtained from tests made at Lewis Inst., Chicago.

PNEUMATIC CONCRETING. The Pneumatic Method of Concreting, H. B. Kirland. Jl. Western Soc. Enger., vol. 23, no. 5, May 1918, pp. 319-349 and (discussion), pp. 349-355, 23 figs. Method consists in blowing batches of concrete through a pipe from a central point of supplies to their place in the concrete forms.

PRECAST CONSTRUCTION. Concrete Moulding Plant, Pennsylvania R. R. Ry. Rev., vol. 64, no. 12, Mar. 22, 1919, pp. 425-432, 14 figs. Facilities placed-in operation for the purpose of manufacturing precast reinforced-concrete members for erection of buildings and construction of bridges, and also for turning out concrete fence posts and telegraph.

QUICK-HARDENING CEMENT. The Hydraulic Properties of the Calcium Aluminates, P. H. Bates. Jl. Am. Ceramic Society, vol. 1, no. 10, Oct. 1918, pp. 679-696, 5 figs. Tests are reported to have shown that it is possible to make cements giving 24 hours strengths as high as those developed by Portland Cements in in 28 days. This quick-hardening cement is said to consist of calcium aluminate high in alumina (55 to 75 per cent).

REINFORCED-CONCRETE STRUCTURES. Theory of Reinforced-Concrete Structures (Calculo de estructuras de hormigon armado), Julio R. Castinciras. Universidad Nacional de la Plata, Publicaciones de la Facultad de Cienias Fisicas, Matematicas y Astronomicas, vol. 1, no. 35, May 1918, pp. 373-454, 55 figs. Formulæ and theorems applicable to beams under simple flexure. (Continuation of serial).

REINFORCING ELEMENTS. New Accepted Form of Reinforcing Metal in Concrete (Sur une nouvelle forme canonique des massifs armés), Charles Rabut. Comptes rendus des séances de l'Académie de Sciences, vol. 168, no. 1, Jan. 6, 1919, pp. 50-53. Value of plates in reinforcing; claimed advantages over bars.

SLAG CONCRETE. Blast Furnace Slag in Concrete and Reinforced Concrete, J. E. Stead. Eng. World, vol. 14, no. 6, Mar. 15, 1919, pp. 25-27. Oxidation of sulphides in slag; conditions under which slag concrete has failed; suggestions for production of reinforced concrete.

UNDERGROUND WORK. The Use of Concrete in Underground Work, Chem. Eng. & Min. Rev., vol. 11, no. 125, Feb. 5, 1919, pp. 130-132, 3 figs. Work done by Wallaroo and Moonta Mining & Smelting Co., Ltd.

UNDERWATER WORK. Methods of Depositing Concrete under Water. Eng. & Contracting, vol. 51, no. 13, Mar. 26, 1919, pp. 307-308. Report submitted at convention of Am. Ry. Eng. Assn.

WASTEFUL CONSTRUCTION. Useless Waste in Concrete Construction Due to Legal Requirements, W. Stuart Tait. Am. Architect, vol. 115, nos. 2250 and 2251, Feb. 5 and 12 1919, pp. 211-212 and 254-256. Ruling for column design adopted by Am. Concrete Inst. Feb. 12: Comparison of concrete regulations with Lloyd's factors of safery for ship structures.

EARTHWORK, ROCK EXCAVATION, ETC:

COFFERDAMS. Cofferdam and River Wall Construction, T. E. Thain. Practical Engr., vol. 59, no. 1672, Mar. 13, 1919, pp. 124-127, 16 figs. Particulars of dam designed for dock works, where it is proposed to dam up a dock.

DAMS. The East Canyon Creek Dam, A. F. Parker. Proc. Am. Soc. Civil Engrs., vol. 45, no. 3, Mar. 1919. Papers and Discussions, pp. 93-113, 4 figs. Design and construction of arched concrete dam.
Conditions of Stability and Suggested Design for Wooden Dam Built on Sand. Eng. & Contracting, vol. 51, no. 11, Mar. 12, 1919, pp. 261-262. Dam is to be built on very permeable sand.
Recent Multiple Arch Dams, John S. Eastwood. Jl. Electricity, vol. 42, no. 6, Mar. 15, 1919, pp. 263-266, 3 figs. Data on four structures of this type.

DREDGE, HYDRAULIC. Operating a Hydraulic Dredge Under Difficulties, Albert S. Fry. Eng. News Rec., vol. 82, no. 9, Feb. 27, 1919, pp. 410-414, 7 figs. Excavation used to dig out log-filled earth in channel which had been filled up by slipping of spoil banks.

EXCAVATION, BALANCING. Economic Balancing of Highway Excavation by a Semi-Graphic Method, Dudley S. Babcock. Eng. News-Rec., vol. 82, no. 8, Feb. 20, 1919, pp. 361-364, 6 figs. Device called "trace curve" used in designing Storm King Highway of N. Y. State Highway Dept.

FILLS. Dump Cars and Wagons Enlarge Railway Fills. Eng. News-Rec., vol. 82, no. 9, Feb. 27, 1919, pp. 419-420, 2 figs. Methods of raising and widening fills.

TUNNEL, HUDSON RIVER. Vehicular Tunnels under the Hudson River. Martin Schreiber. Jl. Franklin Inst., vol. 187, no. 3, Mar. 1919, pp. 273-288 9 figs. Necessity of constructing proposed tunnel is emphasized principally by the fact that out of a total of 40,000 miles of terminal railway within the metropolitan area, 29,000 miles are on the Jersey side. Views, details, and location of various projects for tunnel and bridge are given.

TUNNELS. Principles and Scientific Rules for Designing Long Tunnels Under Water Courses (Principes et règles scientifiques pour l'établissement des longs tunnels sous nappe d'eau), Charles Rabut. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no.4, Jan. 27, 1919, pp. 220-221. Subordination of plans, profile, and all other details of project to preventing inundation, or in case it happens, to avoid loss of human life by providing suitable means such as accessory exploration galleries, etc.
Regulations for Constructing Long Tunnels Under Water Courses (Règles à suivre pour l'établissement des longs tunnels sous nappe d'eau), M. Lecornu. Génie Civil, vol. 74, no. 6, Feb. 8, 1919, p. 114. Rules intended to prévent inundation. Read before the Académie des Sciences.

ROADS AND PAVEMENTS

ASPHALTIC CONCRETE PAVEMENTS. Two Types of Hard Surface Roads Successfully Employed in New Hampshire, Frederic E. Everett. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 80-81. Service given by asphaltic concrete pavement.

BITUMINOUS PAVEMENTS. Efficiency of Bituminous Surfaces and Pavements. Under Motor Truck Traffic, Prevost Hubbard. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 98-100. Rates increasing efficiency of bituminous types as follows: Bituminous surfaces, bituminous macadam, bituminous concrete, sheet asphalt and asphalt block. Also in Good Roads, vol. 17, no. 11, Mar. 15, 1919, pp. 117-119; Can. Engr., vol. 26, no. 10, Mar. 1919, pp. 117-119.

BRICK PAVEMENTS. Present Status of Brick Pavements Constructed with Sand Cushions, Cement Mortar Beds and Green Concrete Foundation, Wm. M. Acheson. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 103-105. Changes in design since 1915.

BUREAU OF PUBLIC ROADS. Operations of the Bureau of Public Roads Under the Federal Aid-Road Act, P. St. J. Wilson. Good Roads, vol. 17, no. 9, Mar. 1, 1919, pp. 97-98. What has been done in regard to individual federal aid projects. Presented at convention Am. Road Builders' Assn.

CANADA. Roads in Coleman Township, H. J. Routly. Can. Engr., vol. 26, no. 10, Mar. 6, 1919, pp. 274 and 286-287, 4 figs. History, developments, improvements and organization of personnel. Ontario Land Surveyors.

CHICAGO. Recent Developments in Design and Construction of Pavements in Chicago, H. J. Fixmer. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 92-94, 2 figs. Layout of central concrete-mixing plant.

COST-KEEPING. Cost-Keeping for Highway Contractors, Albert B. Gillette. Can. Engr., vol. 26, no. 10, Mar. 6, 1919, pp. 282-283. Recommends securing daily reports that show the total unit cost of every item on which contractor has bid a unit price. Before Convention of the Am. Road Builders' Assn.
Some Points to Observe in the Construction of Concrete Roads, William W. Cox. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 105-106. Concerning drainage, preparation of sub-grade, selection of materials, workmanship and designing.

DUSTLESS ROADS. Smooth Dustless Roads Maintained by Gang System. Eng. News Rec., vol. 82, no. 11, Mar. 13, 1919, pp. 526-528, 3 figs. Bituminous carpet placed on macadam highways said to prove satisfactory metal on such roads.

ENGLAND. Highway Work in Nottinghamshire During the War, J. Cracroft Haller. Surveyor, vol. 55, no. 1410, Jan. 24, 1919, pp. 47-48. Description of reconstruction and maintenance of roads in the county of Notts from 1915-1918.

FINANCING. Efficient Methods of Promoting Bond Issues, S. E. Bradt. Good Roads, vol. 17, no. 13, Mar. 29, 1919, pp. 139-140. Considerations generally taken up in issuing state bonds for highway construction.

DRAINAGE. Drainage Methods for Country Roads. Contract Rec., vol. 33, no. 6, Feb. 5, 1919, pp. 110-114, 2 figs. Discussion of foundations and drainage suitable to various soils found in highway construction.

FOUNDATIONS. Road Foundations, Drainage and Culverts, Geroge Hogarth. Contract Rec., vol. 33, no. 10, March 5, 1919, pp. 197-199, 19 figs. Examples of various constructions. Also in Can. Engr., vol. 26, no. 10, Mar. 6, 1919, pp. 284-285, 6 figs.

GOOD ROADS. The Road: Its Paramount Importance, J. H. A. MacDonald. Better Roads & Streets, vol. 8, no. 10, Oct. 1918, pp. 376-379. Military value of good roads.
The Interrelationship of Highways, Railways and Waterways, George H. Pride. Good Roads, vol. 17, no. 12, Mar. 22, 1919, pp. 127-128. Presented at convention Am. Road Builders' Assn.

GRADE CROSSINGS. Grade Crossing Elimination in New York City, William L. Selmer, Mun. Engrs. Jl., vol. 5, no. 3, Mar. 1919, pp. 1-21, 10 figs. Progress made by Public Service Commission for First District during the 11½ years of its existence.

GRANITE BLOCK PAVEMENTS. Some Suggestions on the Proper Construction of Granite Block Pavements, Albert T. Rhodes. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 106-110, 7 figs. Suggestions based on differences of production in Northern and Southern quarries.

INDIANA. Provisions of Proposed Indiana Highway Law. Good Roads, vol. 17, no. 7, Feb. 15, 1919, pp. 58-60. Summary of test of bill introduced in Indiana Senate pr viding for establishment of state highway commission, state system of highways and state highway fund.

KANSAS. Some features of Highway Work in Kansas, M. W. Watson. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 86-88, 3 figs. State Highway Commission created by legislature.

LABOR. Sources of Supply of Unskilled Labor for Highway Work. Good Roads, vol. 17, no. 10, Mar. 8, 1919, pp. 111 and 114-115. From reports of state highway departments, city departments and contractors, it is stated that there will be sufficient supply of unskilled labor for highway projects during coming season and at wages lower than those prevailing during season of 1918. Committee report of Am. Road Builders' Assn. Also in Eng. News Rec., vol. 82, no. 10, Mar. 6, 1919, pp. 466-467.

MACADAM ROAD RECONSTRUCTION. Building New Concrete Shoulders to Preserve the Old Macadam Roads of Marylamd, John N. Mackall. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 79-80, 3 figs. Preserving old macadam roads constructed before coming of extremely heavy motor traffic of to-day.
The Reconstruction of Worn Out Macadam Upon a State Road in Rhode Island, I. W. Patterson. Mun. & County Eng., vol. 56, no. 3, Mar. 1919. pp. 81-83, 1 fig. Difficulties encountered in reconstructing; imperfect drainage; resurfacing macadam roads built originally with coarse-grained granite.

MAINTENANCE. System Without Red Tape Makes Success of Day Labor Road Maintenance. Eng. News Rec., vol. 82, no. 8, Feb. 20, 1919, pp. 384-386, 3 figs. Weekly return form to show status of each job.
Methods of Maintaining Highway Systems Prior to Construction by State or County, Frederic E. Everett. Good Roads, vol. 17, no. 13, Mar. 29, 1919, pp. 137-138. Practice followed at New Hampshire. Paper presented before Am. Road Builders' Assn.

MICHIGAN. Low Hauling Cost and No Waste of Material on Construction of Michigan Roads. Better Roads & Streets, vol. 8, no. 10, Oct. 1918, pp. 380-381, 1 fig. Layout of Lake Shore road job; number of men required; material-handling system.

REPAIRS. Repairing Pavement Openings. Mun. Jl., vol. 46, no. 12, Mar. 22, 1919, pp. 215-218, 2 figs. Practices of various cities as to methods of restoring pavements.

STREETS. Street System; Their Relation to Highways Outside of Urban Districts, Nelson P. Lewis. Good Roads, vol. 17, no. 9, Mar. 1, 1919, pp. 99-100. Concerning exit from a city to system of roads outside it. Presented at convention Am. Road Builders' Assn.

STREET CLEANING. Recommended Procedure in Cleaning Streets in Rochester, N. Y., James W. Routh. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 90-91. Criticism of common methods of street cleaning with reference to conditions in Rochester.

SURFACES. Build Permanent Road Surfaces, R. Crawford Muir. Contract Rec., vol. 33, no. 10, March 5, 1919, pp. 200-204, 17 figs. Analysis of methods of constructing the various types of surfaces; importance of gaging amount of future traffic.

TEMPERATURE OF ROAD SURFACES. High Relative Temperatures of Pavement Surfaces, G. S. Eaton. Eng. News-Rec., vol. 82, no. 13, Mar. 27, 1919, pp. 633-634, 3 figs. Observations made by engineer of Universal Portland Cement Co. on surface temperatures of various types of surfacing and variation between these surfaces and adjacent localities.

VIRIFIED BRICK. Vitrified Brick. Construction for Heavy Motor-Truck Traffic, W. M. Acheson. Eng. News-Rec., vol. 82, no. 10, March 6, 1919, pp. 467-468. Advantages claimed for brick pavements of monolithic type.

WIDTH. Wider-Pavements Needed by Motor Vehicles at Curves, G. S. Eaton. Eng. News-Red., vol. 82, no. 10, March 6, 1919, pp. 461-462, 3 figs. Graph of theoretical and recommended widths of lane for various radil.

SANITARY ENGINEERING

CAMP DRAINAGE. Camp Drainage and Sanitation W. H. Beswick. Jl. Roy. Sanitary Inst., vol. 39, no. 2, Oct. 1918, pp. 70-74. Outline of work done at Salisbury Plain Camps.

GARBAGE DISPOSAL. Baltimore Adopts Feeding Method for Garbage Disposal. Eng. & Contracting, vol. 52, no. 11, March 12, 1919, pp. 258-259, 1 fig. Specifications of city of Baltimore garbage Disposal. Also in Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 96-98.
Suggestions for Improvements in Apparatus and Appliances for Dealing with House Refuse, James Jackson. Surveyor, vol. 55, no. 1415, Feb. 28, 1919, pp. 180-181. Concerning the assignation of special charges and daily removal of refuse.

SEWAGE DISPOSAL. Sewage Disposal Works at London, Ontario, Willis Chipman. Can. Engr., vol. 26, no. 10, March 6, 1919, pp. 269-274, 12 figs. Two-story, non-reversible sedimentation tanks and enclosed filters with fixed spray nozzle.
St. Catherine's Relief Sewage System, D. H. Fleming. Contract Rec., vol. 33, no. 8, Feb. 19, 1919, pp. 178-181, 12 figs. Details of tunnels, manholes, etc.
Sewage Disposal at Manchester. Surveyor, vol. 55, no. 1408, Jan. 10, 1919, pp. 17-18. Activated sludge investigations; results of operation.

SEWERS. Rideau River Intercepting Sewer, Ottawa, L. McLaren Hunter. Can. Engr., vol. 36, no. 1, Jan. 2, 1919, pp. 105-106 and 111, 6 figs. Map showing areas drained; method of supporting pipe under fill; operation in laying 40-in. concrete pipe.

STREET CLEANING. Street Cleaning Methods. Mun. Jl., vol. 46, no. 6, Feb. 8, 1919, pp. 101-104, 4 figs. Sweeping by machine and hand, flushing and sprinkling. Report of Rochester Bureau of Municipal Research. (To be continued).

WATER SUPPLY

CONDUCT DESIGN. Economical Section of Water Conduct for Power Development, Cary T. Hutchinson, Mech. Eng., vol. 41, no. 4, Apr. 1919, pp. 369-371, 2 figs. Method of determining economical section of water conduit for supplying water to a power plant.

FACTORY WATER SUPPLY. What It Pays to Know About Factory Water Supply, Charles L. Hubbard. Factory, vol. 22, no. 3, March 1919, pp. 453-455, 3 figs. On insuring against well going dry.

FLOOD CONTROL. Colorado River Flood Control by Storage, E. C. La Rue. Eng. News Rec., vol. 82, no. 10, Mach 6, 1919, pp. 456-461, 7 figs. It is claimed that reservoirs at various sites would so cut flood at Yuma as to control Imperial Valley.

FREEZING OF RESERVOIR. The Freezing of a Reservoir Outlet Works, Gilbert Christie. Surveyor, vol. 55, no. 1408, Jan. 10, 1919, pp. 19-20, 2 figs. Operations to restore supply. Paper before Instn. Water Engrs.

RAILWAY WATER SUPPLY. Modern Water Supply Plant on Southern Railway System. Railroad Herald, vol. 23, no. 3, Feb. 1919, pp. 52-54, 1 fig. Sedimentation basin of 2,500,000 gal. capacity, installed to provide improved water supply for operation of locomotives.

WATER TREATMENT. Results of Application of Chloramine Process to Catskill (Esopus) Water of New York City, Frank E. Hale. Eng. & Contracting, vol. 51, no. 11, March 12, 1919, pp. 262-264, 3 figs. Process consists in combining bleach with ammonia just before applying to the water treated.

Chlorine Absorption and the Chlorination of Water. Abel Wolman and Linn H. Enslow. Jl. Indus. & Eng. Chem., vol. 11, no. 3, Mar. 1, 1919, pp. 209-213, 3 figs. Results of the study of the question of chlorination control in Maryland.

Design and Performance of the Iron Removal Plant for Laundry Water at State School, Sparta, Wis., W. G. Kirchoffer. Mun. & County Eng., vol. 56, no. 3, Mar. 1919, pp. 88-90, 3 figs. Removal of iron from deep-well water by aeration, coke and treated sand filter.

WATER-WORKS OPERATION. Water Works Operation: Reservoir Maintenance. Mun. Jl., vol. 46, no. 6, Feb. 8, 1919, pp. 105-107, 1 fig. Collection of sediment in reservoirs and methods of removing it.

WATERWAYS

CANALS. Construction of a Lateral Canal at Allier (Construction d'un canal latéral à l'Allier), René Travernier. Houille Blanche, nos. 23-24, Nov.-Dec. 1918, pp. 337-338. Study of a joint commission of the Departments of Allier and Puy de Dome.

The Rhone-Rhine Canal (Le canal du Rhône au Rhin). Huille Blanche, nos. 23-24, Nov.-Dec. 1918, pp. 334-336. History of project. From Bulletin Hebdomadaire de la Navigation et des Ports Maritimes, Aug. 4 and 11, 1918.

The Cher Hydraulic System (Contribution à la détermination du régime hydraulique du Cher), P. Moriu. Revue Générale de l'Electricité, vol. 5, no. 11, Mar. 15, 1919, pp. 417-418, 3 figs. Concerning supplying Berry caual at point near bridge from Cher to Montluçon.

FLOODS. On the Gradually Varying Movement and the Propagation of Floods (Sur le mouvement graduellement varié et la propagation des crues), Edmond Maillet. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 5, Feb. 3, 1919, pp. 266-268. Suggests, no. 5, Feb. 3, 1919, pp. 266-268. Suggests modification of Boussinesq's equations.

INLAND WATERWAYS. What the Government Did in Inlaud Waterway Navigation. Eng. News-Rec., vol. 82, uo. 10, March 6, 1919, pp. 480-481. Abstract of Director General of Railroads' report ou progress made during 1918 on waterways taken over by his administration.

MISSISSIPPI RIVER. Revival of Mississippi River Traffic — III. M. von Pagnchardt. Int. Mar. Eng., vol. 24, no. 4, Apr. 1919, pp. 295-297, 4 figs. Structural features of barge terminal at St. Louis; arrangements of cargo-handling machinery.

STREAM FLOW. Stream Flow and Percolation Water, Samuel Hall. Surveyor, vol. 55, nos. 1408 and 1409, Jan. 10 and 17, 1919, pp. 15-16 and 35-37, 5 figs. Sources of supply due to percolation. Paper before Instn. Water Engrs.

STREAM REGULATION. Meteorology aud Stream Regulation, W. F. V. Atkinson. Can. Engr., vol. 36, no. 1, Jan. 2, 1919, pp. 101-103, 1 fig. Chart showing direct effect of weather on flow and indirect effect through protection of forest growth; utilization of data concerning wind, temperature, precipitation and barometer records in fighting forest fires.

RECLAMATION AND IRRIGATION

CONCRETE. Concrete Box Flume Carried Across Gulch ou Trestle, A. W. Collins. Eng. News Rec., vol. 82, no. 10, March 6, 1919, pp. 463-464, 2 figs. Substitution of concrete for steel in irrigation system at Hawaii.

DITCH. Hydraulic Efficiency of a Drainage Ditch for Five Different Channel Conditions, C. E. Ramser. Eng. News Rec., vol. 82, no. 11, Mar. 13, 1919, pp. 522-523, 5 figs. Data of various channels.

DRAINAGE. Land Drainage in Cambridgeshire. Engineer, vol. 127, no. 3295, Feb. 21, 1919, pp. 174-176, 10 figs. Details of work on river and fen improvement.

IRRIGATION CANAL CLEANING. Removing Algæ from a California Irrigation Canal, E. Court Eaton. Eng. News Rec., vol. 82, no. 8, Feb. 20, 1919, pp. 382-383, 1 fig. Rotary screen with water jet and heavy dose of agent.

MOROCCO. The Hydraulic Wealth of Occidental Morocco (Les richesses hydrauliques du Maroc Occidental), P. Penet. Houille Blanche, nos. 23-24, Nov.-Dec. 1918, pp. 338-351, 8 figs. Possible industrial utilization; utilization of waters in agriculture; suggested program of study.

RECLAMATION WORK. Reclamation Work on the Key System, Chas. Christopher. Traction, vol. 15, no. 3, Mar. 15, 1919, pp. 189-190 and 194-195, 4 figs. Installation of electromagnet and Brownhoist for handling scrap material.

SURVEYING

POINT DETERMINATION. Errors in Position of a Point (Sur les erreurs de situation d'un point), Alf. Guldberg. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 3, Jan. 20, 1919, pp. 153-155. Concerning probability of error in position of point determined by rectangular coordinates in series of continuous observations.

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CHEMISTRY

ANALYSIS. Notes on Chemical Standards and Their Bearings on the Unification of Analysis, C. H. Ridsdale. Jl. Soc. Chem. Indus., vol. 38, no. 3, Feb. 15, 1919, pp. 15T-25T and (discussion) pp. 25T-26T. General study of discrepancies in chemical analysis, and writer's experiences on the preparation and issue of analytical steel standards, both private and prepared on wider basis.

The Accurate Determiuatiou of Carbon Monoxide in Gas Mixtures, J. Ivor Graham. Jl. Soc. Chem. Indus., vol. 38, no. 2, Jan. 1919, pp. 10T-14T, 2 figs. Methods of determination by means of iodine pentoxide, based on reaction $3CO + I_2 - O_5 = CO_2 + I_2$.

COLLOIDS. The Degree of Dispersion of Colloids and Its Determiuation, George King. Jl. Soc. Chem. Indus., vol. 38, no. 2, Jan. 31, 1919, pp. 4T-7T. Ultramiscroscopic methods of determining dispersion in colloids.

Properties of the Colloid State and Their Application ot Iudustry, W. C. McC. Lewis. Jl. Soc. Chem. Indus., vol. 38, no. 2, Jan. 31, 1919, pp. 1T-4T. Holds Laplace's fondemental assumption in regard to field of attraction round a molecule as ineffective for explaning colloidal phenomena.

ELEMENT. The Classification of the Chemical Elements, Ingo, W. D. Hackh. Sci. Am. Supp., vol. 87, no. 2253, Mar. 8, 1919, pp. 146-149, 3 figs. Presents three arrangements: According to increasing atomic number or atomic weight; a periodic spiral obtained by bending pevodic chain so that elements of similar properties come together; and tabular arrangement representing a "chart of matter" where position of element indicates the properties.

The Conception of the Chemical Element as Enlarged by the Study of Radioactive Change, Frederick Soddy. Jl. Chem. Soc., no. 657, Jan. 1919, pp. 1-26, 2 figs. Transmutational character of radioactive change; history of the analysis of matter; radioactive chauge aud the periodic law; origin of actinium; different varieties of isotopes and hetorotopes.

FLAVORING MATTERS. The Chemistry of Flavoring Matters, François Barral. Sci. Am. Supp., vol. 87, nos. 2251 and 2252, Feb. 22 and Mar. 1, 1919, pp. 114-115 and 134-135. Relationship between constitution of a body aud its taste. From Revue Scientifique.

GAS REACTIONS. The Influence of Temperature on Homogeneous Gas Reactious, George W. Todd. Lond., Edinburgh and Dublin Phil. Mag., vol. 37, no. 218, Feb. 1919, pp. 224-230. Deduction from Maxwell's distribution theory of an expression of the number of gas molecules per cc. having velocities greater than an assumed value.

NITROUS VAPORS. Constitution of Nitrous Vapors (Sur la constitntion fes vapeurs nitreuses), P. Jolebois and A. Sanfourche. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 4, Jan. 27, 1919, pp. 235-237. Laboratory examination of couditions under which NO_2 and air unite to form N_2O_3 and subsequent phenomena following combination.

TUNGSTIC OXIDE. The Reduction of Tungstic Oxide, C. W. Davis. Jl. Indus. & Eng. Chem., vol. 11, no. 3, Mar. 1, 1919, pp. 201-204. Result of experimental work.

WATER ABSORPTION BY GELATINE. Investigations on the Absorption of Water by Gelatine, Edith B. Shreve. Jl. Franklin Inst., vol. 187, no. 3, March 1919, pp. 319-337. Work on imbibitional colloidal pheuomena. It is reported that within the temperature range of 10 to 35 deg. Cent. heat favors the imbibition of water by gelatine, although reaction is exothermic.

MATHEMATICS

CONTINUOUS FRACTIONS. On Two Extensions of Algebraic Continuous Fractions (Sur deux extensions des fractions continues algébriques), M. A. Angelesco. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 5, Feb. 3, 1919, pp. 262-266. Concerning Hermite's generalization of continuous fractions.

DIFFERENTIATION. Differentiatiou with Respect to a Function of Limited Variation, P. J. Daniell. Tran. Am. Math. Soc., vol. 19, no. 4, Oct. 1918, pp. 353-362. Definition of derivative corresponding to Stieltje's integral as generalized by Lebesgue. (Comptes rendus des séances de l'Académie des Sciences, vol. 150, 1910, p. 86). Fundamental property of derivative is proved by means of modification of Vitah's theorem.

EQUATIONS. Irregular Singularities of Linear Differential Equations (Sur les singularités irregulières des équations différentielles linéaires), René Garnier. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 3, Jan. 20, 1919, pp. 142-144. Extends to linear differential equations of any order, propositions established for equations of second order in Comptes rendus, vol. 164, 1917, p. 265 and vol. 166, 1918, pp. 103 and 602.

On Equations with Partial Derivatives (Sur les equations aux dérivées partielles), H. Duport. Comptes des séances de l'Académie des Sciences, vol. 168, no. 1, Jan. 6, 1919, pp. 45-46. Generalization of integration of Laplace's equation.

Linear Integro — Differential Equations with a Boundary Condition, Minfu Tah Hu. Tran. Am Math. Soc., vol. 19, no. 4, Oct. 1918, pp. 363-407. Treated as limit of system of n tinear differential equations of first order.

Concerning The Zeros of the Solutions of Certaiu Dlfferential Equations, William Benjamin Fite. Tran. Am. Math. Soc., vol. 19. no. 4, Oct. 1918, pp. 341-352. Discusses oscillation of solutions of various types of linear equations of second order. Claims that Kneser's conclusions (Mathematische Annaleu vol. 42) hold when m is restricted merely to being less than n.

Algebraic Solutions of Differential Equations of the First Order (Sur les solutions algébriques des équations différentielles du premier ordre), Jules Drach. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 4, Jan. 27, 1919, pp. 212-215. Conditions under which $X\,dy - Tdx = 0$ possesses algebraic particular solutions.

FUNCTIONS. Approximation Polynomials and the Existence of Derivatives (Sur les polynomes d'approximation et l'existence des derivées), Paul Montel. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 4, Jan. 27, 1919, pp. 215-217. Theorem establishing relation between differential properties of function to order of nearest approximation u (n) of this function by polynomial of degree inferior or equal to n.

Fundamental Geometric Magnitudes. Fundamental Geometric Magnitudes of Euclidian Space (Les géométries fondamentales de l'espace euclidien), René de Saussure. Archives des Sciences Physiques et Naturelles, year 124, vol. 1, Jan.-Feb. 1919, pp. 29-47. Study of figures possible in one-dimensional space and of quantitatives of two and three parameters. (To be continued).

Implicit Functions. Implicit Functions (Sur les fonctions de lignes implicites), Paul Lévy. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 3, Jan. 20, 1919, pp. 149-152. Conditions under which inversion of point transformation is constant and uniform.

Integration. On the Analytical Extension of the Integrals of Certain Systems of Equations to the Linear Partial Derivatives (Sur le prolongement analytique des intégrales de certains systèmes d'équations aux dérivées partielles linéares), M. Riquier. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 3, Jan. 20, 1919, pp. 144-147. Considers as illustrative example case of five independent variables in seven arbitrary functions.

Quadries. On the Deformation of Quadries (Sur la déformation des quadriques), C. Guichard. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 4, Jan. 27, 1919, pp. 200-204. Homographic transformation of parametric functional quantic. Determination of integral systems by Laplace's method.

Ruled Surfaces. Trajectories and Flat Points on Ruled Surfaces, J. K. Whittemore. Bul. Am. Math. Soc., vol. 25, no. 5, Feb. 1919, pp. 223-229. Determination of point of ruled surface, with real rulings, where curvature of every normal section is zero.

Spiral Minimal Surfaces. Spiral Minimal Surfaces, J. K. Whittmore. Tran. Am. Math. Soc., vol. 19, no. 4, Oct. 1918, pp. 315-330. Study of Minding parallels and meridians of minimal surfaces with reference to Z axis.

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Acoustics. New Value of Velocity of Sound in Open Air (Sur une nouvelle détermination de la vitesse du son à l'air libre), Ernest Esclangon. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 3, Jan. 20, 1919, pp. 165-167. From various outside measurements under different conditions writer's value reduced to 15 deg. cent. in dry air becomes 339.9 m. per sec., 1115.15 ft. per sec.

Tables of the Zonal Spherical Hermonic of the Second Kind Q_1 (z) and Q_1' (z), A. G. Webster and Willard Fisher. Proc. Natl. Acad. Sciences, vol. 5, no. 3, Mar. 15, 1919, pp. 79-82. Tables prepared in connection with investigations in regard to submarines.

Aggregation. Investigations Dealing with the State of Aggregation. Part IV.—The Flocculation of Colloids by Salts Containing Univalent Organic Ions, S. B. Schryver and Nita E. Speer. Proc. Roy. Soc., vol. 90, no. B631, Feb. 17, 1919, pp. 400-414. Deals with surface tension of solution and relationship between this property and capacity of salts for flocculating colloids.

Critical Phenomena. Critical Phonomena, William R. Fielding. Chem. News, vol. 117, no. 3063, Dec. 20, 1918, pp. 379-383. Attempt to obtain general formula connecting critical temperature of a gas and its critical pressure.

Crystallography. Molecular Orientations in Physics and in Crystallography, Albert Perrier. Sci. Am. Supp., vol. 87, nos. 2245 and 2246, Jan. 11 and 18, 1919, pp. 18-19 and 46-48, 1 fig. Investigations of matter based on fundamental concepts of anisotropy. Address before Helvetian Soc. Nat. Sciences, Zurich. From Minutes of Swiss Soc. Sci. Research, vol. 2, 1917.

Structure of Crystals in Thin Layers: New Experimental Determination of Molecular Magnitudes (Structure des cristaux en lames très minces; nouvelle détermination expérimentale des grandeurs moléculaires), René Marcelin. Annales de Physique, series 9, vol. 10, Nov.-Dec. 1918, pp. 189-194. Principle of measures is as follows: a crystalline filmis compared, in white parallel light, with quartz birefringent plate placed between two nicols; tickness of quartz plate is modified until it present same appearance as first crystal.

Electrons. Movements of Small Particles With and Against Light Rays. Engineering, vol. 107, no. 2771, Feb. 7, 1919, pp. 180-181, 5 figs. Ehrenhaft's investigations with particles of solids and liquids are said to demonstrate that the electronic charge is not the ultimate unit of electricity. From Annalen der Physik, July 12, 1918, pp. 81-132.

Flame Propagation. The Propagation of Flame Through Tubes of Small Diameter — II, William Payman and Richard Vernon Wheeler. Jl. Chem. Soc., no. 675, Jan. 1919, pp. 36-45, 2 figs. Experiments to determine the safety practice in testing miners' lamps.

Gravitation. Experimental Researches on Gravitation (Recherches expérimentales sur la gravitation), V. Crémieu. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 4, Jan. 27, 1919, pp. 227-230, 1 fig. Investigation of electromagnetic field, Hertzian field, and plane of polarization of light, in vicinity of 50-kg. led cylinder rotating 1200 r.p.m., undertaken to examine relation between gravitation and electromagnetism, which theories hold are both properties of ether.

Hail Storms. Atmospheric Electric Effects and Hailstorms, R. T. A. Innes. Tran. South Africa Inst. Elec. Engrs., vol. 9, part 10, Oct.-Nov. 1918, pp. 184-185. On prevention of hail.

Inflammability of Gas Mixtures. The Inflammation of Mixtures of Ethane and Air in a Closed Vessel: The Effects of Turbulence, Richard Vernon Wheeler. Jl. Chem. Soc., no. 675, Jan. 1919, pp. 81-94, 6 figs. Survey of experimental research by other investigators and account of results obtained by writer

Magneto-Striction. Magneto-Striction with Special Reference to Pure Cobalt — I, Howard A. Pidgeon. Phys. Rev., vol. 13, no. 3, Mar. 1919, pp. 209-337, 15 figs. Experimental curves for Wiedemann effect in specimens of pure cobalt wire, and for the purpose of comparison, results are also shown for specimens of iron and nickel subjected to the same heat treatment; hysteresis curves for iron, nickel and cobalt.

The Dilution Limits of Inflammability of Gaseous Mixtures. Part III. The Lower Limits of Some Mixed Inflammable Gaese with Air. Part IV. The Upper Limits of Some Gases, Singly and Mixed, in Air, Hubert Frank Coward, Charles William Carpenter and William Payman. Jl. Chem. Soc., no. 675, Jan. 1919, pp. 27-36, 4 figs. Accuracy of Le Chatelier's formula in calculating lower limits of inflammability; formula of an additive character for the case of upper limits of inflammability.

Oscillation. On a Theorem of Oscillation, William F. Osgood. Bul. Am. Math. Soc., vol. 25, no. 5, Feb. 1919, pp. 216-221. Concerning Bôcher's theorem involving continuous and monotonic functions.

On the Vibrations of Elastic Shells Partly Filled with Liquid. Sudhansukumar Banerji. Phys. Rev., vol. 13, no. 3, Mar. 1919, pp. 171-188, 3 figs. Problem considered in relation to theory of "musical glasses." Principle of method used in similar to that adopted by Lord Rayleigh in treating two-dimensional cases of long cylinder completely filled with liquid.

Radioactivity. Some Photometric Tests of the Brightness of Radio-Active Self-Luminous Materials, W. C. Clinton. Illuminating Engr., vol. 11, no. 11, Nov. 1918, pp. 260-262, 3 figs. Tests consisted in viewing the luminous sample through small slit in while surface illuminated by a glow-lamp maintained at a fixed P. D. and screened by suitable green-glass filter.

Radium and Radio-Activity — I, Charles H. Viol. Sci. Am. Supp., vol. 87, nos. 2256 and 2257, Mar. 29 and Apr. 5, 1919, pp. 194-195 and 214-215. Consideration of physical and chemical aspects. Presented before Phila. Section, Am. Chem. Soc., Apr. 5: Physical and chemical aspects of problem. (To be continued).

Thermodynamics. Formula for Latent Heat of Vaporization of Liquid (Formule donnant la chaleur de vaporisation d'un liquide), E. Ariés. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 4, Jan. 27, 1919, pp. 204-207. Modification of Clausius' equation by entropic relations, co-volumes estering as functions of temperature.

The Thermal Conductivity of Air, E. O. Hercus and I. H. Lady. Proc. Roy. Soc., vol. 95, no. A 668, Jan. 1, 1919, pp. 190-210, 4 figs. Attempt to establish absolute value of thermal conductivity of air by eliminating in experimentation flow of heat by conviction.

Entropy and Probality (Entropie et Probabilité), R. Fortrat. Revue Générale des Sciences, vol. 30, no. 3, Mar. 13, 1919, pp. 135-140. Problem is examined from point of view of statics and the proposition is advanced that the evolution of an isolate physical system (having constant energy involved) follows successive stages of increasing probability.

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THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

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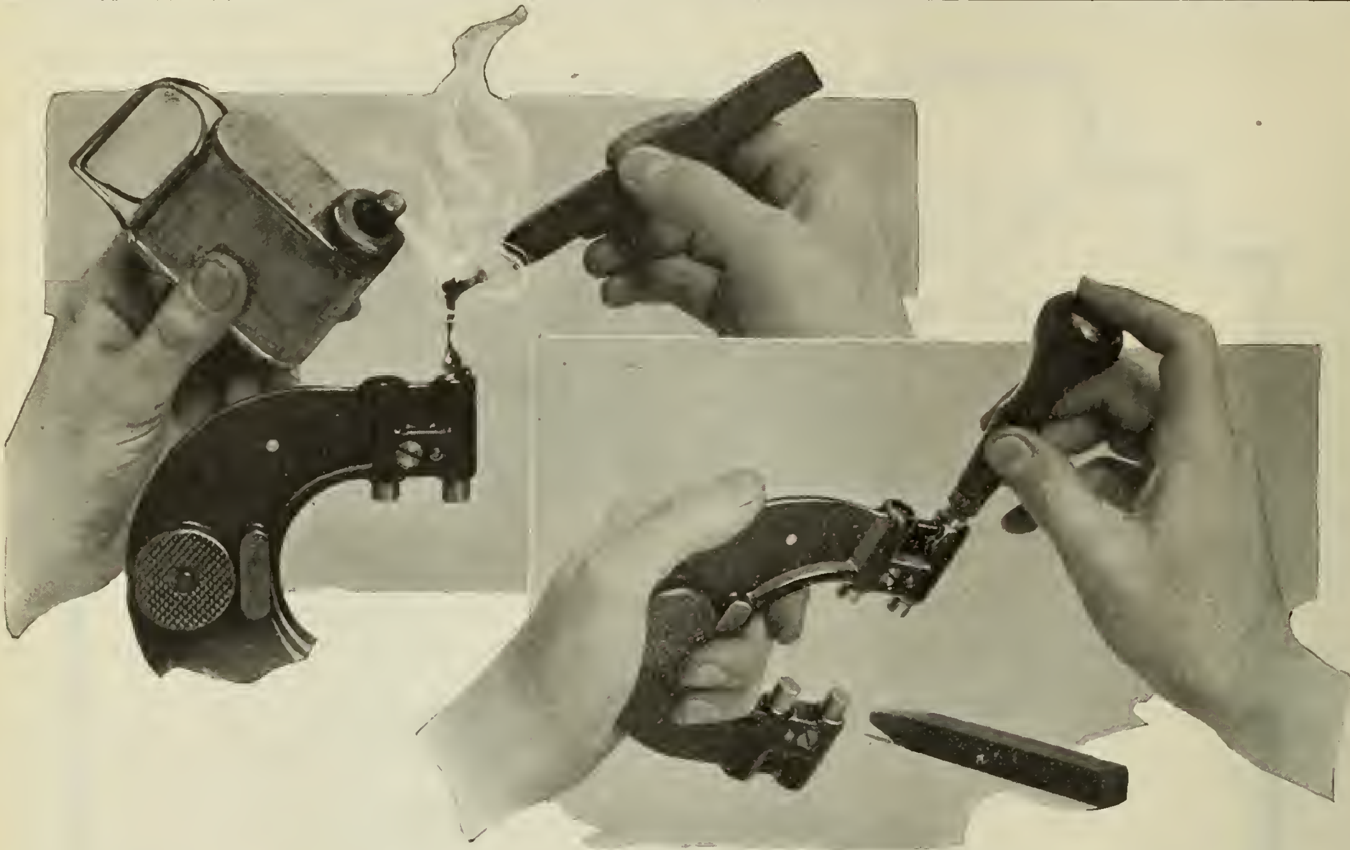

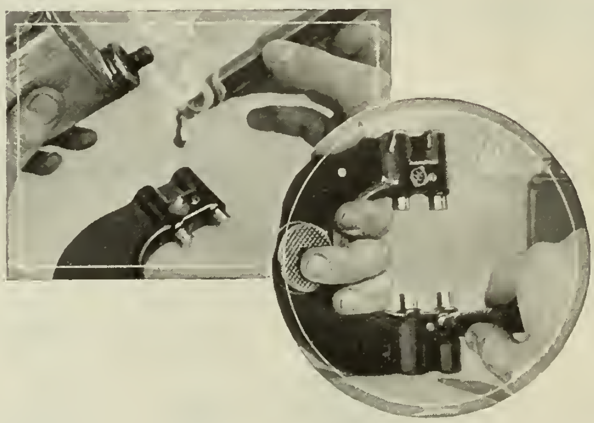

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Reports, will give the city from 12 to
of up-to-date streets, and there
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contracts let, as reported in
ing News-Record for 10 months
1918, show $68,000,000 worth of work
The kinds of construction were
ported on approximately two-thirds of
this amount, or $43,000,000. The divi-
sions and percentages of this amount
DISTRIBUTION ACCORDING TO MATERIALS OF CONSTRUCTION
Per Cent
Concrete $12,000,000 28
Brick and Granite Block . . 8,500,000 20
Sheet Asphalt 8,500,000 20
Bituminous 7,100,000 17
Water-bound Macadam . . 5,240,000 12
Wood Block 1,000,000 2
Plank Roads 400,000 0.8
Sand-Clay and Earth . . . 95,000 0.2
Total $42,835,000 100
are shown in the accompanying table
and the monthly and geographical
visions in the diagram.
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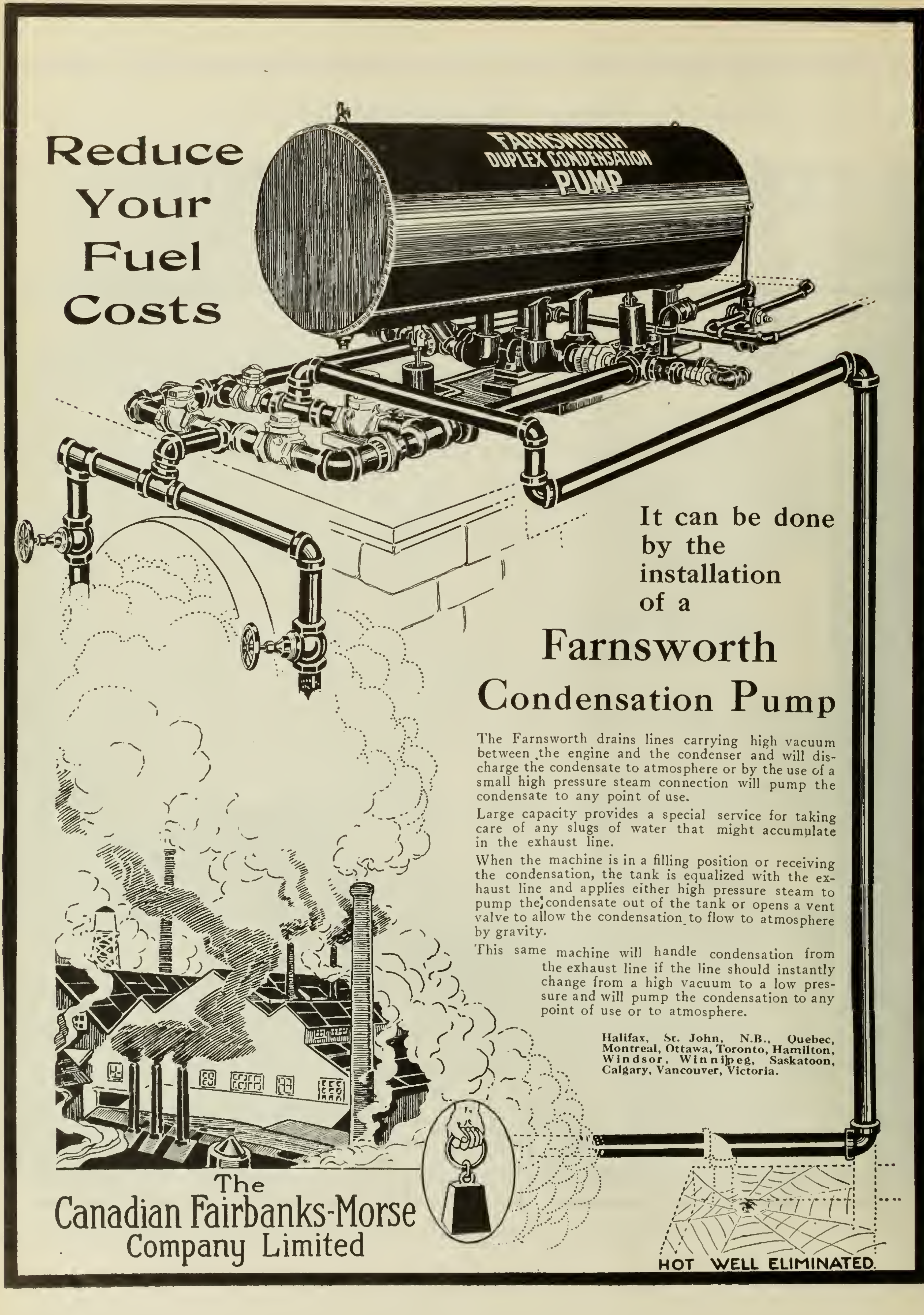
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AT 176 MANSFIELD STREET, MONTREAL

VOLUME II — MONTREAL, JUNE 1919 — NUMBER 6

The Production of Peat Fuel*

By Ernest V. Moore, A.M.E.I.C.

The most vital question in connection with peat fuel to-day, in this part of Canada particularly, is—Can a peat fuel be manufactured at a cost that will permit delivery to the consumer at a price that will be attractive alike to him and to the producer? While I cannot answer this question as definitely as I would like to do, at present, I propose to outline to you the reasons why the peat fuel industry is not already established in this country and to tell you what has been accomplished towards this end.

In 1908, I had the privilege of preparing a paper for a meeting similar to this meeting tonight and I would have liked to make this paper a continuation of my previous paper, but, since I anticipate being able to make certain definite announcements at a later date, I will prepare another paper at that time, which will be a supplement to the one already read.

For those who are not familiar with either the raw material or the fuel which has already been produced therefrom, I will endeavour to describe briefly these two materials, and I would like you to follow what I have to say with the idea of asking question for, with the limited amount of time available, this will be the most efficient way of giving you the information which you desire.

Peat is the result of incomplete decomposition, in the presence of water, of vegetable matter, consisting mostly of mosses, grasses and aquatic plants. In appearance it is a brown to black spongy or pasty mass of decayed vegetable matter. It occurs in deposits of from a few acres to many square miles in area, and in depths varying from a few feet to as much as 50 ft. It is found distributed over almost the whole of eastern Canada, but more particularly in Ontario and Quebec, where there is a marked scarcity of any other variety of fuel. A peat bog is a noticeably level tract of country, which is usually covered with a short thick growth of shrubs, and, in some cases, without any other vegetation; but, in other cases, it is more or less thickly covered with small trees, mostly spruce and tamarack. These trees, however, seldom grow to more than 4" to 6" in diameter. Immediately under this covering of shrubbery there is usually found a continuous blanket of moss and grasses, from 12" to 18" thick, which gradually turns from the green growing tops to brown decomposing and decomposed roots. The peat is found below this blanket of moss; and, in an undrained bog, it may be almost semi-fluid, which makes it in some cases dangerous, if not impossible, for a man to cross. After proper drainage, however, it will become sufficiently solid to carry a horse but, under any circumstances, the horse will be able to pull only a very light load. Even after proper drainage peat contains about 85 to 90% water, but it is difficult to believe this on seeing it excavated.

Raw peat at the Alfred Bog, where probably the most extensive operations in Canada have taken place, weighs approximately 66 lbs. per cubic foot. A short distance away from the face of a drain 8 ft. deep, the average of a number of samples of peat taken a year after the drain was made, showed that it contained 87½% water and 12½% of solids. An analysis of this dried material showed, on an absolute dry basis, 68% of volatile and combustable material, 24% to 26% fixed carbon and 5% to 7% ash. Other bogs in Ontario show from 60% to 70% volatile matter, from 18% to 27% fixed carbon and from 3.7% to 20% ash. In no case was the phosphorus content found to be over .09%, while in the majority of cases it was under .03%. In one case .9% of sulphur was found although, generally speaking, it is only about .03%. The nitrogen content in the Ontario bogs runs from 1.13% to 2.7%.

I do not wish to burden you here with more than two or three statements as to the extent and location of peat in Canada. Perhaps it will be sufficient to say that there are over 37,000 square miles of peat known to exist in

*Read at the Montreal Branch meeting, March 20th, 1919.

Canada and, of this area, 58 bogs have been examined by the Canadian Government, Department of Mines. This Department has mapped out about 170,000 acres and has taken samples and soundings over these areas in such a way as to make it possible for one to form a very reliable estimate as to the quantity of fuel a bog will produce and an approximate estimate of the quality of the peat. An acre of peat 1 ft. deep will produce a minimum of 200 tons of air dried peat fuel. Mr. Haanel in his paper, read before this *Society* at the Annual Meeting of 1918, informed you that there were 7 bogs, conveniently situated with respect to Toronto, that can supply that city with 26½ million tons of fuel; and an equal number adjacent to Montreal can supply that city with 23 million tons. Other bogs are situated adjacent to other centers of population, both in Ontario and Quebec. You will readily realize that if a satisfactory fuel is manufactured from the raw material available, practically any part of Ontario or Quebec can be supplied with fuel by a short rail haul.

Raw peat is a peculiar material having certain definite properties some of which have only recently been understood by the majority of those interested in the manufacture of peat fuel. When first excavated, it is usually brown in colour but turns black quite rapidly on exposure to the air. If it is excavated carefully and broken apart, the remains of the mosses and grasses from which it is formed can be seen quite plainly, but if the structure is broken by working up in the hand in the way putty is softened for use, all this structure disappears and you get a soft, black, homogeneous mass, not unlike clay to the touch, although it is very much lighter in weight. This, incidentally, is the most practical test to determine the suitability of peat for the manufacture of fuel. Any peat which, when worked up as I suggest, dries into a hard mass is, generally speaking, suitable for the manufacture of fuel but this will depend, of course, to some extent on the amount of ash present. The quality depends on the completeness of humification and the deeper the bog the better it is for fuel purposes, the lower layers being best.

If such peat when excavated, be thoroughly ground up, well mixed, and left in the open weather to dry, it will shrink to about ⅛ of its original volume when in the bog. If it is not ground up but excavated in bricks or sods as has been done in Ireland for a long time, very little shrinkage takes place. Peat contains a complex gelatenous hydrocarbon compound called hydro cellulose, the quantity varying from a very small amount in a fibrous peat, in which the process of decay has not taken place to any great extent, to as much as 1%, or more, in a well humified black peat. It possesses some remarkable properties; viz., it is capable of increasing its volume enormously through the absorption of water and in raw, well decayed peat it is found as a swollen mass, having the consistency of soft soap. On account of this substance the ground up peat, when dried, is practically non-hydroscopic, has a specific gravity of about 1.1 and, when it contains from 20 to 25% moisture, is tough and will stand the rough handling it necessarily receives in loading on railway cars and in unloading, and delivering in wagons. This gelatenous substance also performs the function of a binder.

Another property exhibited by a good fuel peat is its resistance to any mechanical means for expelling the water content. This is due to the fact that such peat possesses, to a certain extent, the properties of a true colloid and, therefore, the peat mass itself will follow the water in any attempt to get rid of the water by pressure; that is, after a certain amount of *free* water which is in the peat has been expelled.

It has been recognized for years that dried peat can be used as a fuel. At first it was cut out with a spade but later on primitive means were employed to grind it up and mould it. In countries where labor is cheap these primitive methods can be used today; for peat in many cases is the only fuel available and the cost of coal is very high. However, as the demand for peat fuel increased, efforts were made to devise a continuous process of mechanically expelling the water or of driving the water off by heat, and it has been in attempts such as these that most of the money in this country has been spent. Many prominent people lost money in these efforts and the peat industry received a set-back from which it has not recovered even today. At present, in spite of all this experience, ideas are being advanced for getting rid of the water in peat by the use of heat. I would like to emphasize in this connection a fact that should be plain to any man who gives the matter serious consideration. Raw peat contains, as I have pointed out, about 12½% of solids which, in an absolutely dry state, have a maximum heating value of about 10,000 B.T.U's per pound. Theoretically, this is about sufficient, with 100% efficiency, to evaporate the quantity of water with which the one pound of dried material is associated in the raw state; but in practice 100% efficiency cannot be obtained. Even if this was possible there would be no object in carrying on a process where there was no surplus material made. It does not matter whether an attempt is made to evaporate the water in a closed vessel, in a cylinder revolving over fire, or in tunnels through which currents of heated air are passed; for it takes a definite number of heat units to dispose of each pound of water evaporated and these heat units must come from some source. If the plant is run on its own fuel, this heat must be obtained by burning the fuel itself.

It is true that combinations of pressing out a part of the water (which can be done) and driving off a certain quantity of water by heat (which can be done) have been worked out on paper and a surplus of dried peat shown, but this can only be obtained with an expensive and elaborate outfit and at a comparatively high cost. The product so obtained will compare unfavorably, for fuel purposes, with the product I have already mentioned to you, which is obtained by grinding up and air drying the raw peat.

May I repeat that failure to recognize the significance of the following facts has been one of the main reasons why the peat fuel industry is not farther advanced. These facts are:—

(1) That owing to the colloidal properties of peat enough water cannot be successfully pressed out of it to materially aid in making a fuel.

(2) That there are not enough heat units in the dry portion of ordinary raw peat to drive off the water associated with it and leave a surplus for other uses.

(3) That if, by a combination of pressing out water and driving it off with heat, a surplus is produced, it compares unfavorably with the product which may be obtained by grinding the fuel up in its wet state and drying

it in the weather. These operations can be carried on at a very much less cost and with less costly apparatus than can be done with any equipment which has been suggested thus far to carry on the operations of artificial drying.

(4) When the artificially dried peat is obtained it is still in the form of a powder. This powder has to be briquetted before it can be used to advantage and this briquetting operation has been found full of difficulties.

There remains, then, only one process for manufacturing peat fuel, so far as I am aware, in which there are no technical difficulties and which gives promise of ultimate success. This process consists in excavating the raw material, thoroughly grinding and mixing it up and then spreading it out on the adjacent surface of the bog to dry. This process presents only such mechanical difficulties as have to be overcome in every day contracting work, and it is by this process that all the peat fuel, commercially manufactured today, is made. Large quantities are so made in Russia. In Sweden, I have been informed, the output of peat fuel has increased enormously since the war began, and I presume this is the case with other European countries where war conditions did not interfere with its manufacture.

The first attempt to manufacture fuel in this way in Canada, of which I have record, took place on a bog near Farnham, Que., between 40 and 50 years ago. A floating plant was built which excavated the peat by means of revolving knives ahead of the device to form a canal in which it worked. The peat was taken on board, ground up and eventually deposited on the bog surface adjacent to the channel which was being cut. I understand a considerable quantity of fuel was made in this way and that it was used for a time on steam railways. Owing to the increased demand, however, the fuel was delivered to the consumer containing nearly 50% of water which, of course, killed the operation.

The next attempt along this line took place at Victoria Road, Ont., where the writer made an effort to improve the drying conditions by spreading the peat on an artificially prepared drying area raised up off the ground. While a certain element of success was obtained at this plant it had the fundamental drawback that, as its capacity increased, the plant became very cumbersome and proportionately more costly; moreover, the depreciation was very high. This attempt was given up owing to lack of money to continue the work. Between the time the Farnham plant was operated and the time the Victoria Road plant was operated, most of the money which was raised for the artificial drying and briquetting of peat was spent, and lost. About the time of the operations at Victoria Road the Canadian Government Department of Mines sent a commission to Europe to investigate the peat fuel situation there. Acting on the report of this commission, a plant, the duplicate of one in successful operation in Sweden, was purchased by the Government and installed at Alfred, Ont. This plant was operated two seasons and a technical demonstration of the manufacture of peat fuel was made. The operation of this plant showed that the raw material could be made into a fuel that would stand transportation and that it could be conveniently used for certain domestic purposes. No attempt, however, was made to develop the industry in a commercial way; in fact, it was decided that, in order to make the process of manufacture commercially successful in this country, certain alterations would have to be made in the process in order to eliminate the large amount of hand labor necessary.

About this time J. M. Shuttleworth, of Brantford, Ont., who had already spent considerable time and money in connection with peat fuel projects, approached the Department and negotiations were finally concluded whereby Mr. Shuttleworth undertook to finance the construction of an improved plant on the lines suggested by the Government. With a view to encourage Mr. Shuttleworth, the Department of Mines granted him the use of the Alfred property and equipment and, in 1912, investigations were commenced with this new type of plant. A number of difficulties had to be overcome and, in 1913, just about the time that things were beginning to turn over, Mr. Shuttleworth was suddenly called to England and, a short time afterwards, had to sever his connections with this work. In 1914, however, the work was continued, with a small amount of capital then available, but with the expectation that the necessary money could be raised. Sufficient capital was arranged for, but, on account of the war, only a part of it was actually paid in. For the same reason, during 1915, it was not found possible to finance the proposition and it eventually closed down at a time when the only thing necessary to complete a commercial demonstration of the manufacture of peat fuel was the continued operation of a plant for a season.

Before proceeding with the description of the mechanical equipment used to make peat fuel, I would like to say something about the fuel itself.

The peat made in Alfred was approximately rectangular in shape 7″ to 8″ long, about 2¼″ wide and a little under 2″ thick. The blocks warped to a certain extent in drying and were not particularly attractive to look at. 70 to 75 cubic feet of the fuel, when thrown roughly in a pile, weighed a ton but, even with this bulk, it was possible to load the ordinary 30 ton box car with 25 to 28 tons. 250 tons of the fuel manufactured by the Government was left for two years in small piles open to the weather before being sold; but it was found that only the outside layers had deteriorated to any extent. They showed a tendency to break up into smaller pieces, but they could still be used. The blocks are non-hydroscopic and can be immersed in water for a considerable period without any bad effect; and will not, in any case, return to anything resembling the original raw material. The fuel was sold to a large number of customers in Ottawa and was found to be highly satisfactory for the following purposes:—

1. Autumn and spring uses in the furnace;
2. Cooking;
3. Open grate fireplaces;
4. Use in such type of stoves as the Quebec heater.

It is not satisfactory for use in a furnace during the heavy winter months except where constant attention can be paid to the fire. If sufficient fuel is loaded into the fire box to obtain a bed of coals that will give out sufficient heat during the day, for comfort, one of two things will happen: if sufficient air is admitted to promote complete combustion of the volatile matter, which comes off very rapidly, the fire will get beyond control; and, if the drafts are closed down to regulate the fire, the heating value of the fuel goes up the chimney in unburnt gases. In order to permit of its satisfactory use, it is necessary to add fresh fuel to the fire about every two hours. When this is done, excellent results are obtained. This is not the case, however, in the autumn and spring. During these seasons a moderate quantity of fuel can be put in the furnace in the morning and a hot quick fire obtained which will make the house comfortable, and leave sufficient live coals to ignite another fire in the evening. The house may thus be kept comfortable with less inconvenience than with the use of coal; for a coal fire, under similar conditions, if permitted to burn sufficiently vigorously to keep alight, overheats the house and the heat is wasted through having to open the windows. If, in this case, the fire is damped down it will go out with all the attending inconvenience and loss of fuel.

For the open fireplace, it found to compare favorably with cannel coal on account of the long fat flame and the cleanliness of the fuel. There is no spitting; or heavy black smoke; or soot from peat, and actual experience shows that it would replace cannel coal practically ton for ton, although the actual number of heating units available is much less. For cooking purposes peat is found to be highly satisfactory on account of the ease of control.

Although a great deal of experience is not actually available, yet, for the man who is unfortunate enough to have to buy his fuel in 100 lb. lots, peat should be more satisfactory, ton for ton, than coal. Not more than 3 or 4 separate fires can be made from 100 lbs. of hard coal while double this number can easily be made from a like quantity of peat and more useful heat obtained from it than from the coal. For this and similar reasons, although it requires 18 lbs. of peat to be equal to 10 lbs. of coal in actual heat units produced, the difference in favor of coal is not nearly so great in actual practice.

I would like to make one other explanation before closing this paper. From time to time articles have appeared in which various claims, as to the cost of peat fuel, have been made. This word cost has been used in a number of different ways and failure to state definitely what is meant, has been the cause of much misunderstanding and uncertainty. The cost of fuel to the consumer is made up of a number of items—the cost of delivery, the retailer's profit, freight charges from the place of manufacture to the place of consumption and finally the cost of the fuel on the cars at the plant. This latter item may again be subdivided into the production cost, the overheat cost and, so far as the consumer is concerned, the manufacturer's profit. It is necessary to keep all of these factors in mind in order to understand why fuel which is said to cost $1.50 per ton, is offered to the consumer at, say, $6.00 to $6.50 a ton.

By considering these items some reasons why the peat fuel industry is not at present a going concern will be seen. The actual cost of fuel on the cars, I have said, is made up of two items—the production cost and the overhead cost. By production cost I mean the actual cost for labor, fuel and operating supplies; which elements vary, practically, directly as the amount of fuel produced. By overhead cost I mean such items as the superintendent's salary, depreciation, insurance, rents, taxes, etc., which are practically the same whether 100 tons are produced in a season or the plant is run to full capacity. Since none of the plants, which have been operated to date in Canada, have run anything like a full season it has been necessary to estimate this overhead cost as, if it were charged against the actual quantity of fuel made, it would show a cost that would be very misleading and quite prohibitive to the commercial manufacture of peat fuel.

The small quantity of fuel made at any one time has also had a very considerable influence on the costs of the other items I have mentioned above. For instance, the railways have refused to make any special rate for peat fuel until there is a sufficient quantity offered for transportation to make it worth their while to go into the matter. There has never been sufficient fuel offered for sale to warrant the retailer making provision for storage and such other provision as might be necessary for the economic delivery of the fuel to his customer. In fact, there has never been enough fuel offered for sale to enable one to make any businesslike arrangements for its disposal, and, therefore, fuel which has reached the consumer, has been loaded up with maximum costs all around.

Summing up then, the reasons why the manufacture of peat fuel are not farther advanced in Canada are:—

(1) A great deal of money has been wasted in experimental work along improper lines. This has been responsible for a more or less general antagonism on the part of the public towards any further developments.

(2) Investigations, later attempted, toward the adoption of the already tried and proven prccess as used in the old world, have never been carried to completion. They were on too small a scale to warrant the equipment necessary for economic loading on cars; to get the best freight rates; and to make anything like efficient arrangements for delivery to the consumer.

I might add to this the fact that, prior to the war, the cost of hard coal was so low that there was not a big margin in favor of peat even under favorable conditions. The present price of coal and the experiences which we have gone through in the last few years, tend greatly to eliminate this condition.

I have not said anything about the industrial uses of peat. As there has never been a reserve supply of peat fuel available there is little actual data on which to express an opinion, outside of the experiences of the Fuel Testing Branch of the Department of Mines. They have, however, made a number of steam raising tests on their Babcock and Wilcock water tube boiler and also on a portable, locomotive-type boiler. Briefly, their bulletin No. 17 shows that the fuel burnt with a long flame and considerable light coloured smoke. The best results were obtained with a large grate having small air space, and a fuel consumption of 15 lbs. per square foot per hour. The evaporation of about 4 lbs. of water from, and at, 212°F. was obtained per pound of peat fired. The fuel used ran about 30% water, and a thermal efficiency of about 52% was obtained. In no case were any special arrangements made to proportion the fire box to the heating surface, etc., and undoubtedly better results could have been obtained if proper arrangements could have been made.

The production of electrical energy from peat fuel, using a producer with or without bi-product recovery, seems to me to be the ultimate industrial use for peat, but I will not go into this further at present as I understand it is to be treated in another paper, following.

Peat, Oil and Gas Fuel*

By B. J. Forrest, M.E.I.C.

During the past century peat and lignite have been employed in their raw state as fuel in those countries of Europe and America where coal is scarce or costly, and where peat bogs and lignite are abundant. According to Government reports, there are over 37,000 square miles of good peat bogs in Canada, and this is only a fraction of the area which could be turned into light, heat and power in the shape of coke, oil and gas. The object of this paper is to try to point out the best use that might be made of this, up-to-the-present, practically latent resource of our country.

Scientific research is every day making industry less of a gamble and more an exact proposition by eliminating the waste of fuel and useful bye-products; by increasing production; and by finding new uses for the bye-products.

About 5 years ago, at Toronto, Professor Gillespie stated that Canada must plan for decades; as the fuel supply was becoming a serious question and as electricity, which has been so largely developed of late years from hydraulic sources, cannot generally be used for heating purposes at reasonable cost. It might be noted, in connection with this, that peat bogs are not generally situated near rivers. Electric light or power can be developed from peat by means of a gas producer, gas engine, and dynamo. Dr. Haanel, Director of the Canadian Government Department of Mines, stated that the only way to become independent of foreign resources in Canada is to develop our numerous peat bogs; and C. A. Davis, U. S. Bureau of Mines, says that, where coal is scarce or dear and peat bogs abundant, the peat bogs should be exploited.

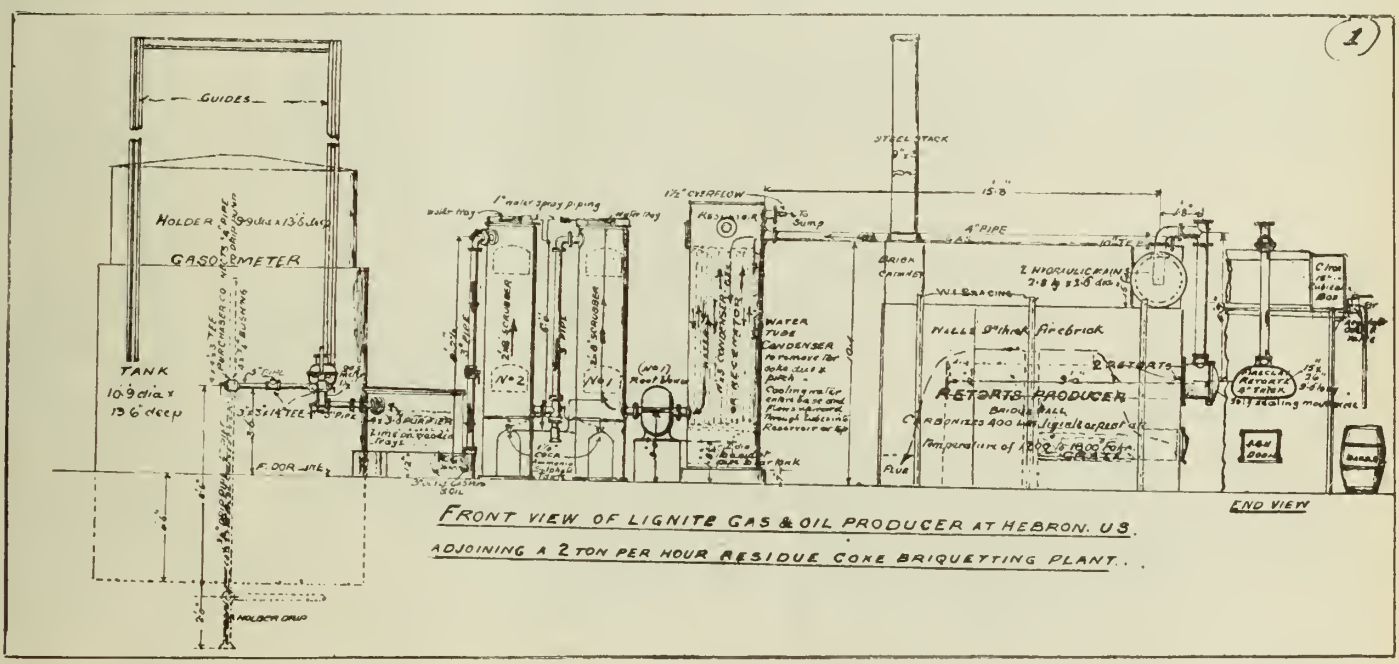


Fig. 1.

The production of commercial products from peat, culm and lignite is now an accomplished fact; for there are about thirty plants in Europe and America making coke, oil, gas and bye-products from peat, lignite, culm, shale and saw mill refuse. Unfortunately, what is true of some mining propositions is also true of industrial undertakings; for many have been ruined by quack engineers, stock jobbers and speculators. Such was the case with a peat company I knew in Ontario. Many experiments have been carried on and improvements made in methods of handling peat fuel during the past ten or fifteen years, but, according to the opinions of Prof. Morgan, C. A. Davis, J. A. Cottrell and Bruning (fuel and gas experts of the British, United States and German Governments and of some of the big steel and industrial corporations) the peat problem has not hitherto been handled logically. In all industrial problems it is necessary to get down to the basis of the chemical composition of the material used. Hitherto peat problems have mostly been attacked with the idea of producing and selling a solid fuel, whereas the industrial value of peat, as shown by chemical analysis, would be greater if sold in the form of gas, oil and bye-products. It contains about 60% of tars, oils, hydrocarbons and gases and only 25% of fixed carbon. One ton of peat containing 50% of moisture—the latest producer plants in Europe are working with 60% moisture, using improved producer gas plants, will produce the following:—

(1) About 20,000 cu. ft. of high grade illuminating gas (160 B.T.U's per cu. ft.); or,

(2) 40,000 cu. ft. of medium grade heating and power gases (130 B.T.U's per cu. ft.); or,

*Read by the author at the Montreal Branch meeting, March 20th, 1919.

(3) 80,000 cu. ft. of low grade heating and power gases (about 100 to 110 B.T.U's per cu. ft.).
The last (3) is the grade of gas the steel corporations in Europe and America are introducing in their plants; it being the most economical per heat unit.

In addition to the above gases, the following bye-products are produced, by retorting, per ton of peat:—about 800 lbs. of coke, 100 lbs. ammonium sulphate, 40 lbs. crude oil, 16 lbs. paraffine, 4 to 8 lbs. pitch, 5 lbs. creosote, benzol, alcohol, toluol and antiseptics. A fertilizer and packing company in the United States says that they can use 3000 tons of peat, moss and litter per annum: this could be shipped straight from the bog. Incidentally, I might state that peat olafines and gases are first-class preservatives, antiseptics and disinfectants. Dr. Miller, of Toronto, has stated that they are good for lint dressings for wounds. There should be no nuisance from, or objection to, fume or smoke from peat gas manufacture.

The manager of the Gas Power Corporation, England, informed a friend of mine that 100 tons of dry peat yielded about 37 tons of gas and volatiles, 30 tons of oils and olafines, 25 tons peat coke or coke powder, and 8 tons of waste and ashes. The following is an approximate valuation of one ton of gasified peat:—(Gas Power Corporation—average from 16 plants).

Gas

40,000 cu. ft. medium or semi-oil gas @ 25c. per 1000 c.f.	10.00
or 80,000 cu. ft. low grade producer gas @ 12½c. per 1000 c.f.	10.00

Bye-products:

750 lbs. coke @ $5 per ton drawn from producer grate	1.50
80 lbs. sulphate of ammonia @ 2c. per lb. (price going up)	1.60
about 100 lbs. tar, asphalts and acids @ 2 c. per lb. (price going up)	2.00
Total value per ton of peat, gasified, about	$15.10

(A recent U. S. Engineer's report gives $15.)

Against this we have producing cost as follows:—

Preparatory work in bog digging, transporting, spreading, drying, decorticating and feeding producer, about	$4.00	per ton.
Superheating, condensing, scrubbing, supplying reagents, lime, gas, steam, gas cooling and blast fans	2.00	"
Repairs, renewal and upkeep of conveyors, producer plant, scrubbers, etc., about	.50	"
Transportation, delivery, piping or storage of finished products, overhead charges, interest, etc	.60	"
Total	$7.10	"
Value of manufactured product	$15.10	"
Cost of manufacture	7.10	"
Approximate profit per ton of peat	$8.00	"

This shows that the bye-products pay most of the operating cost. This estimate also shows that the main value of peat is its gas and bye-product production. The estimate applies to a large and complete *bye-product plant*, running continuously. A plant with no bye-products would give about one half the profit.

The late D. J. Wilson, of Toronto, fuel and gas engineer, showed me, at an experimental plant near Toronto, a number of samples of peat and muck with which he was making trials. He found that the lower and blacker peat and muck gave better results when gasified or olafined than when briquetted. During trials made with a gas engine he found that he was troubled by tarry oil gas clogging the valves. After trying a solvent and after using a special type of vaporizer and injector, he got the engine to work. He was really trying to make a gas engine work on oil. Owing to war work and lack of capital he had to suspend further trials. I may remark that, during reaction tests, he got some fine colored olafine stains, which were no doubt dye bases. He told me that he was also working on briquetting, but found that he was losing most of his oil and gas values thereby. The briquetting plant was later shut down. In an ordinary producer plant there is very little machinery except small water, gas, oil and air pumps to get out of order. Further, the producer plant can deal with semi-dry peat—a saving. Excess of water is not only the civil engineer's but the peat engineer's bugbear.

C. A. Davies, United States fuel and gas expert, states that the cost of the upkeep and operation of an oil gas producer plant is about half that of a briquetting plant, while it is less liable to break down; for there is practically no machinery to get out of order. This is confirmed by Mansfield, Cottrell, and a friend of mine who is the engineer of a Gas Corporation in England. More attention has been paid to bye-products of late years. To handle them requires a more complete and expensive plant, and generally an addition to the generating plant is necessary. Generally, very low grade lignites, shales and peat are gasified in Europe and the United States. Gasifying gives better results; for briquettes often crumble to fine slack or culm (even with binders) when roughly handled in loading, unloading and transportation.

In view of the foregoing facts and what I have seen in Wolverhampton England, Toronto, Thornhill and Montreal, I am of the opinion that there is a good outlook for this industry and especially so in Ontario where coal is dear and scarce. Lower grade producer gases, and cheaper fuels for producing such oils and gas, are in increasing demand by steel mills and factories. Heavy and light oils and gases can be produced alternately or continuously by the same producer plant. The price of the coke powder produced, and especially the bye-products, is rising steadily. These are some of the main reasons why peat should be exploited in Canada.

According to fuel and gas engineers, to whom I have already referred, the points or features to study in connection with the construction of "producers" are as follows:—effective heating and gasifying capacity, poking and charging facilities, uniform distribution of air and steam blast into incandescent zone, water seals, traps and doors around producer to facilitate ashing, poking and inspection of steam and air supply, ease of manipulation while working at full load and charge, visibility of fire and fume space by stoker, which is very necessary for proper control of producer. Air and steam blowers and injectors must be conveniently located and the necessary pressure and pyrometer gauges fixed at combustion and gas zones to insure a maximum reduction of monoxide fumes and to facilitate the formation of olafines and gases. The same authorities state that the maximum heating effect of a producer is obtained when the temperatures of furnace, producer, condenser and regenerators are under direct and proper control; so that the olafines and gases can be delivered hot or cold. All the necessary condensing, regenerating and superheating of olafines, tar oil, liquor gases, steam and air are thereby conveniently and inexpensively accomplished by intercepting, jacketing, trapping and regulating waste heat from the producer, superheater, regenerator, condenser, scrubbers and engine.

(6) A good clean fire is maintained with little trouble.

(7) A steady and regular output is maintained in producer.

(8) Standby losses and upkeep are greatly reduced; for working can be stopped or damped immediately.

(9) A saving of from 20% to 25% on the ordinary boiler and furnace, which can only operate with very dry fuel.

(10) A saving (by actual test) of about 20% to 23% in fuel.

(11) It is generally possible to use a cheaper class of fuel; such as lignite, peat, lumber waste, sawdust, culm, oily or shale refuse.

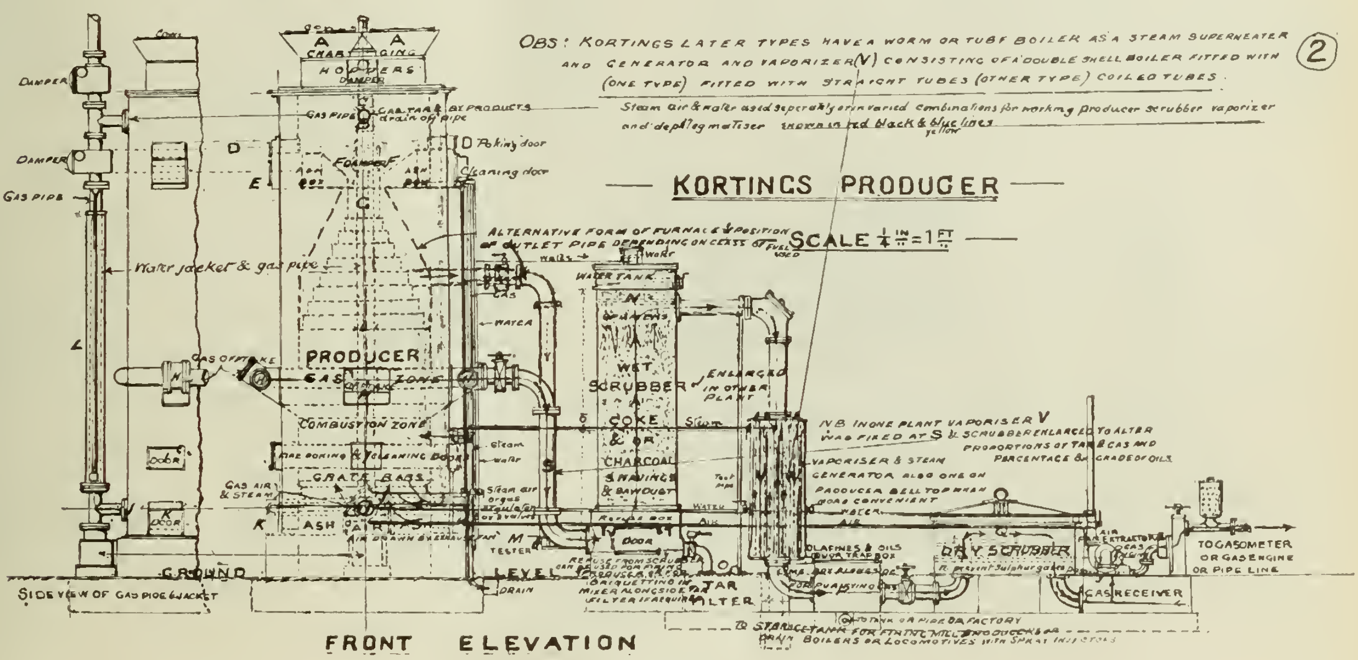


Fig. 2.

The advantages of using Gas Corporation producers are the following:—

(1) Higher temperature and more complete combustion obtainable.

(2) Fire trimming and condensing, and heating and cooling temperatures are under absolute control.

(3) By recuperation a large amount of heat, lost in waste gases, is returned to furnace through the water heater and the air and steam dryer.

(4) Smoke nuisance is eliminated. (Although peat smoke is a disinfectant.)

(5) The labor of handling peat ash is one-third that of coal and what is left is very fine and could be either sucked or blown from the ash-hole by a Koerting or other blower. (Some plants have sold the ash as fertilizer).

Heavy and light peat oils and gases may be used in mills, factories, teelworks, furnaces, gas engines, locomotives (see Fig. 5), or road tractors. The olafines may be piped and tanked and later gasified in the garage, depot, or round house. Storage tanks might be erected opposite plants and alongside railways and the gas or oil pumped into the engine room or locomotive tender and then gasified or vaporized by a suitable vaporizer, the same way as petroleum and heavy oils are used. By this means the pressure in the boiler can be raised very quickly or the fire shut off instantly in case of need, or when a locomotive run is completed. If more convenient, or if required for other services, the heavy olafines could be pressed into blocks, or caked like petroleum "masut" in Russia, and delivered to the locomotives, mills, factories or garages and later by means of condensers or vaporizers could be turned into heavy or light oils or gases, as required, on the spot.

The following extracts and quotations are of special interest:—

The Fuel Problem

Powdered fuel and oil for locomotives has given good results on German, Swedish, Norwegian and Russian railways and is now being tried by some United States railways. Any kind of fuel such as lignite, culm and peat, with two-thirds combustible contents, suitable for steam generating purposes, is used. These are now practically unsaleable. The cost of preparing pulverized coal or peat is about 60 to 80 cents per ton; liquifying and gasifying is done in same operation.

The outfit is simple (See Figs. 1, 2, 4 and 5.), consisting of air, steam and powder blowers or injectors. Fire is started up instantly and a pressure of 200 lbs. per sq. inch is obtained within one hour. Apparatus requires very little attention, and is easy on stoker, as all is regulated by valves. When properly controlled, mixture bursts into a strong flame with very little smoke. A saving of about 20% in fuel account is effected.

Though fuel units of lignites and peats are about half that of coal, their olafines contain a large quantity of gassy oils, which raise its efficiency to nearly two-thirds that of coal and its cost per ton being about one-half or less, its utility is nearly as great. When liquified or gasified, the gas or oils can be cheaply piped from the bog to the tank alongside railway, as the pressure is low. Owing to this, very little leakage results and box piping is preserved. No rust arises in iron piping or tanks.

If more convenient, the tar oil can be tanked direct from plant and piped into tender, from tank, and gasified by a vaporizer injector on locomotive firebox, of the same type as used in petroleum fired engines. There are various types of injectors and vaporizers, Holman, Hornsby-Ackroyd, Tangye and others, suitable for this work.

Extract from Scientific American. March 25, 1916.

Fuel and Power

Canada has by no means wrestled as she should with the fuel and power problem. We are glad that peat and lignite are being considered and trials made. These efforts are certainly a move in the right direction and should be given all possible support which should have been done two years ago. The U. S. are already working on this matter, making a saving of 3,000,000 tons per annum. The advantage of using gas fuels and extracting their bye-products before consuming coal for power purposes will make a saving of about $500,000,000 in the U. S. fuel account.

Extract from article by A. V. White, in the Canadian Engineer, March 12th, 1919.

Summary on Handling Peat

1st. Liquify or gasify in producers saving bye-products which are valuable.

2nd. Turn the large amount of nitrogen into ammonium sulphate, a valuable fertilizer, together with the peat ash containing potash (a fertilizer).

3rd. Fractionate the tar into pitch, tar, candle wax, lubricating and burning oils and powerful disinfectants, greatly exceeding carbolic acid in germicidal strength.

4th. The aqueous distillate contain ethyl alcohol, acetone, pyridine bases and acetic acid are very valuable.

By Dr. Morgan, Cottrell, Lawson and Davis.

Gasoline Shortage

A world shortage of gasoline waits just around the corner for the motor propelled world, according to Mark L. Requa, Standard Oil official, who has been directing the oil division activities of the fuel administration.

The only preventive Requa believes is an engine that will burn crude oil.

The American Society of Automotive Engineers in session here to-day, in considering this problem, put it up to Requa and his associates. J. E. Pogue who has been devoting his attention for the government to oil conservation, is scheduled to tell the engineers that but 50% of the petroleum produced in this country is being utilized, that kerosene burning engines, while a great help in conservation, will not solve the difficulty, and that much higher prices for gasoline are ahead unless the crude oil burning engine comes to the rescue.

Extract from a New York Paper, February 13th, 1919.

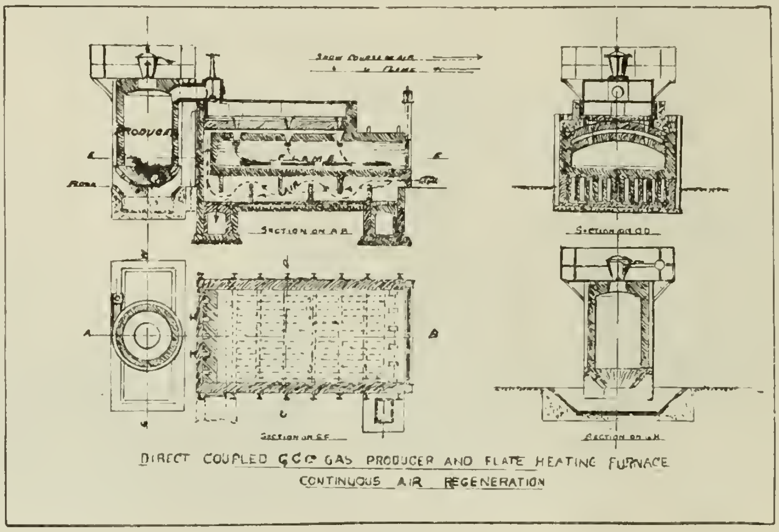


Fig. 3.

To the best of our knowledge there is not a successful peat briquetting plant in operation in the United States or Canada to-day. Peat briquettes only give from 6000 to 8000 B.T.U's per lb. and the cost of manufacture is about twice as much as briquets made from anthracite or bituminous coal and the results obtained from burning peat briquettes is little better than wood."

"We have been recommending for some years the carbonizing of peat in producers, thus saving the bye-products which are valuable and should pay a good profit (Briquetting the peat charcoal residue). These products command in the United States and Canada about $15 per ton.

Extract from Mashek Engineering Company's book on Briquetting Plants, Page 26.

The serious increase in the cost of fuel which has occurred during the past 18 months and the certainty that when the war is over, coal will not return to its former low level of value, is forcing engineers and chemists in all countries to consider the use of other forms of fuel such as peat and lignite for heating and power purposes and the much neglected low grade fuels are at last receiving a fair measure of attention. In Friesland, Weismore, Emjade, Whilhelmshaven, Aurich, Bant, Nolden, Oldenburg, Rustingen, points within 30 miles of these districts are using peat from adjacent bogs and plants; so far they have spent £200,000 ($1,000,000) on these plants, which they are successfully operating up to 5000 H.P. The calorific value of the dried peat briquettes equals 7000 B.T.U. or about half of ordinary coal, giving 73% of efficiency and evaporating 3 lbs. water to one pound of peat. The cost of operation compares favorably with ordinary steam plants—gasification being considered.

Extract from the Scientific American, April 8th, 1916, Page 233.

Peat, Fuel and Gas

Experiments in Europe, notably in England and Germany with ordinary producer gas, as fuel for internal combustion engines and boilers, has shown that the longer the combustion and power, the more the loss decreases. Producer gas although of lower calorific value than illuminating gas, gives better results as it produces little or no back fire.

hydrocellulose will not part with all its water by pressing, but will do so by evaporation and heat; this also releases wet mush, olafines and gases.

Engine power efficiency 70% with gas—about 2 tons air dried peat would run a 100 H. P. Engine for 10 hours with producer.

Above figures show plant is dearer than a steam plant for same horse-power, *but cost of operating with oil or gas fuel is reduced by about one-half and this is the main point.*

Capacities of small plants from 10 to 100 tons peat per day. Gas engineers say it is only a question of deciding type and size of engine, and remark that a 100 H.P. engine worked with natural gas of 800 B.T.U's per cu. ft. will only give 80 H.P. by producer gas (or 20% less) (with 200 H.P.—15% less) (with 300 H.P.—10% less) thus proving that the power of producer gas is much more efficient than the rich one even in an engine designed for using the richer gas, hence preference for it by large factories and steel plants. Numerous trials in Europe with producer gas have shown that it will give two to three times the power obtained by steam. Results in 16 plants were from 28 to 30 cents per effective horse-power hour. Plant can be started in a few minutes and run for a considerable time without attention or shutting down plant; easy to handle and simple in construction.

Extract from the Scientific American, November 20th, 1918.

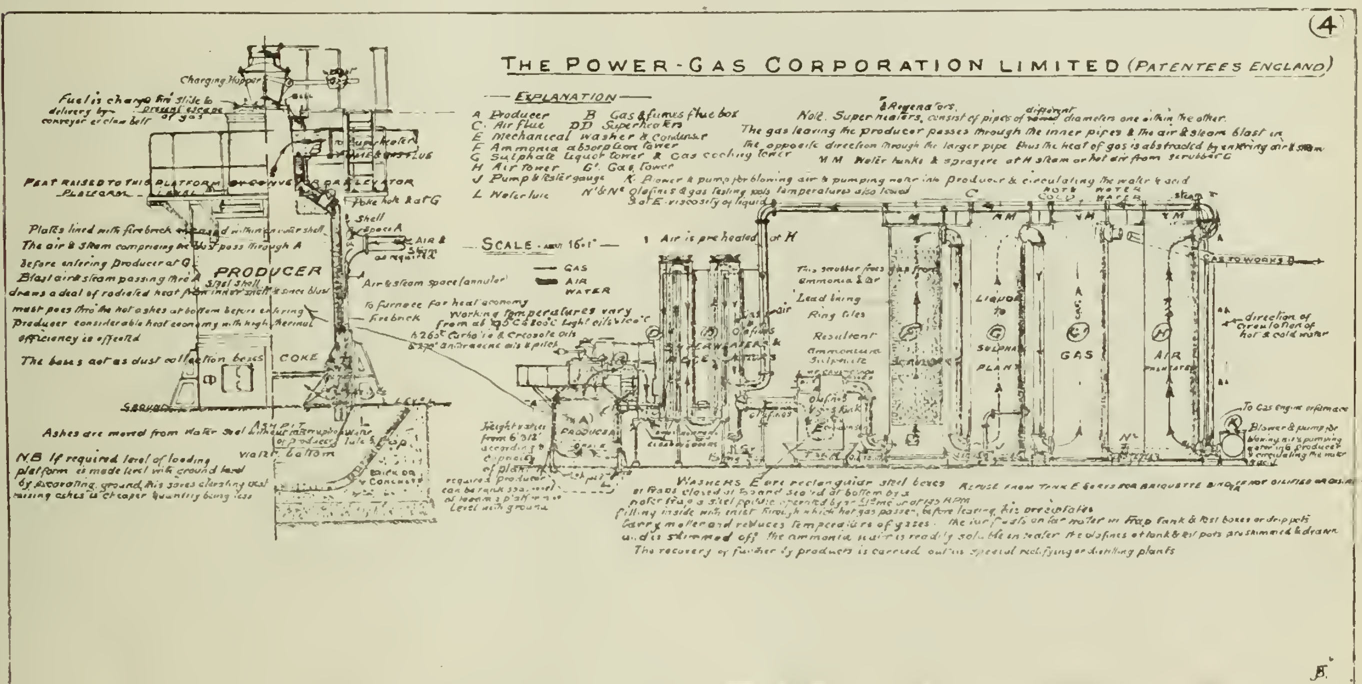


Fig. 4.

Large area of peat near Minnesota Iron Mines is being turned into producing gas for boiler firing, for power plants, the bye-products alone are paying for the installation of plant, and actually getting the producer gas free of cost. Companies say that though B.T.U's lower than illuminating gas it gives better results.

Comparative analysis:— Peat tested 1911

Average moisture.....	33%	coal gas.....	660 B.T.U's per cu. ft.
Dry fuel, carbon......	30%	water gas....140/150	" "
Volatile matter.......	63%	peat gas, about 360	" "
Ash and loss.....	7%	calorific value 9460 B.T.U's per lb.	
	100%	explosive mix. 10 air to 1 gas.	

Flashing points of oil gas 80% to 100% Fahr. according to quality.

Semi-dry peat liberates about 60% of tar oil and gases and 25% coke powder.

Gas can be liquified by high pressure and freezing.

Electrolytical drying of peat—results poor. Eight times the cost of direct firing. Ekenberg & Zieglers processes for peat drying have not been a commercial success. Prof. Morgan says the

The Utilization of Peat—Peat as a Source of Power

The problem of the utilization of peat for industrial purposes is one of perpetually recurring interest, and scientific men in many countries have turned their attention to work out a solution. This is not surprising in view of the fact that the amount of combustible matter in the world's peat deposits exceeds that of all the known coal fields. This represents a vast amount of potential energy awaiting only a practical way of utilizing it.

A new vista of potentialities for peat has opened up in recent years. As the nineteenth century will always be associated with the development of the steam engine, culminating in the steam turbine, so will the twentieth century be able to claim the triumph of the internal combustion engine. The success of the gas engine has led to investigations which resulted in the many forms of producer gas plant, and there are now many thousands of installations of this method of producing power for mechanical purposes.

It is a noteworthy and encouraging fact that an installation at Portadown, Ireland, for utilizing peat in producer gas plants has been found to be entirely satisfactory and to effect a considerable saving over anthracite. This is the more remarkable, as the bye-products are not at present utilized. But these bye-products are of considerable value.

The first of these is the power plant of the Societa per L'Utilazione du Combustibill Italiani, at Orentano, Italy.

The peat excavated by manual labor is fed into Dolberg peat machines which are provided with belt conveyors to transport to the peat macerators. Part of it is air dried and part mechanically treated and dried artificially. The peat delivered to the producers with an average moisture content of 35/42% has an average nitrogen content of 1.04%. The nitrogen is recovered as ammonium sulphate, and the gas is used to drive two engines of 360 metric horse-power, each, which drive a.c. generators—there being a transmission—line to Pontedera ten miles distant.

The second installation referred to is the ammonia recovery power plant of the German Mond Gas Co., situated on the Schweger Moor, the system of Frank and Carlo to utilize peat containing about 60% moisture. The total power capacity is over 3000 H.P. and the gas engines are coupled to alternators running in parallel.

Messrs. Hamilton Robbs, of Portadown, have a weaving industry and about 4 years ago decided to try the experiment of establishing a peat producer gas plant. The fuel used is peat dried in open air by the usual method of stacking, and this is cut from a bog some miles distant. The plant supplies gas to two engines, of 120 b.h.p. and one of 150 b.h.p. By means of the conveyor the peat blocks are elevated and carried to the feed hoppers on the top of the producers, from which they pass into the generators where gasification takes place. It is stated that under working conditions with peat at 5s. a ton, power can be obtained at the rate of one-sixteenth of a penny a horse-power hour, with an extension of this method of utilizing peat, it would be possible to deal in a profitable manner with the bye-products which would thus be produced in a sufficient quantity to allow of their being dealth with in chemical works. We should in this way not only establish an additional industry, but this method of obtaining power from peat would be rendered still more profitable. Where a sufficient demand for power exists, it appears certain that instead of carrying the bulky peat either by road or by water, it would be advisable to instal producer plant on the bog itself and to convert the mechanical powers into electricity and transmit the energy at high pressure to the point where it is required. The efficiency of such conversion and transmission is now very high.

The foregoing development appears to be a practical realization of the view held by many workers on peat in this country, that the most economical use to make of this combustible is to convert it into gaseous fuel in suitable gas producers.

When peat is gasified the products are combustible gas, ammonia, ash, tar and an aqueous distillate containing certain technically important organic compounds. The combustible gas which is generally free from sulphur, consists of carbon monoxide and hydrogen mixed with the non-combustible gases, nitrogen and carbon dioxide.

These plants supplied by the Power Gas Corporation, Ltd., England, who, in 1905, first turned their attention to the method of utilizing peat, have obtained the following extremely favorable results:

Fuel Used	German Peat	Italian Peat	English Peat
Moisture content of fuel.......	40 to 60%	15%	57.5%
Nitrogen "	1.0%	1.58%	2.3%
Quantity of gas produced per ton of theoretically dry peat—cu. ft.	85,000	60,000	90,000
Heat value of gas produced—B.T.U's. per cu. ft.........	150	166	134
Sulphate of ammonia produced per ton of theoretically dry peat.....................	70 lbs.	115 lbs.	215 lbs.

Peat containing 63% of moisture and with a nitrogen content of 2.235% yielded per ton 94,850 cu. ft. of gas (100 B.T.U. per cubic foot) and 168 lbs. of ammonium sulphate.

The ash of peat contains the oxides of aluminum, iron and calcium with a preponderance of potash.

The moisture peat producer tar yielded on distillation 50 to 55% of volatile oils. The fraction of acidic peat oil boiling at 200-240° is seventeen times as active as phenol (carbolic acid).

The neutral oils left after extracting the germicidal acidic oils with alkali could be used as lubricants, as liquid fuel, for example in Diesel engines, and when mixed with the pitch from peat tar would furnish a refined tar.

From article by Professor Morgan, F.R.S., London, in "Nature," March 2nd, 1916.

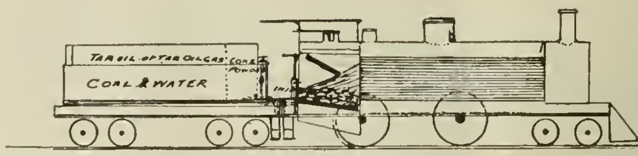


Fig. 5.

Peat, Gas Fuel and Bye-Products

Extracts from various Government reports and reports of experts:—

Analyses:

Raw peat moisture....	49.80%
Volatile matter........	29.20%
Fixed carbon..........	11.00%
Sulphur..............	0.33%
Ash and waste........	9.67%
	100.00%

Gas by Volume:

Carbondioxide (CO_2)..	11.30%
Carbon monoxide (CO).	22.30%
Hydrogen (H_2)........	14.10%
Methane (CH_4)......	2.10%
Nitrogen (N_2)........	50.00%
	100.00%

Producer gas runs about 150 160 B.T.U's per cubic ft. Florida peat gas runs about 170 B.T.U's per cubic ft. Prof. Wyer, Germany, states that the relative heating value of poor gases is more than rich gases, as tests have proven that there is a loss of about 20% with the rich gases. He says the ideal power gas of the future will be one having a heat value of about 100 B.T.U's per cubic foot. These gases are now being used by some of the steel corporations.

The tests made in Europe and the United States with peat gas producers and engines, surpasses in effective horse-power all the various coals used in boiler tests. This proves that the value of peat, as fuel, is greatly increased by the use of the gas producer.

The quantity of peat consumed in producer plants per horse-power hour varies from 2 to 3 lbs. The cost of peat gas works out, therefore, much less than that of coal in steam boilers.

The Peat Gas Company use peat containing about 60% of water and, out of 30 plants, 20 are using this class of peat. They build two types of producer to suit the different percentages of peat moisture and the bye-products extracted. The cost of these plants vary from $40 per h.p. for small plants to $20 per h.p. for large plants. A 30 h.p. gas peat plant costs about $1600 F.O.B. England.

A gas producer plant costs more than a steam engine plant but the cost of operation and maintenance is nearly one-half; on account of its fuel efficiency, the cost of labor and fuel being reduced 50%.

Many gas producer plants in Europe are now being modified so that peat gas may be used and the bye-products recovered. Tars and dyes are only recovered in the larger plants; they are best left alone in small plants.

The approximate cost of a producer, complete, varies from $1,550 for 25 h.p. to $35,000 for 1000 h.p. exclusive of buildings. It was found that 2 tons of air-dried peat unsuitable for boiler fuel would run a 100 h.p. plant 10 hours by employing a P.G. producing plant and engine.

Peat gas is being used in Europe for lighting; firing under steam boilers; brick, pottery and lime kilns; forges; furnaces; and for ore roasting and glass furnaces: peat gas fuel is generally free from sulphur and is cleaner than coal. The class of producer depends on the class of fuel used.

Our large peat deposits can be profitably utilized and the large amount of stored up energy in them recovered, as power, by converting the raw peat into producer gas. The power developed may be used by factories on the spot or used as electrical energy at a distance. Large plants may go in for the distillation of bye-products (sulphate of ammonium and tar) but, even without these, the gas producer presents many advantages, especially for plants of 100 h.p. and upwards. A gas producer admits of wetter peat being used than in direct firing and the economy is greater.

Summary

1. The industrialization of peat could be most efficiently brought about by gasifying it in gas producers; as this procedure would render feasible the recovery of several valuable bye-products.

2. The combined nitrogen of the peat can be economically recovered in the form of ammonium sulphate. The valuable fertilizer, together with the peat ash containing potash and phosphoric acid, could be restored to the land from which the peat has been taken.

3. Peat tar, another bye-product, can be fractionated into the following useful materials:—refined pitch and tar, candle wax, lubricating and burning oils, and very powerful disinfectants greatly exceeding carbolic acid in germicidal strength.

4. The aqueous distillate from the producer contains methyl alcohol, acetone, pyridine bases, and crude acetic acid, all of which are capable of recovery and utilization.

Improvements in Hot-Air Furnaces

The author opens this paper with a general dissertation on hot-air heating, and points out especially the importance of drawing the cold air supply from within the building in very cold weather by means of a suitable inlet, preferably in the first floor landing. Although it may be more conducive to health to draw the air supply from the outside at normal temperatures, in very cold weather the air leakage through door and window cracks has been proved to be ample for ventilation purposes. In the interests of fuel economy the interior air, which is already probably at 60° F., should be used, instead of exterior which may be at zero or even colder. A two-way valve or simple damper will enable the operator to draw the air supply from whichever direction seems best at any particular time.

The author proceeds to describe some improvements which he made to his own hot-air plant, and points out that two of the great advantages of hot-air heating systems are: there are no water pipes or boilers to give trouble in severe weather, and no complicated parts to get out of order if carelessly or ignorantly handled.

If it is found that the air distribution to different parts of the building is not equable, the cause may be traced to the fact that one of the hot-air delivery vents is acting instead as a cold-air suction. This is because the suction inlet pipe in the furnace is not of sufficient size, and the slight vacuum in the furnace has consequently to be relieved through some other direction. To overcome this difficulty the cold-air inlet should be increased until it equals in sectional area the total sectional area of the delivery pipes.

If a strong wind should be blowing into the outside cold-air inlet more air may enter the duct that can pass through the furnace. Unless it is prevented, this cold air will flow through the inside cold-air furnace inlet and thus into the building. To prevent this an automatic check valve may be made by suspending a light framework covered with any light material over the inside inlet, in such a way that it will swing to by its weight, but will open to the slightest suction of the furnace vacuum. The air of the building may be kept properly humid by the installation of a cast-iron evaporating pan immediately over the fire pot in the hot-air chamber, fed by a pipe from a small copper tank outside the furnace, the water supply being controlled by a float-valve in the tank. The water in the tank and in the pan is at the same level.

The author points out the advantages to be derived from placing an electric fan in the cold air supply pipe to act as a blower, and concludes by emphasizing the importance of giving greater attention to the design and construction of the furnaces for these hot-air plants than has been done in the past.

(Baker, U. S. Bureau of Mines, Technical Paper No. 208.)

* * *

Gas-Engines of the Future

The effects of the war on engineering generally is yet hardly appreciated. Internal-combustion engines must undergo further development. Already types have been developed which point the way. Higher piston speeds will be demanded, and to get them, increased power per unit of cylinder measurement, approaching 50 per cent, will be required. Hitherto, the weight of reciprocating masses has been such that a piston speed of, say, 800 feet per minute was considered the limit. By the experience gained in aviation, in automobilism, and in "tanks," it has been found possible to obtain with perfect safety piston speeds of 1,200 ft. per minute. The future of gas-power, therefore, may be considered, from a mechanical standpoint, well assured. (American Gas Engineering Journal.)

Sooke Lake Water Supply, Victoria, B.C.*

By C. H. Rust, M.E.I.C.

Victoria, B.C., the capital of the Province of British Columbia, is situated at the south end of Vancouver Island, and has a population of about 50,000. The consumption of water in the summer is 80 Imperial gallons per head; in winter, 50 Imperial gallons per head. All services are metered.

From 1872 to 1913 the City procured its water supply from Elk Lake, situated in a north-easterly direction about five miles from the City. The writer has been informed that the first open sand filter beds constructed in North America were erected at Elk Lake.

Owing to the growth of the City, and to the capacity of Elk Lake being only about 2½ million gallons per 24 hours, the City was compelled to take steps towards procuring a more ample supply.

The lake is about 4 miles in length and its maximum width is half a mile. The area of the lake at 555 ft. above sea level is 978 acres. It was decided to construct a dam at the foot of the lake and rise the level 12 ft. This gives a total area of 1180 acres. The watershed area is 31½ square miles.

In the scheme for the ultimate development, it is proposed to utilize the Leech River Watershed, which has an area of about 31 square miles. This watershed can be used by constructing a 5 mile conduit-line to convey the water to Sooke Lake, and, if it should be necessary to do this, it is proposed to construct a dam at Sooke Lake to a height of 45 ft. It is estimated this will give a daily flow of 100 second feet whilst the reservoir storage will be 17,358,000,000 Imperial gallons. The scheme which has now been completed gives a reservoir capacity of 5,555,000,000 Imperial gallons.

Lower Sooke Lake and Dam. October 28th, 1914.

Negotiations were entered into towards purchasing the works of a private corporation known as the Esquimalt Water Works Company, which supplies Victoria West and the District of Esquimalt, and who procure their water supply from the Goldstream Lakes, but the property owners voted against this proposition. These works have a maximum capacity of 13 million Imperial gallons per 24 hours, and are situated about 17 miles north of the City.

In 1911, Wynn Meredith, western representative of Messrs. Sanderson & Porter, of New York, was called in by the City to advise as to the best method to be undertaken to procure an adequate supply of water. Mr. Meredith undertook a very careful investigation of various projects, and it was finally decided to utilize Sooke Lake, which lies about 18 miles north-west of Victoria.

*Read before the Toronto Branch of *The Institute* on December 10th, 1919.

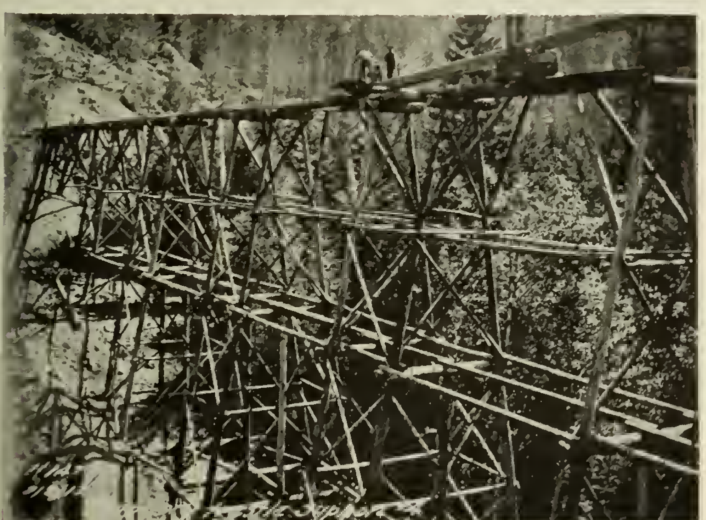
The contract called for the clearing of the land around the lake 15 ft. above low water; the construction of a dam at the foot of the lake, with necessary screen house, intakes etc.; the construction of 27 miles of concrete pipe 40 inches in diameter (this involved the building of 27 miles of railway track 2 ft. guage); the construction of 6 siphons and the necessary concrete trestles, and temporary wooden trestles to carry the track; the construction of a telephone line; the building and clearing of a reservoir site; and the erection of a dam, screen house, valve chamber, venturi meters, etc., at Humpback, which is about 12 miles from the City; the building of 11 miles of 36 inch steel pipe, leading to the City Reservoir, which was awarded to the Westholme Lumber Company of Victoria, and the following are some of their figures:—

The price for earth excavation was from 60 cents to $1.50; for rock excavation from $1.75 to $7.50, the former being the price paid on the concrete pipe-line; the price for concrete, for the dam at Sooke Lake, was $11.00; for the dam at Humpback the price of concrete, Class "C", was $9.00, Class "B", $10.00, and Class "A", $12.50 per cubic yard. The necessary clearing around the lake ranged from $150. to $250. per acre.

View of Concrete Dam.

Tenders were called for three classes of pipe for the flow-line, namely: wood stave, rivetted steel and reinforced concrete. The prices submitted were for the pipe laid and installed. Wood stave pipe was $2.47 per foot, rivetted steel pipe $5.50 per foot, and reinforced concrete pipe $2.53 per foot, and it was finally decided to use concrete pipe.

On the pressure-line tenders were called for lap-welded, rivetted steel and lock bar pipe. The prices quoted by the contractors being as follows: lap-welded $7.00 per foot laid and connected; rivetted steel plate 5/16″ thick $5.25, 3/8″ thick $6.25; lock bar pipe $6.80. It was decided to use rivetted steel plates.



Temporary Trestle.

Siphon No. 4. August 9th, 1913.

The contractors commenced operations early in 1912, but the progress made was not at all satisfactory, and in April, 1913, they abandoned their contract.

The writer, as Water Commissioner, recommended to the Council that the work be proceeded with by day labor. This was approved of and the City immediately put on a large force of men at various camps. The laborers were paid $2.75 per day for 8 hours, one dollar a day being deducted for their maintenance. Free medical attendance was supplied by the City Medical Health Officer.

The City completed the clearing of the land at Sooke Lake; carried out the construction of the dam, head works, etc., at the foot of the lake; and built the dam at Humpback.

It was considered advisable to call for tenders for the concrete flow-line and the pressure pipe-line. The contract for the construction of the flow-line was awarded to the Pacific Lock Joint Pipe Company, and, in place of a 40″ pipe, the contractors, having the necessary forms on hand, agreed to construct a 42″ pipe for the same price, their tender being $2.29 per foot, including laying and installing, but not transportation.

Sooke Dam—Looking West. February 2nd, 1914.

The concrete pipe was made of a shell 3″ thick and in 4 ft. lengths, except the pipe used for siphons which was more heavily reinforced and the shell was 4½″ thick. To save yard space and forms it was decided to steam the pipe. The pipes were first steamed 3½ hours then the forms were stripped and the pipes steamed for another 3½ hours, the temperature of the steam being kept at 135 to 150 lbs.: the pipes were kept about two weeks before being used. The reinforcement was style 6, triangular mesh, made by the American Steel & Wire Co. Square steel bars were used for the ring reinforcements in the siphon pipes and six 1⅜″ square bars were used longitudinally.

Three special bevel pipes were used in laying the curves, made by dropping the spigot ring on one side to give ¾″, 1½″ and 2¼″ taper in the diameter of the pipe.

In the manufacture of the pipe a 1-2-4 mixture was used with the course aggregate limited to ½″ diameter gravel.

Tests made of the pipe with 3″ walls gave a crushing load of 1½ to 2 tons, and a bursting pressure of 20 to 25 lbs. per sq. inch, equal to a head of 53 to 57 feet.

Some copper diaphragm expansion joints were installed with no appreciable effect and were discontinued; hair line cracks developed at every fourth joint. The contractors guaranteed to maintain the pipe for a period of one year.

Steel Pressure Pipe. January 23rd, 1915.

During the winter months when there are sudden temperature variations, ranging from a few degrees below freezing to a few degrees above, leakage, amounting to ½ million gallons in 24 hours on the 27 miles of pipe, has been noticed, but upon a rise in temperature this leakage at once stops.

From 150 to 160 four-foot sections of pipe were made in an 8 hour shift. For laying the pipe, a pipe tripod with a chain block, having a long horizontal pipe laying hook, was used.

Method of Laying Concrete Pipe. May 30th, 1914.

The City awarded the contract for the fabrication and laying of the rivetted steel pipe to the Burrard Engineering Company, of Vancouver, at the following prices: 5/16″ - $5.50 per foot, 3/8″ - $6.25 per foot, but they carried out by day labor the necessary excavating and backfilling.

The following is a general description of the work as constructed:—

The dam at the intake channel at the lake is excavated 4 ft. below low water, where an intake tower is constructed, controlled by seven sluice gates. The openings of these gates are protected by screen cages. From the intake tower, two lines of 40″ rivetted steel pipe are laid to convey the water to the screen house. Only one of these is in service at present. In the screen house is installed a set of 12 screens. The original screens had a mesh of 40 and 60 openings to the inch, but these were found to be too small, and have since been replaced by screens having 16 and 24 openings to the inch. Below these screens are the measuring weir and cascade steps. The screen house is constructed of concrete with a concrete roof. The dam is a composite structure, the west end being an earth embankment with a concrete core wall bonded into the natural rock. From the screen house to the east abutment,

Method of Laying Concrete Pipe. May 30th, 1914.

an o.g. weir section 200 ft. in length is built, which is generally about 15 ft. above the level of the natural rock.

In the construction of the concrete flow-line a right of way 100 ft. wide was secured. All trees were cut down and any tall trees outside this area, which might in falling damage the pipe, were removed. The pipe is not covered except immediately in the vicinity of the Humpback Reservoir, where it was thought slides might occur. At a distance of 2000 ft. apart on the conduit-line, there are open standpipes, and all inverted siphons, of which there are six, have waste outlets at the bottom controlled by 6″ gate valves. The deepest siphon is 600 ft. in length and has a maximum head of 90 ft. The whole of the pipe-line was constructed to a grade of one foot in a thousand feet.

One of the difficulties in connection with this scheme was to secure a reserve reservoir at a proper elevation and

Concrete Trestle No. 41.
Siphon No. 3. June 17th, 1914

in fairly close proximity to the city. A suitable site was finally located at Goldstream on the Humpback Road, about 11 miles from the city. This reservoir has a storage capacity of 136 million gallons and covers an area of 33½ acres. This area was covered with a very thick forest. A portion of the reservoir site had black soil of a peaty nature. It was decided to cover this with a 6″ layer of clean gravel. The dam is 560 ft. long, 60 ft. in height, and contains about 9,000 cubic yards of masonry.

The water flows into the reservoir from the flow-line over a series of concrete steps. There is also constructed a by-pass 24″ in diameter by which the water can be taken direct to the pressure-line. There is in addition a submerged outlet controlled by a butterfly valve. During the summer of 1915, owing to algae in the reservoir, the water was delivered to the city direct through this by-pass. Owing to the great pressure, it was decided instead of delivering the water direct to the city to permit it to overflow into Smith's Hill Reservoir, situated within the city and having a capacity of about 15 million Imperial gallons, and which acts as a standpipe.

It is interesting to record that during the construction of this work, the greater portion of which was of a hazardous nature, no fatal accidents occurred.

The flow-line follows the shoulder of the mountain and the work involved the clearing of a dense forest composed almost entirely of Douglas Fir.

The City, so as to protect the watershed from any possible danger of pollution, has purchased the whole area comprised within it, being about 15,000 acres, for the sum of $12. per acre. The City expect ultimately, if they so desire, to more than compensate themselves for this expense by disposing of the very large amount of valuable timber which is on the watershed.

Concrete Trestle No. 14. April 7th, 1914.

The abandoning of the work by the contractors, the Westholme Lumber Company, led to a protracted litigation. The Company entered suit against the City claiming $500,000. damages. The suit was heard in Victoria and the Judge hearing the case was assisted by two assessors who were *civil engineers*. The trial lasted six weeks and a verdict was given for the City, but the Company appealed to the Supreme Court and finally to the Privy Council, both of which gave decisions in the City's favor.

The system was completed at the end of May and put into use on the 2nd of June, 1915.

Some interesting tests were made on the concrete flow-line. The original contract called for the delivery of 16 million Imperial gallons per 24 hours through the 40″ pipe. As previously mentioned, the contractors, without any additional cost, constructed a 42″ pipe and the maximum flow from tests through this pipe was 22,400,000 gallons in 24 hours, the coefficient being .0106. 55% of the pipe-line is on curves, the longest tangent being 500 ft., and the minimum radius 76.7 ft.

The following is the actual cost of the work carried out by the City:—

Sooke Lake:

Earth excavation in construction of dam at Sooke Lake	$1.42	per cu. yd.
Rock excavation	4.24	" " "
Concrete in foundation of dam	15.68	" " "

All the cement had to be shipped by rail and hauled by teams about ten miles over very rough roads. The gravel and cement were procured from the upper end of the lake, and had to be towed to the foot of the lake. This involved the placing of a tug in the lake which had to be transported from Victoria over the mountain, and the construction of scows.

Concrete Pipe-Line:

Pipe—per lineal ft	$2.32	
Concrete trestles, ft	.18	
Railroad, ft	.53	
Transportation, ft	.33	
Total	$3.36	per lin. ft.

Telephone Line:

Cost per mile	$426.00

Steel Pressure-Line:

Contractors' prices were as follows:—

5/16″	$5.50	per foot.
3/8″	6.25	" "

The City did the earth excavation and backfilling at the following cost:—

Earth excavation	$1.32	per cu. yd.
Backfilling	.56	" " "

Humpback Reservoir:

Earth excavation	$ 2.09	per cu. yd.
Rock "	12.78	" " "
Clearing	605.00	per acre.
Placing gravel in bottom	2.48	per cu. yd.
Concrete foundations for dam	9.00	" " "
Concrete in dam	10.05	" " "

These prices included plant, tools, equipment, supplies, bookkeeping, etc.

As previously mentioned Mr. Meredith, of the firm of Sanderson & Porter of New York, was Consulting and Designing Engineer, and had charge of the construction. He was represented on the ground during the progress of the work by Boyd Ehle, Mem. Am. Soc. C.E.

The following data in connection with this work may be of interest:—

Area of Sooke Lake at 655 ft. elev. (City Datum)	978 acres.
After 12 ft. rise, area	1,180 "
Land clearing around the lake	300 "
Length of concrete flow-line — 42″ in diam	144,040 ft.

First pipe made 20th April.
Commenced laying 16th May, 1914.
Finished on 8th May, 1915.

Length of pressure pipe-line — 36″ in diam., 56,677 ft.

Started to mfg. July, 1914.
Finished laying, Jan., 1915.

Total quantities of earth excavation, 180,342 cu. yds.
" " " rock " 150,517 " "

Cost of construction, including engineering, etc	$2,037,176.00
Cost of land, which includes right of way for pipe-lines, site for Humpback Reservoir, land adjoining Sooke Lake and Sooke Lake draining area	540,000.00
Total	$2,577,176.00

* * *

Electric Brass Furnaces

It has long been recognized, and commercial experience in the last few years has confirmed the results of observation, that melting brass by electricity offers many advantages. These are a saving of zinc, high quality of product through freedom from contamination of the melt by oxygen and sulphur, the elimination of crucibles, the ability to melt large charges, and better and safer working conditions. Various types of electric-furnaces have been devised, some of which are suitable only for a narrow range of foundry and rolling-mill conditions, and have certain drawbacks which limit their usefulness. Dr. Gillet and his associates in the experimental work of the U. S. Bureau of Mines, have evolved a rocking-furnace for melting brass that appears fitted for a wider range of conditions than most other furnaces. This furnace has been submitted to commercial tests with highly satisfactory results. Not only does it reduce losses of metal, but it avoids the use of graphite crucibles; and is so economical of electrical power that no more fuel is required for brass melting than if the fuel were used directly in a fuel-fed furnace. The melting cost is reduced below that of pre-war times. This rocking electric-furnace is shown in drawings to scale, and numerous experiments made to test its efficiency are described in detail.

(U. S. Bureau of Mines, Bulletin No. 171.)

Patents and Engineering*

By Hanbury A. Budden, A.M.E.I.C.

On the 5th December, 1912, Russel S. Smart, A.M.E.I.C. of Ottawa, read an excellent paper on Patent Law before the Mechanical Section of the Canadian Society of Civil Engineers. In this paper he discussed the legal aspect of patents in Canada, the formal requirements of patent applications and the maintenance of patents, and gave a brief reference to the question of infringement. Reference was made in the paper, and during the discussion which followed, to a number of defects in the Canadian Patent Act; and the urgent necessity for a thorough re-drafting of the Act was supported by several of the speakers. Unfortunately nothing has been done by the Government to remedy these defects which continue to exist. One of the speakers J. A. Jamieson, M.E.I.C., in supporting the claim that the subject was one of interest to engineers, made the remark that the " the history of patents was the history of progress ". This statement I will take as the text of my remarks to-night, and particularly as applied to engineering.

Now, although the expression Civil Engineering originally covered the whole field outside Military Engineering, in recent times it has come to signify merely a sub-division. This may be seen by reference to the calendar of McGill University. Here we find Civil Engineering is one of the ten courses in Engineering. By the recent change of title of *The Canadian Society of Civil Engineers* to that of *The Engineering Institute of Canada* the scope of the Society has been greatly enlarged, and now covers the whole field.

Engineering is defined in the Standard Dictionary as:—" The science and art of making, building, or using engines and machines or of designing and constructing public works, or the like, requiring special knowledge of materials, machinery and laws of machines."

Now Engineering is a generic term, and includes a variety of branches or sub-divisions.

Thus we have:

Chemical	Sanitary
Civil	Steam
Dynamical of Power	Topographical
Electrical	Industrial
Heating	Research
Hydraulic	Organizing
Marine	Irrigation
Mechanical	Highway
Military	Production
Mining	Efficiency
Municipal	Combustion

We are rapidly approaching the time when these sub-divisions will be further divided. Each one of these branches has grown and developed by improvements that have been the subject-matter of patents. Take, for example, chemical engineering. The apparatus that, in the early days, consisted of simple tanks, vats, pipes and boilers now takes the form of huge specially planned buildings containing elaborate and intricate devices constructed of materials that were then unknown; and employing temperatures, pressures and effects that were scarcely dreamt of even in comparatively recent times.

At a recent meeting we saw in the moving-picture film on Coal how elaborate modern mining engineering had become in one of its branches. Municipal engineering with its sewage treatment, water filtration, incinerators and road making and maintaining apparatus has reached a high degree of development. The same may be said of each of the branches of engineering. This great development has taken place gradually and is largely due to the work of inventors who have recorded the steps of their progress in the patents they have taken out. And, in most of these branches one of the best methods of finding out the latest and highest development, is a search in the recent patent records for improvements relating to the particular subject of the branch concerned.

This may not have occurred to the members of *The Institute* and the means and methods of obtaining such information may be unknown to the majority of the audience. With this end in view my remarks will relate now to the Patent Records.

Patents relate to the invention of useful arts, machines, manufacturers or composition of matters. I do not intend to take up your time in discussing the subtleties of patent law on the question of the distinction between invention and mere improvement. The point I wish to make is that the patent records contain a historical record of the growth and development of practically every branch of engineering. It is not in respect to patents as monopolies that they are to be considered but as a source of information; to be gathered from the vast accumulation of patents which may or may not have become public property. In this respect, the essential point of a patent is its disclosure, i.e., what information it gives to the public.

Disclosure

Disclosure is a statutary requirement in patents. The Canadian Patent Act in Section 13 requires that the specification shall correctly and fully describe the mode or modes of operating the invention as contemplated by the inventor. In the case of a machine, the specification shall fully explain the principle and the several modes in which it is intended to apply and work the same. Drawings are required where the invention admits of illustration. The British Act is very brief on this point. It reads:—" A specification must particularly describe and ascertain the nature of the invention and the manner in which the same is to be performed." The United States Statute is more definite in Section 4888 where it requires:—" A written description of the invention and of the manner and process of making, constructing, compounding and using it in such full clear concise and exact terms as to enable any person skilled

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*Read at the Montreal Branch Meeting, March 13th, 1919.

in the art or science to which it appertains or with which it is most nearly connected to make, construct, compound and use the same; and in the case of a machine, he shall explain the principle thereof and the best mode in which he has contemplated applying that principle so as to distinguish it from other inventions."

In Great Britain the courts have held that the specification must not be so ambiguous that fresh experiment or research is necessary before the results set forth in the specification can be obtained. It may be interesting here to refer to the recent annulling of a number of chemical patents, taken out by Germans in Great Britain, on the ground that essential steps in the processes had been omitted, purposely or otherwise. In these cases the disclosure was incomplete and useless and the patent was therefore invalid.

The State of the Art, is an expression used in patent law to determine public knowledge on matters relating to an invention. In patent litigation one of the most important questions is to know the State of the Art on a given date. It is often very difficult, in the light of subsequent invention and progress in the art, to solve this question. But that difficulty is not met with when the State of the Art of the present day is the objective. Recent patents will furnish this information most readily. It has been often said that the percentage of patents that are successful is very small, but success in that respect only refers to remuneration. A great many patents, which have failed to reward the inventors, have been very valuable in disclosing means and methods, which by the addition of slight improvements, have made great advances in the art. A record of experimental failures may often be of great value in preventing waste of time and effort in duplicating such experiments. A frequent cause of failure is that inventions are so far ahead of the State of the Art that they are not appreciated at first and it may take years before their real value becomes known. The disclosure of these ideas and devices in patents is however very valuable in directing the development of the art. Another cause of failure is that inventors are frequently entirely lacking in financial knowledge and in the ability to exploit their inventions to advantage. In Canada, a large number of patents lapse before the inventions covered by them have been made use of; owing to non manufacture or failure to renew at the end of six years. In Great Britain, annuities are payable on the fourth year from date of application and failure to pay invalidates the patent. However, in spite of so many failures, patents are issued in increasing numbers and the mine of information continues to expand its field or operations.

Engineers have usually some hobby or subject that they are specially interested in. Frequently these hobbies are the subject of investigation, and a knowledge of the history of the art would be of great advantage to them in supplying a good foundation on which to build their theories and to base their conclusions. As I said before, a knowledge of what has been done in the past will avoid waste of time and effort in repeating such work. Moreover, it may happen that the investigator in examining a patent that has failed to reach success, will hit upon an improvement or slight modification that will change failure to success.

Up to the present date there have been issued in the world nearly four million patents.

In Great Britain	515,000
The United States	1,292,000
France, over	500,000
Germany, over	300,000
Belgium	272,000
Canada	188,000
Italy	140,000

This immense number of patents would be of little value without systematic classification.

Great Britain adopted a system of classification in 1855, which has been readjusted from time to time, and now contains 271 classes. Every six years, since 1855, a series of volumes have been issued covering the patents issued in each class for the preceding six years. The volumes covering 1909-1915 are now available. These volumes contain abridgments of specifications with drawings. It is thus possible to get a complete set of ten volumes covering any class and the cost of the set is only 12 s.

I am glad to say that the library of *The Engineering Institute of Canada* has been receiving these volumes with the exception of the last set, covering 1909-1915. No doubt these have been delayed owing to the war but they should be procured as soon as possible to complete the series. They form a valuable, though but little known and used, section of the library. Complete printed copies of British patents can be purchased at not more than a shilling a piece; before the war they cost 6d. The British Patent Office also issue a weekly Illustrated Official Journal. At present this is not received in any of the libraries in Montreal. Complete copies of all British patents are received at Ottawa and also, I believe, at the Parliamentary Library, Quebec.

The classification adopted by the United States Patent Office consists of 295 classes, each of which is subdivided into numerous sub-classes. A Manual of Classification is published which contains a useful index; cost 25 cents. A volume of definitions of classes and sub-classes is also published from time to time. The latest issue is dated 1912, but this does not as yet include the definitions of all classes. The Official Gazette is published weekly and this contains a recent, valuable addition in the form of a weekly classification of patents. The Annual Index also contains a classification of patents. These classifications give the Class number, Sub-class number and Patent number. By means of these lists it is a simple matter to obtain the numbers of any patents issued in any sub-class. The United States Patent Office sell printed copies at five cents a piece. Coupons, in pads of 20, are obtainable, and make the purchase of copies very easy. They also supply complete sets of all the patents issued under a sub-class at the same rate. It is thus possible, in both Great Britain and the United States, to procure a fairly complete history of the development of any device or process at a moderate expense.

In regard to systems of classification the French publication "Chimie et Industrie" employs the Dewey Decimal System in reference to patents as well as to periodical literature. This system has the advantage of flexibility and an indefinite capacity for extension. It has been adopted in many libraries and by engineers, manufacturers and business concerns for indexing data and information of any description. The University of Illinois publish a bulletin on The Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries, which will be found to explain very clearly the use of the system in this particular sphere. Mr. Arthur Surveyer, M.E.I.C., has referred to this system in an article to be found in the last number of "Revue Trimestrielle."

In contrast to such beneficial systems of classification, Canadian patents are not classified. The Canadian Patent Office does not print patent specifications, and the cost of a typewritten copy of a patent is exorbitant, running from $2.00 upwards. In referring to this system, Sir Robert Hadfield of Sheffield in an address to the British Gas Association made the following remark: "As an example of the antediluvian policy of our Empire on this question, it is difficult to imagine that an Englishman in this country cannot get a copy of a Canadian patent without sending to Canada, and even then only a typewritten one; as patent specifications are not printed there. Fie upon you Canada in this respect! This is only one of quite a number of shortcomings on the question."

The United States Patent Office took in from the sale of printed copies of patents, in 1917, the sum of $127,166 as well as $28,000 for photographic and photostat copies of drawings: they actually issued over 5,000,000 printed copies in the year. Our Patent Office took in $2,500 which would represent about 1200 copies. And, the worst feature of our system is that each year's delay increases the arrears. Our Patent Office has agreed to exchange copies of all patents with the U. S. Patent Office. Printed copies are therefore necessary to carry out this agreement.

The Patent Office Record is now published weekly but so far it contains all the defects of the former monthly issues. Amoung these may be mentioned:—

1. There should be a list of applications filed giving title, name of inventor, date of filing, name of assignee and date of foreign patents issued for such invention, if they exist. Section 8. Para. 1 of the Patent Act makes it necessary to apply in Canada within one year from the date on which the first foreign patent issued. It is therefore important that the dates of applications should be known; as the rights of the public are affected by them. Failure to apply within the year, gives the public the unrestricted use of the invention.

2. A List of Patents subject to Compulsory License should be published from time to time. In Great British all patents are subject to compulsory license but in Canada it is a matter of special application and therefore this information should be published.

3. The Patent Record should record Extensions to Import and to Manufacture under Sections 39 and 40 of the Patent Act.

4. In regard to Renewals. As Patents usually are issued for a term of six years only, it is important to know which have been extended and which have become public property. A list of patents that have lapsed for non payment of renewal fees, or a list of renewals should be published. Such a list was formerly published but it was discontinued in 1897.

5. A List of Reissues. Hitherto reissues have been mixed up with new patents and indexed with them. Reissues are, however, simply continuations of the original patents and continue to date from the original date of issue. They should be numbered in a distinct series and indexed as reissues.

6. All Rules and Orders in Council relating to patents should be published in the Patent Office Record.

7. All Decisions of the Commissioner of Patents and Decisions of the Courts Relating to Patents, Decisions of Arbitrations in Conflicting Cases, etc., should be reported in the Record. It is essential that all decisions of the Patent Office should be published in order to established a uniform practice.

8. The indexes should give title, name of applicant, name of assignee, official number, date and page.

At present the page is not given in the indexes of patents and the title list gives the assignee's name instead of that of the inventor. This makes it difficult to indentify references; as a patent is always cited in reference to the inventor. In indexes which are widely used for reference, the proof reading should be accurately done, but this is far from being the case in the Patent Record indexes. Most of these defects can be easily remedied and are due to the absence of the necessary interest, on the part of the Patent Office, to make the Record as useful and complete as possible.

The financial position of the Patent Office is curious and decidedly interesting. The revenue of the Canadian Patent Office for the year ending March 31, 1918, was $224,051.93, the expenditure $122,531.23; leaving a balance of $101,520.70 which was handed over to the Minister of Finance and merged in the Consolidated Revenue Fund.

In the United States Patent Office, for 1917, the receipts amounted to $2,258,377 and the expenditure $2,048,173: a very different proportion; as there the surplus is under 1/10 of the receipts while in Canada it is 5/11. But even with their large expenditure, Thomas Ewing, the late Commissioner of Patents at Washington, claims, in an article on The Needs of the Patent Office which appeared in the Scientific American on 21st. December, 1918, that the office needs to-day one million dollars beyond what it has. It is receiving $2,000,000. and could use $3,000,000. to great advantage.

In Great Britain the surplus is also turned over to the general funds and the following protest was made against this system by Alan A. Campbell Swinton, F.R.S., Chairman of the Council of the Royal Society of Arts, in an address on Science and its Functions in November, 1917. He states as follows:—"This brings me to another point in connection with invention, and that is the injustice and the inexpediency, from a public point of view, of the present system whereby the Patent Office makes a large annual profit out of the fees paid by inventors. There might possibly be some justification for this were the money thus obtained spent on scientific education, on scientific libraries, or on some other object that would further invention and discovery. The money is, however, merged in the ordinary revenues of the country, and thus becomes a veritable tax on brains. It is, moreover, a tax on the cerebral activity of a class of men who are usually by no means overburdened with wealth. Though all inventors are fortunately not driven by poverty to such expedients as Palliser the potter, who actually had to burn his household furniture in order to provide heat for his furnace, still the majoirty of inventors are undoubtedly poor and find the cost of protecting their inventions by patent, and still more of maintaining these patents when granted, a considerable strain upon their finances. The truth of this may be seen by the frequency with which patents are dropped merely in order to save the renewal fees, and the patentee in some cases deprived of profits to which he is justly entitled."

The Canadian Patent Office has in the past been a milch cow supplying the Government with a large amount of funds annually. This may account for it having been a branch of The Department of Agriculture for so many years. Within the past year it has been transferred to The Department of Trade and Commerce. Let us hope that this is at least a good omen.

Owing to the small number of patent attorneys in Canada it has not been possible to form a strong association such as The Chartered Institute of Patent Agents, London. Individual efforts have been made from time to time to obtain a more efficient organization of the Patent Office and a thorough re-drafting of the Patent Act, but without result.

Reconstruction is now the all important question and our patent system is one that calls for immediate action if we are to take our place among up-to-date nations. We have a Reconstruction and Development Committee and an Hororary Council for Scientific and Industrial Research appointed by the Government. The development of the Patent Office and the assisting of inventors are matters which come within the scope of both Boards. The Honorary Council has already taken up the question of reference libraries and is now consulting the various local authorities, to arrange on some plan of action. If the Patent Office had a fully equipped technical and industrial library with an efficient staff, it would be an ideal centre or headquarters for the organization and development of local libraries. By means of a photostat equipment the Patent Office Library could supply copies of references, drawings, etc., that were not available in the local libraries. At the present we are entirely dependent on foreign libraries. Fortunately the members of *The Engineering Institute of Canada* have available the library of the United Engineering Societies, New York, for scientific and technical literature and the Patent Office Library at Washington, for foreign patents.

As loyal Canadians we cannot look at this state of dependence on foreign aid as a proper condition. We must aim at having our own means of investigation and research. The Patent Office can be made a more useful institution than it is at present. With proper facilities it could become a storehouse of technical information available to the public. At present it is chiefly occupied in granting monopolies to other than Canadians. Last year only 973 patents out of 7233 were granted to Canadians. It would, therefore, appear that an opportunity is offered our new *Engineering Institute* to apply its influence in a direction that would benefit our country, not only from technical and industrial but also from commercial standpoints, by taking a lead in the reconstruction of our Patent System.

In closing let me suggest a few of the features that should enter into an ideal patent system:—

I. A research library containing all current literature on technical matters, properly indexed and kept up to date, and with photostat equipment. Such a library is essential to the efficient work of the examiners of the Patent Office. Under a competent librarian, there should be a staff of research workers who would make searches and prepare reports on questions submitted to them.

II. A Commissioner of Patents who is a real head of his department and who is fully qualified to handle the technical and legal questions of his office as well as administer the same.

III. A sufficient number of competent examiners headed by an Examiner-in-Chief, to whom all appeals from the decisions of examiners should be submitted.

IV. Printed copies of patents to be sold for not more than 25 cents a copy.

V. A Patent Office Record that should be a complete medium of information to the public on all matters relating to patents, patent law and practice.

VI. A list of registered Patent Attorneys: subject to the control of the Commissioner of Patents.

VII. A revised Patent Act.

VIII. And finally, that Canada should become a member of the International Convention.

New Process of Casting Non-Ferrous Alloys

The process consists in pouring the molten alloys into metal moulds and forming or congealing them under pressure. They are really die castings, formed under high pressure. It is claimed that almost any grade of non-ferrous alloy can be handled, the casting being made in a specially constructed automatic machine by which a large number can be produced in a day.

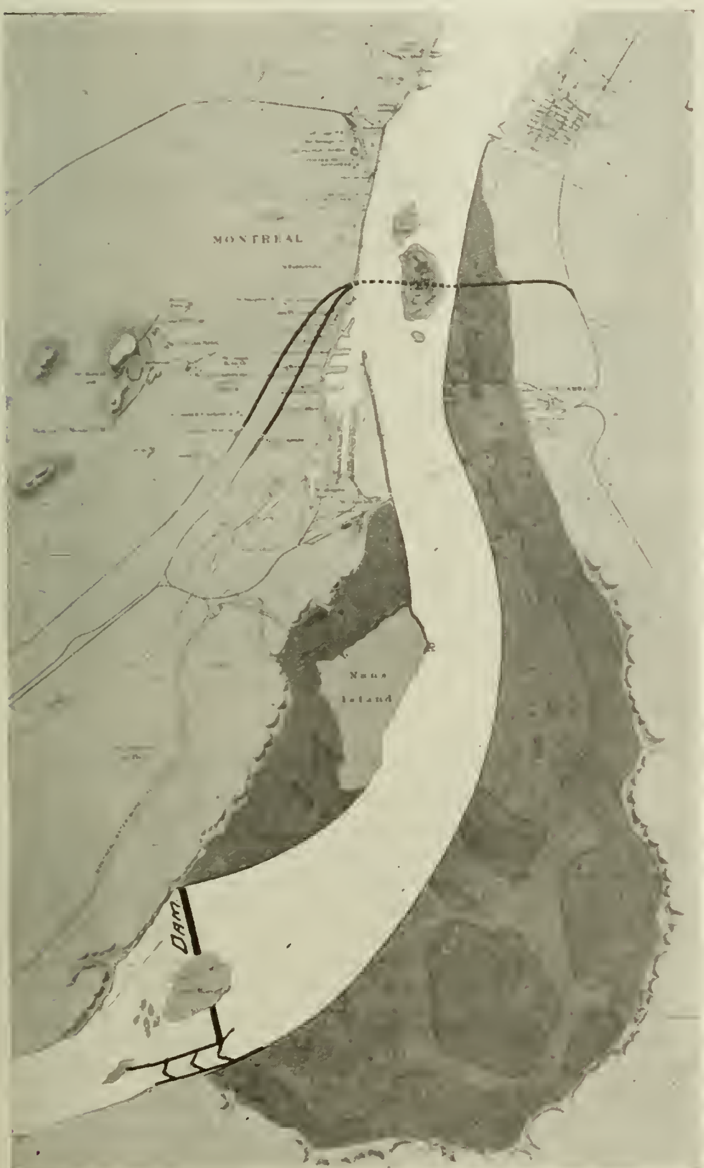
It is possible to use an alloy of aluminium, copper, and iron, which has a low coefficient of expansion. The ordinary piston made of aluminium and copper is said to have too great a coefficient of expansion, but the introduction of iron is regarded as making it possible to produce very large aluminium pistons essential for high-power aircraft engines. *Scientific American, Jan. 18, 1919.*

Discussion on Papers Previously Published in The Journal

Suggested Harbour Improvements for Greater Montreal*

By E. S. M. Lovelace, M.E.I.C.

T. Kennard Thomson, M.E.I.C: The writer has read with much interest the paper by Mr. Lovelace describing his very ingenious, proposed plan for improving the Harbour of Montreal and he is sorry that he did not know of it in time to attend the meeting.



Plan for Improving Montreal Harbour

* Published in Vol. II, No. 4.

The writer begs to take this opportunity of presenting to our *Institute* a plan which he submitted to a number of Montreal and Ottawa gentlemen before the war—in fact as far back as 1911 — in which the writer hopes to solve the problem in a manner directly opposite to that of the author. In other words, it would seem that the easiest way to handle ice is to have deep water and plenty of current, and it would surely be a great advantage if all ocean steamers could reach Montreal without passing any lock whatever. In brief, the writer's plan is to build a dam at or near Isle Heron having locks of at least 40 foot draft, and then to deepen the Channel from Isle Huron to below Montreal so that vessels of 40 foot draft could reach the locks and then pass directly into Lake St. Louis.

In deepening the wide channel (between the shaded portions on the map), there would be reclaimed an area of about ten square miles. The dam would also permit the construction of power plants which could easily develop 1,000,000 horse-power, per annum. The enormous value of this hydro-electric development and of the reclaimed land would pay for all the harbour improvements, dredging, etc., and a very handsome interest on the money expended besides. A glance at the map enclosed will show what an enormously valuable manufacturing site would be added to Montreal, which would be connected by numerous tunnels.

The late Sir Wm. C. Van Horne said that this plant would make Montreal one of the greatest ports, if not the greatest port. on the American Continent.

E. S. M. Lovelace, M.E.I.C., (the author): The very interesting discussion on the above paper contributed by T. Kennard Thomson, M.E.I.C., in which is outlined an *alternative* scheme for the betterment of Montreal Harbour, serves to show that, generally speaking, more than one solution of a problem is possible; the better one to adopt in any given set of circumstances depending largely on some outstandaing factor, or point of view, which may be said to dominate the situation.

While the writer has not had an opportunity of giving any great amount of study to Mr. Thomson's scheme, it would appear that in his proposal, the governing idea is that of *power* and *industrial developments, harbour betterments* being more or less incidental; while 'n the suggestion of the writer, it is the improvement of the *Harbour,* pure and simple, that is kept strongly in the foreground. As has already been pointed out in the discussion, Mr. Thomson's idea of a dam at the foot of the Rapids is not entirely new; as before the war a company was incorporated and surveys made for the development of the Lachine Rapids: the idea being to place a dam at almost the precise point indicated by Mr. Thomson on the plan accompanying his discussion. *Such power development,* therefore, can scarcely be said to have to do with any direct improvements to the Harbour of Montreal. If thought desirable, it could, moreover, be carried out as a separate undertaking in connection with the proposal of the writer.

In making a comparison as to the cost of the two schemes, the cost of this power development could, therefore, be placed to one side; and the cost of the submerged dam and locks, as suggested by the writer, placed against the cost of dredging out a forty foot channel to the foot of the Lachine Rapid, as provided for in Mr. Thomson's proposal. In the opinion of the writer, the submerged dam and locks would cost but a fraction of the amount necessary to do the enormous amount of dredging (a good deal of it in rock) required if the latter proposal were adopted. While, as Mr. Thomson points out, *locks* are not entirely desirable in a river when situated as these would be, at the entrance to the Harbour; yet, having only a small lift to negotiate, they would not, in the writer's opinion, be found as objectionable as the existing strong St. Mary's Current.

In the construction of the Panama Canal it was proposed at one time to have no locks, but ultimately, and very wisely as it now seems, they were introduced.

Other things being equal, apart from the question of cost, a wide open harbour, such as would be created through the building of the submerged dam giving plenty of room for ships to manœuvre and pass, would be preferable to the narrow channel with swift current which would result from the carrying out of Mr. Thomson's proposal. It would further seem to the writer that in carrying out Mr. Thomson's idea, heavy land damages would have to be provided for. Owners with property now facing the river would scarcely care to have such frontage replaced by a maze of factories, however beneficial to the community in general such factories might in the long run prove. While it is likely that such damages could be made up for by the value of the land recovered from the bed of the river, there is, as yet, however, so much *cheap* land, suitable for industrial development, obtainable on the south shore that it would scarcely seem to be worth while, apart from *other* considerations, to go to any very great expense in reclaiming the river bottom.

The whole question is, however, a very large one and the possibilities are so far reaching that it is desirable that all the light possible should be thrown upon it. The writer, therefore, would like to express his personal regret that Mr. Thomson was not present to take part in the discussion when the paper was originally read. Mr. Thomson's *proposal*, focussing attention as it does on at least one aspect of the problem, will doubtless be given the gravest consideration by those who ultimately may be called upon to take action in the matter of improvements to the Harbour.

Limitations to Alternating-Current Transmissions

It is argued that the limits of distance over which it is desirable to transmit electric energy by alternating currents are being approached, and that future developments will be carried out by the high-voltage direct-current system.

The probable great increase in industrial activities will outrun the capacity of the facilities for gaining and transporting coal, and large-scale electric systems of transmission will have to be constructed. Germany may have to draw its electric supply from Norwegian and Finnish waterfalls. It may be possible to increase the transmission voltages to some extent, but when exceeding 100,000 volts the capacity currents flowing in the line become of great importance, and the losses caused by these currents may become high enough to lower the efficiency of transmission seriously. That is to say, above certain voltages it is no longer correct to say that the efficiency of transmission of a given power increases with the voltage. A decrease of frequency below the usual would not be permissible owing to the bad effect on lighting and the increase of cost of motors and transformers.

An examination of the problem shows that for each case there is a maximum voltage giving the best efficiency. If the distance of transmission is L, the voltage E, the power transmitted P, and the capacity of the line C, then the "electric cost of transmission" (percentage line losses x weight of line per kw.) is given by the expression $(L/E)^2$ $(CEL^2/P)^2$. The presence of the second term shows that with alternating current the cost is always greater than with direct current at the same voltage. If the distance is increased n-fold, the first term may be kept constant by increasing the voltage in-fold, but the second term will increase n^6-fold. Thus above certain distances direct current will have to be adopted.

The combination of capacity and inductance sets a further limit to the use of alternating current, and the limit to the use of alternating current will be found at about 200,000 volts, with transmission distances of several hundred km. If cables be used the limit will be much lower.

A further advantage of direct current lies in the fact that safety devices, such as condensers and choking coils, are more effective than with alternating current. Also cables have many advantages as compared with overhead lines, and they are cheaper for direct than for alternating current. (M. Dolivo-Dobrowolsky, Electrotechnische Zeitschrift, Jan. 2, 1919.)

* * *

Electron Theory of Thermo-Electricity

Most investigations based on the electron theory of Riecke, Drude and Lorentz make for the calculation of thermo-electric effects the simplifying assumption that the atomic fields of force in metals are rigid and unaltered by temperature. The causes of thermo electric effects are then sought in the variations of the mean energy of the electrons arising from the movements of the electrons and the variations in the number of free electrons. The view of Bohr is followed up, according to which the variations of the atomic fields of force must have an influence on thermo electric magnitudes. An attempt is made to establish the proposition that the movements of the electrons in rigid fields of force exert only a small effect, whereas the phenomena of thermo-electricity are mainly controlled by the changes in the atomic fields of force produced by the thermal expansion and the heat movements of the atoms. (G. Gorelius, Annalen der Physik, No. 19, 1918.)

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Western Professional Meeting

July tenth, eleventh and twelfth are the dates and Edmonton is the place of the Western Professional Meeting of *The Institute* for the current year.

The success of the Saskatoon meeting last year stimulated engineering activity in the West to no small extent. Immediately after that meeting plans were started for the meeting this summer and several cities put in applications to be favoured by having this meeting held within their borders. Edmonton was finally selected and the choice was made unanimous.

Three at least of the important subjects discussed a year ago will occupy a prominent place in the programme of the coming meeting. A subject which was discussed at Saskatoon, for the first time at a general meeting of *The Institute*, that of legislation has received more attention during the past twelve months than any other. It is obvious, therefore, that it should occupy a prominent place at this meeting. During the year the whole situation regarding legislation has crystallized and is now focused in the draft Act, with which the western members had much to do.

The committee on a problem which has caused some uneasiness in the West, that of the action of alkali salts on concrete, have done a large amount of investigating and research within that time and their report is being looked forward to with unusual interest.

The good roads movement is not confined to the east as indicated by the lengthy discusssion on this subject last year. The committee appointed to study the situation and bring in recommendations regarding improving the earth roads of the prairies, will have an important announcement to make. The Chairman of the Honorary Council for Scientific and Industrial Research has become interested in this subject and has invited the co-operation of *The Institute* with that body in effecting a solution of the road problem in the West.

Other subjects suggested for the Edmonton meeting are: remuneration of engineers, sewage and water purification, reclamation of lands, natural gas distribution, town planning and the development of aeronautics in the public service; all of them of interest to the entire profession and most of them of particular moment to the West at the present time.

Last year one hundred members of *The Institute* met at Saskatoon, having travelled an average of two hundred miles each, which illustrates how strong the "get together" spirit has grown in the profession. Those who were fortunate enough to be at last year's meeting are now looking forward to Edmonton, and July tenth, eleventh and twelfth. It is certain that many others will attend the Western Professional Meeting this year. It is expected that President Leonard will open the meeting and preside at a number of the sessions.

* * *

Transactions

Inasmuch as some of the members have requested information regarding publication of transactions, showing that the matter is not yet clear in the minds of all our members, it is opportune to state that it is intended that transactions be published yearly as in the past.

In nineteen hundred and seventeen one volume of transactions only was printed, and that volume completed the transactions for that year. There are now in the hands of the printers two volumes, one of these is part two for the year 1918, being devoted entirely to the Quebec Bridge, and will constitute a valuable historic record, by the men who were responsible for the design and construction of this great engineering feat.

Part 1 of 1919 will be the presidential address by H. H. Vaughan, delivered at the annual meeting at Ottawa.

The volumes now under way will be issued in the name of *The Engineering Institute of Canada*, and the size will be similar to those of the transactions already issued, so that members who keep their transactions will have uniformity in their shelves.

Legislation for Professional Engineers

Letter of transmittal of special legislation committee. Individual opinions of members of council. Branch opinions.

In the May issue was published the Act respecting the engineering profession, prepared by the special committee of *The Institute* and forwarded to council under date of April 11th.

It was considered expedient to publish the letter of transmittal, sent by the special legislation committee, in the June issue of *The Journal,* rather than wait to have it sent out with the ballot as was first proposed, in order to give an opportunity for some discussion before the ballot is issued. The issuance of the ballot has been delayed two weeks, with the approval of the majority of the committee, consequently it will be sent out on June 15th.

The letters received, discussing legislation at the time of going to press follow the committee's letter.

* * *

MONTREAL, April 11th, 1919.

To the Council of the Engineering Institute of Canada.

Gentlemen:—

In accordance with a Resolution passed at the Annual Meeting of *The Engineering Institute of Canada* in Ottawa, on the 12th of February, 1919: " that the wishes of the majority of the Members and of the Branches of *The Engineering Institute of Canada* are that Provincial Legislation should be obtained to define the status of Engineers throughout Canada " . . . .

. . . ." that this Legislation should be as uniform as possible throughout the Provinces " . . . .

. . . ." that a Special Committee be formed, composed of one delegate appointed by each Branch to meet at headquarters before the 15th of April, 1919, to draw up such sample Legislation as it may deem necessary and advisable".

A Committee was duly formed, consisting of the following delegates:—

C. E. W. Dodwell, Chairman	Halifax, N.S.
C. C. Kirby	St. John, N.B.
A. R. Decary	Quebec, Que.
A. Surveyer, Secretary	Montreal, Que.
R. F. Uniacke	Ottawa, Ont.
Willis Chipman	Toronto, Ont.
E. R. Gray	Hamilton, Ont.
N. L. Somers	Sault Ste. Marie, Ont.
E. E. Brydone-Jack	Winnipeg, Man.
H. R. McKenzie	Regina, Sask.
F. H. Peters	Calgary, Alta.
R. J. Gibb	Edmonton, Alta.
A. G. Dalzell	Vancouver, B.C.
A. E. Foreman	Victoria, B.C.

The full Committee met at 10 o'clock A.M. on Saturday, April 5th, 1919, Mr. Dodwell of Halifax, being elected Chairman, and Mr. Surveyer, of Montreal, Secretary.

The concrete result of the labors of the Committee, after three sessions daily for the past five days, during which its discussions and deliberations were characterized by the greatest possible thoroughness and unanimity, is a tentative Bill, of which the Committee now has the honor to submit a copy herewith enclosed, for the further action of the Council.

It may be safely assumed that there is no opposition or objection on the part of any Engineer in Canada to the basic principle of Legislation.

Every Branch of *The Engineering Institute of Canada,* from the Atlantic to the Pacific, has expressed itself in no uncertain terms as earnestly desirous of obtaining Legislation.

It requires no arguments or special pleading to establish the proposition that the Engineer has just as good a right and claim to recognized legal status by Legislative enactment as the lawyer, doctor, or other professional man. It will also be generally admitted that the public has just as real a need for protection from the unqualified and incompetent Engineer as from the ignorant and incapable practitioner in other professions.

In the development of the principle of Legislation, and its practical embodiment in the frame-work and details of such an Act, or Statute, as will accomplish the desired result, the Committee has been guided by a few definite ideas:—

(*a*) Before any Legislative body can be reasonably expected to accept or to give serious consideration to any proposed Bill, it must be made apparent, not only to that Legislative body, but to the public, that the Bill, as an enacted law, would redound, directly or indirectly, to the benefit of the community at large.

(*b*) It is eminently desirable that any such Bill, as may finally be decided upon, shall be uniform for all Provinces, so far as is reasonably possible.

(*c*) It is of the first importance that any such Bill shall meet the views of, and be acceptable to, every individual Engineer, and to every Engineering and Technical Organization in the country.

(*d*) It is indispensible, especially with a view to the future, that any such Bill shall be as clear as language can make it, and be also practicable and workable.

With these principles in view, the Committee after consultation with Mr. Aimé Geoffrion, the eminent lawyer, and Legal Advisor to *The Institute,* has drafted and prepared the tentative Bill herewith submitted.

The Council will observe that the outstanding feature of the draft is the creation and incorporation in each Province of the Dominion, of an entirely new body, to be called " The Association of Professional Engineers of the Province of . . . ."

After prolonged and earnest debate this provision appeared to the Committee to be not only imperative and unavoidable, but to offer the only practicable solution of the problem before us. Its special object is to forestall adverse criticism, and if possible, to eliminate jealousy and opposition, that might reasonably exist or arise in Engineering and other technical organizations, by the apparent or attempted assumption of either initiative of movement or ultimate control of the machinery sought to be set up, on the part of either *The Engineering Institute of Canada*, or by any other specific or individual organization.

The Committee would respectfully suggest to the Council that in forwarding this draft Bill to the Membership of *The Institute*, in accordance with the terms of the Resolution of the Annual Meeting above referred to, the Members be informed that at this stage their approval, or otherwise, of the draft should be expressed as in regard to its general spirit and principle, and not as to the details or wording of its sections and provisions.

The Committee requests that a copy of this letter be forwarded to each Member of *The Institute*, with a copy of the draft Bill.

In conclusion, the Committee individually and collectively takes this opportunity of expressing its high appreciation of the hospitality and consideration shown to it during the sojourn of its Members in Montreal, and the fervent hope that its labors, aided, supported and supplemented by the Council, as representing the several thousand Members of *The Engineering Institute of Canada*, may result in lasting and substantial benefit to the Engineering profession in Canada.

On behalf of the Committee,

C. E. W. DODWELL, Chairman.
A. SURVEYER, Secretary.

Individual Expressions of Opinion

President, Lieut.-Col. R. W. Leonard

In response to the request of Council that the various Members should express their views on the proposed Special Legislation, for publication in the June number of *The Journal*, I beg to submit the following:—

(1) I share in what I believe to be the general opinion that the salaried members of the Engineering profession in Canada have for many years past been underpaid and do not receive the recognition from the public which the importance of the profession should ensure;

(2) The salaries of members of other professions, as well as Engineering, have remained practically stationary for many years, while various Trades and Labour organizations have, by co-operation and strikes, been able to obtain recently very much greater remuneration for their services;

(3) The result of these conditions is that the salaried members of the profession generally are looking for some means of organization through which they hope to improve their financial and social status, and the work which *The Engineering Institute of Canada* is doing in this respect is of too recent a date to be fully appreciated by the bulk of the Members as yet;

(4) Apparently realizing that the classification and salaries of employees of the Dominion Civil Service require readjustment, there is being framed at the present time a new Civil Service Act, which it is hoped will be made effective shortly and tend to greatly remedy the conditions complained of;

(5) I believe if the provisions of the proposed Civil Service Act are such as to commend themselves to our Members, and if that Act is put into force during the present Session of the House, that the results to be obtained through the operation of the Act will be deemed by the Members of the profession generally to be of greater advantage than any results which could be obtained through the passage of an Act through the various Provincial Legislatures, as proposed by the Special Legislation Committee;

(6) If, on the other hand, the provisions of the expected Civil Service Act be not favorably received by our Membership, of if the passing of that Act be deferred to another Session, then the majority of the Membership of *The Engineering Institute of Canada* will favor Provincial legislation framed with a view to meeting their desires:

(7) I am of the opinion that a short simple Act of each Provincial Legislature requirirg that all employees of such Province or of Municipalities within such Province, who may be engaged as technical Engineers, should be Members of *The Engineering Institute of Canada*, or possess qualifications sufficient for such Membership, would be of greater value to the Membership and would be more easily obtained than the Act proposed by the Special Committee.

Vice-President, H. E. T. Haultain

Three months ago I did not think any useful legislation was possible, except perhaps in connection with Public Works. After several hours of serious consideration of the work of this Committee I am inclined to think that it very probably is not only practicable, but is good business. It will not succeed in doing what a great many of us expected was required.

It may be possible—I think it probable—that all the different branches of Engineering can get together on this basis, and if we can it will be valuable education, not only for ourselves, but for the Public. It woud be a starting point for much growth to follow.

I cannot see at the present time any serious difficulties or drawbacks. I do not believe it will injure *The Engineering Institute of Canada*. It may hinder perhaps, for a short time, its present rate of growth, but in the long run it ought to be beneficial. *The Engineering Institute of Canada* will have no jurisdiction over the Provincial Associations but it ought to have tremendous influence, and sometimes influence is greater than jurisdiction. These are wonderful get-together days, and in my present frame of mind I believe that this is something that we can all get together on. I know of nothing else so good for that purpose. I consider Clause 33, the closing clause, essential.

William Pearce, M.E.I.C.

I can quite appreciate the sentiments that many engineers have expressed that the proposed legislation appeared to them to be too much along the lines of a trade union. It is not more so than, in fact, in my opinion. it does not approach, the rigidity exercised by the law societies in the various provinces of Canada. The lawyers have assumed, and the public to a considerable extent seems to have acquiesced in the view, that they are pre-eminently the leaders in almost any line of undertaking in the country.

They do not confine themselves to law. All our best public offices, many having no connection with legal points, go to lawyers. Why is that the case? Undoubtedly because of their co-operation which can be enforced by their acts of incorporation and the regulations thereunder. Lawyers live and make their livelihood in centres, and thus possess facilities of co-operation in carrying out thoroughly the schemes of their incorporation. We find medical men are striving to work out along the same lines. The same is noticeable in many other callings or professions.

Engineers on account of the nature of their operations are very much scattered and that is all the more reason they should have incorporation and pull together. The greater the number of the branches of engineering one can get to combine the more beneficial to one and all will be the organization.

It is quite easy to understand and I fully appreciate the feeling of many of the leading members of the profession who believe legislation would be no benefit to them, and it if should be that any odium should arise from such incorporation a certain percentage would no doubt attach to them. From that standpoint they naturally are adverse to such incorporation. That is a condition that will arise at any time in any incorporation of individuals and we must all be ready to sacrifice something to the general good.

At the last annual meeting it was decided to appoint a committee to draw up a draft act. That committee has been appointed and I understand performed the functions assigned to it. Is it not rather late in the day to hark back? From the action that has been taken I think that the time to have taken such action would have been at that meeting or immediately succeeding it.

There is no doubt whatever that the leading members of the profession have in the past and still hold the principle office in the association and it is highly desirable in the interests of *The Institute* that that condition should continue. It would be detrimental, probably fatal, to it if such a condition did not continue. It is I presume a matter of indifference to many of those past or present officials whether we have incorporation or not. Their business either professionally or arising out of their profession is sufficiently assured, so that legislation is a matter of indifference to them at least from a financial, social or any other standpoint. I trust, however, that on reflection they will consider that it would at least be generous if not their duty to the less fortunate members of the profession to assist them in the promotion of their interests. Under the present condition the opinion of the majority must largely rule; any other course would probably be fatal to the interests of the profession and in turn to that of *The Institute;* therefore, I trust that the council will loyally back up the legislation proposed.

There may be, and no doubt, will be, many things in the proposed legislation which will require amendment, but let us make a start: the amendments can come later. If we are to study the matter for a decade it would probably be found that when we came to apply the legislation many weak points would be discovered.

G. H. Duggan, M.E.I.C.

The proposed legislation is, no doubt, the outcome of the widespread feeling that we should bend our energies to our material as well as our professional advancement.

In my view, better pay for all can only come through better and more complete organization of the profession and the education of the public to the value of our services. It cannot be at once reached by any form of legislation except for certain special classes of engineers employed by governing bodies, to be referred to later.

While I am strongly in favor of the introduction of legislation because it can probably be made to immediately benefit some classes and will hasten the better recognition of the profession so that eventually a plan may be worked out by which all will benefit, I think the Act is impracticable in its present scope and if its promoters should happen to be successful in getting legislation in this form that it would almost certainly destroy *The Institute*, segregate the profession and set us back many years.

Admitting, for the sake of argument, that the proposed legislation can be obtained, let us consider its probable effect upon *The Institute* and upon the profession as a whole. The Act provides that a Provincial Association shall be formed in each Province and although it proposes to nominally limit the work of the Association to the administration of the Act and calls upon its Members to pay only moderate dues, it also prohibits any one who is not a member of that Association, regardless of his membership in *The Institute*, from practising any kind of engineering in the Province. It is a foregone conclusion that most of the men who belong to the Provincial Association will not continue to pay double dues and will drop *The Institute* because it will be more efficient and quite easy, notwithstanding the aforesaid limitations of the Act, to substitute the Provincial Association for the Branch; one Association of Engineers being all that is required to do the present work and to administer the Act.

The Act implies that all who are registered under it will be competent to practice as engineers, and then proceeds to cover under the definition of Registered Engineers nearly every branch and grade of the profession.

It is difficult to see the connection between the qualifications requisite for an engineer designing or supervising harbor works or an irrigation scheme with those required for an engineer designing internal combustion engines or electrical machinery, and the lack of parallelism may be multiplied to any extent. No one can hope to be proficient in all branches of engineering and the tendency is towards specialization—the only tie between many of the branches of the profession being the fundamental sciences— and merely being a Registered Engineer without definition would not mean to the employing public or to brother engineers a certificate of general competency.

The Institute has already achieved great influence considering its scattered membership and, under its new Constitution, is apparently in a fair way to include all engineers and become the organization we need. We must recognize, however, that so far we have only included a small number of the mechanical, electrical and other specialized branches of the profession who have not heretofore had any interest in our *Institute* and if we proceed too fast we must expect serious opposition from engineers as well as the Corporations and others to whom we look for employment.

Many other arguments could be set forth to show that the effect of the legislation would be to destroy *The Institute* or, at the very least, to curtail its activities and relegate it to the position of only a technical society.

I recognize that legislation must be Provincial and that associations provincial in name will have to be sponsors for applications to the Provincial Legislatures. Our Branches and Provincial Divisions are naturally the mainstay of *The Institute* and I cannot see why the legislation should be made of such a character that we must dissociate these Provincial bodies from our own division and from *The Institute.*

It has been argued that we cannot apply for legislation through our own Provincial Divisions or through any Associations linked with *The Institute* without serious opposition from the Mining Institute and from other qualified engineers who are not members of our *Institute.* That is no doubt true if it is expected to bring under the Act all who practice engineering in any form and in every capacity, but I believe that if legislation were sought within more reasonable and practicable limits instead of opposition we would have assistance from these other interests.

In my view the fundamental difficulty is in trying to make the Act all-embracing and cover all classes of engineers rather than in defining the character of works which may be designed and supervised only by registered engineers and, for a start, I should make registration necessary only for the designers and supervisors of works built by public money of the character usually called Civil Engineering—that is to say, waterways, harbors, irrigation, roads, railways, bridges, hydraulic works and similar constructions, carefully excluding mining or those works undertaken by private capital or private Corporations.

The Miners might properly be urged to seek legislation at the same time with regard to mines, and we would not suffer if in this legislation they asked that Civil Engineers must join their Institute and pass the mining examinations before being allowed to do work in connection with mines. The surveyors, too, should be safeguarded in the continuation of their present work even to the extent of conducting such engineering works as they have been accustomed to carry out in their Surveying practice.

The Act could provide for admission, without examination, of members of the Institution of Civil Engineers, London, the American Society of Civil Engineers and other recognized Civil Engineering Societies. It would be a simple matter for each Provincial division to collect enough to cover the extra cost of its examinations and registration—thus only the men who benefit by the legislation would be taxed therefor; those who did not care to join *The Institute* would be simply making use of its machinery to handle the legislative enactments benefitting them in the Province, and the Branches would still remain the Associations to which the Members of *The Institute* would owe their first allegiance and would thus become of increased usefulness and be better supported.

I have not touched upon the probable failure of the Act to protect or benefit in any way the very large number of salaried men now designated as engineers but who would be treated under the Act merely as technical clerks. It would seem, in fact, that it is drafted principally with a view to benefitting the consulting engineers or only those who must affix their signatures to plans and documents.

The public has a right to be protected and to know that those in charge of public works are competent. From an economic point of view the public will benefit by paying for the better administration of public expenditures, but there is absolutely no justification for demanding registration for all classes of the profession; it is distinctly contrary to public interest, is sure to arouse the opposition of many corporations and of associations of business men and manufacturers—all tending to lower rather than elevate the engineer in the estimation of the public, and I feel it my duty to oppose legislation of this character and scope.

I am, however, prepared to give whole-hearted support to legislation protecting engineers in the public service and that will not be detrimental to this *Institute,* for I am convinced that in the strengthening of *The Institute* lies the advancement and better remuneration of the Profession.

F. H. Peters, M.E.I.C.

The Model Act published in the May *Journal* I think speaks for itself. I am strongly in favour of gaining legislative enactment. I would suggest to all the members that in determining how to cast their ballot on the matter of legislation that they be not too critical of the minor details of the Act, but rather view it in the broad light as indicating what kind of legislation is desirable. I believe that a large majority of our members will vote in favour of legislation. If this proves to be the case, I think that our members should then take the lead in gaining a full co-operation between all professional engineers in order to get the necessary legislation passed in the several provinces. I think the Model Act as framed by the special committee should prove, once and for all, that *The Engineering Institute* is working for the material advancement of all professional engineers and not for any selfish interest of *The Engineering Institute.*

H. H. Vaughan, M.E.I.C.

I agree that the form of the proposed Act is, in all probability, the only one possible in view of the legal conditions and the position that would be taken by other Societies if it were modified. I consider it unfortunate, however, that conditions should exist which require such an Act being so drafted as to eliminate from its requirements the provision that members of *The Engineering Institute* may, by payment of the local fee, become members of any of the Provincial Associations.

Such a provision would bring together the various provincial associations and the parent *Society* wheras without it *The Institute* must necessarily become a technical society only and gradually lose its influence and the means for improving the status and prosperity of engineers generally.

The proposed Act can only benefit a small number of those who are earning their living as Engineers. It would establish registration, which might be advantageous to men engaged in civil engineering work, in Government or Municipal services or those who are practicing as Consulting Engineers. It is so drafted that it cannot possibly benefit in any way the vast majority of engineers who are salaried employees of firms or corporations manufacturing or contracting for work requiring engineering supervision as employment by such firms of one registered engineer would be sufficient to conform to the requirements of the Act. The majority of engineers must, therefore, understand that in supporting such legislation they will inevitably weaken *The Engineering Institute* which, if properly developed, may evolve into a sufficiently powerful society to be of some substantial use in improving the condition of all, while a series of provincial societies will only be of benefit to the few. Such legislation may react on the younger members of the profession by making it more difficult for them to engage in engineering work in any Province in which they see an opportunity as, before doing so, they would have to become members of the Provincial Association, which might conceivably be rendered quite difficult if any provincial organisation desired to restrict the number of men practising in the territory it controls.

Drafted as this Act is to include as professional engineers men exercising certain classes of supervision over the entire field of engineering work, a large proportion of its requirements are bound to become a dead letter. The admission as a professional engineer carries with it no guarantee of competency; that is to say that the admission of a man on account of his ability in constructing or repairing highways will in no way indicate his fitness as a designer of aeroplanes or floating docks. The consequence will, naturally, be that, while the Act may restrict the employment of men on public or municipal works, it is practically sure to be ignored on mechanical or electrical works or, at the most, will be obeyed by the registration of one engineer in each firm, who would take out his certificate.

I, therefore, consider that if legislation of this kind is to be applied for it would be far wiser to restrict it to civil engineers employed on work involving public funds or public safety so that it might be of some reasonable use as a measure of public benefit.

L. B. Elliot, M.E.I.C.

The Act as proposed by the Special Committee overcomes the principal objections that have been raised against Legislation for Engineers; namely, by providing for similar legislative control in each province, and by placing all engineers on the same basis irrespective of their affiliations. It might also be argued that the creation of the proposed Association of Engineers would encroach on the proper sphere of *The Institute*. I think this objection is more apparent than real, as the function of the Association is restricted solely to the administration of the Act. On the contrary I believe, that once legislation is secured and its benefits become apparent, engineers will take a renewed interest in *The Institute* and its activities.

The Special Committee has I think, succeeded in framing an Act which should commend itself to a large majority of engineers, whether members of *The Institute* or not. While the details of the measure might require to be varied in the different provinces, the general spirit and prinicple of the Act should receive our full support.

A. Gray, M.E.I.C.

In approving of the proposed act, the members of *The Institute* must bear in mind that a new body of engineers is being formed, independent of *The Institute* or any other association now existing.

To have the act successfully passed, will require the co-operation of all engineers throughout the country, including civil, mining, electrical, mechanical, chemical, etc.

As it is hardly likely to find engineers willing to support two engineering associations in Canada working with the same aim, *The Institute* must consider, in the event of the adoption of the proposed legislation, a change in the by-laws, and a wider policy to admit all grades of engineers.

It is the duty, therefore, of the complete membership to support the bill and obtain the co-operation of all other engineering associations in the country. When the act is passed by each province, and carefully complied with, it will greatly redound to the credit and uplift of the Engineering profession throughout Canada.

James H. Kennedy, M.E.I.C.

Though I have in the past never been much in sympathy with the idea of applying for any special Legislation, having viewed the Can. Soc., C. E. from the standpoint of a member outside the Dominion, and possibly over estimating the difficulties to be encountered, I have now arrived at the conclusion that Legislation has become necessary; and should be obtained if possible. I have examined the draft Bill submitted by the Committee and entirely approve of the basic principle of Legislation and the details of the proposed Bill as submitted by the Committee.

J. G. Sullivan, M.E.I.C.

The ideas set forth by the Committee as those which guided them in the forming of the Draft Bill, seem to fully cover the ground, and the draft bill has overcome many of the difficulties that I saw in the way of Legislation. I, therefore, approve of what has been done to date.

L. A. Thornton, M.E.I.C.

Saskatchewan members with whom I have discussed the matter arc in favor of legislation, and of the proposed Bill which embodies the essentials in the Draft prepared by the Saskatchewan Branch. While I concur in this view, I sincerely regret that the identity of *The Institute* and membership thereof will not in any definite way be recognized in Legislation. I feel that there is in this a serious objection since the securing of legislation in the several provinces is liable to cause a flagging of that interest in *The Institute* which of late has been so encouraging.

Branch Opinions

Edmonton Branch

The Edmonton Branch strongly supports the proposed Bill in a general way.

We hope to have a good discussion on it at the Western Professional Meeting and we are writing all Western Branches to present their views, also to find out what the Local Engineers of other Organizations think of it.

We believe it would be advisable for our Headquarters to commence discussion with such organizations as are vitally interested.

Toronto Branch

(Telegram)

At Branch Meeting held May 19th, moved by A. F. Stewart, seconded by C. H. Rust, that this meeting of the Toronto Branch, *Engineering Institute of Canada*, hereby endorse general principles of proposed Act respecting engineering profession, but is of the opinion that there should be a very careful revision of the details before submitting it to the legislature. Carried.

W. S. Harvey,
Sec'y.-Treasurer.

* * *

To Visit Western Branches

Brig.-Gen., Sir Alexander Bertram, who has taken a lively interest in the welfare of *The Institute* in the past and who is now Chairman of the Library and House Committee as a member of Council, has kindly consented to visit the western branches of *The Institute* during the coming summer and be present at the Western Professional Meeting in Edmonton, accompanied by the Secretary, who expects to leave Montreal on or about the 16th of June and attend meetings of the various branches approximately as follows:—Winnipeg, June 19th; Regina Annual Meeting, Saskatchewan Branch, June 21st; Calgary, June 23rd; Vancouver, June 28th; Victoria, June 30th.

Sir Alexander will speak on the activities and welfare of the engineering profession in this country.

Salaries and the Civil Service

Since the last issue of *The Journal* the Ottawa committee has been actively at work compiling information for the benefit of members of Parliament who have promised to speak on behalf or engineers and technical men when this important question comes before Parliament. About seventy members have endorsed the proposal to discuss the matter of increased remuneration, feeling that an injustice has been wrought the splendid men of this class who are in the Government service. The influence of *The Institute* throughout Canada is being brought to bear on this matter in a way that has never before been attempted. If this activity does not bring about the desired result in full measure, the experience gained will have made the profession stronger and in a better position to secure, on behalf of the engineers employed by the Government, what everyone is agreed is rightfully theirs.

Many of the members have been throwing the blame for the salaries advertised by the Secretary of the Civil Service Commission upon that body, but from a letter received from Secretary Foran it is shown that the Civil Service Commission has not yet been able to assume the responsibility of fixing salaries, which still rests with the heads of the various departments. It is proposed, however, under the new Act to have this matter entirely in the hands of the Commission, subject to the regulations laid down in the Civil Service Act.

The subject of remuneration has taken a strong hold of engineering bodies as shown by the activity in the United States. The Engineering Council has taken up this question in an aggressive manner and has appointed a commettee of influential men to report on the whole subject. The American Association of Engineers has been most active in this connection. At its annual convention held in Chicago, May 12th and 13th, the Compensation Committee brought in a report comprising nineteen pages and containing a schedule of salaries covering nearly every line of engineering work. The salary recommendations were on a par with those published in the May issue of *The Journal* and were adopted by the convention.

The suggestion made in some quarters of adopting union methods to increase salaries is an evidence of how keenly the situation is felt by some men. It is, however, unthinkable that *The Institute* should second such proposals and moreover, we cannot in the very nature of things sympathize with the principles of unionism, which demand and threaten, without assuming any responsibility either collectively or individually. Engineers are responsible men and deserve the recognition that men of responsibility should have, and moreover, they are going to receive this recognition by acting together for the common good. The work already initiated will bring about beneficial results and in the near future.

Appreciation from England

Members of *The Institute* will be interested to know the manner in which *The Journal* is appreciated in England, from the following extract of a letter just received:—

> "I was very glad indeed to receive the March copy of *The Journal*, and was interested in the account of the Annual Meeting, which seems, as you said, to have been a very successful one. *The Institute* is in a very live condition, and I look forward with pleasure to the arrival of *The Journal* each month. I have shown it to several members of the British Institute here and they are rather envious".

This is a further tribute to the wisdom of the men who are responsible for *The Journal* being started.

Aims and Ideals of the American Association of Engineers

By F. H. Newell.

Service: Service to the members and through these to the public is the first aim of the American Association of Engineers. This service is rendered directly and in ways where the individual member cannot help himself and where he needs the assistance of a well organized group of men of similar thoughts and habits.

This service takes various forms, but begins with the vital requirement of opportunity for self support. The engineer who is without proper employment cannot perform his duties to his family and to society; to be of the greatest value he must be so placed as to be able to use his abilities to the best advantage. The first aim, therefore, of the Association is to use its resources in trying " to get the square pegs into the square holes and the round pegs into the round holes."

Adequate Compensation: More than this it is obvious that a mere living wage will not permit a highly educated and well trained engineer to do his best for his fellow men. He is " worthy of his hire " and this must be sufficient, not merely to keep his family from privations but to enable him to make choice among opportunities and to express his personality and ideals; not having these crushed out by the daily struggle to make both ends meet.

A fair wage scale, a definition of the training and qualities needed, the terms of employment and the corresponding compensation is being worked out. In the study of these intricate relations it has become apparent that, largely through ignorance, the wages of engineers in subordinate positions often have been kept below those of mechanics and laborers. Out-grown laws and traditions have fixed his low pay rather than the operation of the rules of supply and demand, as usually understood.

It is not to be supposed that every poorly paid engineer is entitled to larger compensation; he may be earning all that he is worth in his present position, but if misplaced he should be enabled to get into a position where his natural or acquired talents will be worth more and where he may be correspondingly remunerated.

Education: The American Association of Engineers is conducting an educational campaign to inform the public not only as to what engineers in general are doing but to enforce the lesson that larger comfort, health, and prosperity to the public will flow from a more complete use of the services of the engineer. This is being done through publicity, through putting in the daily papers and magazines, which are read by the public not the technical journals read by but few, the simple facts in ways which will attract the ordinary readers. These by constant repetition in new forms tend to create a proper appreciation of the services of the engineer and of his value to society.

This publicity is undertaken not to exploit any particular man but on the contracy to let the public know something of engineering achievements and the gain to all which comes from these. For example, millions of dollars are being spent on highways, a considerable part of this,— as in the past,— is being wasted because the public has not yet learned that there is a science in road making and that not every farmer or man out of a job is a born expert in this line. When people in general appreciate that the payment of a liberal salary to a skilled highway engineer will result in saving ten or a hundred dollars for every dollar spent in salary, then our highway construction may be put on a sound basis.

The educational program is also conducted in the local meetings of the American Association of Engineers where the effort is made to bring together all engineers in that vicinity, assembling them in small groups for mutual acquaintance and advancement, not as specialists in some one line or as separate sections of civils, mechanicals and electricals but as engineers concerned in engineering as a profession and with a common background of intellectual activity.

Engineers for Engineering: One of the slogans of the American Association of Engineers is the demand that in all engineering operations engineers be employed in responsible executive positions. Because of defects in their early education and to corresponding indifference to public affairs, the engineers as a whole, as well as the public, have tolerated the designation of men other than engineers to take responsible charge of public works. Lawyers, newspapermen or politicians in general are as a rule put at the head of bureaus or offices having charge of highway construction, water works, sewage, drainage, canals, and innumerable other enterprises; the popular statement being that a cheap engineer can be employed if necessary.

It is one of the aims of the American Association of Engineers to turn the full light of publicity upon such conditions and make it as impossible for the public to tolerate an unskilled man at the head of federal, state or municipal public works as it would be for a doctor to be designated as city attorney.

Mutual Protection: In the same way individual abuses which have been tolerated should be exposed to the purifying sunshine of publicity. Again and again it has happened that the Civil Service laws as they relate to engineers have been violated with impunity, simply because it was known that the existing engineering organizations would make no effective protest. Individual cases of unfair dealing have been all too frequent. In other professions, as of law and medicine, these have been dealt with in a drastic manner, public opinion has sustained the legal or medical fraternity in taking such action. The engineers, however, have gained the reputation of being not merely tolerant but indifferent to such matters, they have rather prided themselves on their individualism, which lets each member sink or swin, or violate ordinary rules of fair competition, or remain subject to requirements of laws such as those which fix the wages of a drainage engineer at $5. a day.

It is not to be supposed that all of these evils can be corrected at once, but a long step forward will be made when it becomes known that a large, well organized body of educated men are ready to take up the just cause of a brother member, even though he may be living remote from any engineering center. Moreover the weaker men in the association will be strengthened to perform better work and more completely discharge their duties if they are aware that their lack of efficiency will be known and will reflect unfavorably upon the standing of all other engineers.

Ethics: Above and beyond these fundamentals of employment, education and protection, comes the larger and more difficult field of ethics, of the preservation and enlargement of that goodwill which is the largest asset of the engineer. Here no hard and fast rules apply: all recognize that the main distinction between the mechanic and the engineer is that the latter seeks as his reward not merely wages but the satisfaction in work well done, and properly appreciated; he needs a certain intellectual reward found in the respect and confidence of his fellow men. Here also as well as in technical achievement the American Association of Engineers is striving for better things.

Town Planning Institute of Canada

Copies of the Provisional Constitution and By-laws of the newly formed Town Planning Institute of Canada are being issued by the Honorary Secretary, F. D. Henderson, Office of the Surveyor-General, Ottawa. The objects of the Institute are termed to be to advance the study of town planning, civic design, and kindred subjects, and of the arts and sciences applying to these subjects; to promote the scientific and artistic development of land in urban and rural districts, and to secure the association of and promote the general interests of those interested in the study of town planning.

The membership of the Institute will comprise residents in Canada, who are architects, engineers, surveyors, landscape architects and barristers, in good standing in their professional institutes or societies, who shall be prepared to qualify themselves to engage in the practice of some aspect of town planning. Provision is also made for associate members, legal members, legal associate members, students, associates and honorary members.

A refreshing feature of the new Town Planning Institute is that there are to be no "Charter" members. Prior to the 31st May, 1920, no members or legal members are to be elected. During that period the membership is to consist only of associate members, legal associate members, students, associates and honorary members. Associate members are elected on probation only for one year. As a condition of their election such associate members must agree to undertake a course of study in town planning, and either pass a qualifying examination, or submit a thesis dealing with an aspect of town planning prior to the above named date, satisfactory to boards of examiners to be hereafter appointed. One of the objects of the Town Planning Institute will be to promote university courses in town planning and some preliminary steps have already been taken in this regard.

An invitation has been sent to a number of architects, engineers and surveyors, who are believed to have sufficient interest in the subject of town planning, and to be willing to become associate members under the conditions set forth in the prospectus. Corporate members of *The Engineering Institute* are invited to offer themselves for probationary membership, and can obtain forms of application from the Secretary. An inaugural meeting of the Institute is to be held shortly at Ottawa.

Of the provisional council elected for the purpose of carrying on the work of the Institute during the probationary period, Mr. Thomas Adams, F.S.I., Housing and Town Planning Adviser for Canada, is Chairman. The engineering members of the provisional council are:— J. B. Challies, M.E.I.C., Director of Water Power, Dept. of the Interior, Ottawa; R. S. Lea, M.E.I.C., Consulting Engineer, Montreal.

Provision is made for the formation of local branches of the Town Planning Institute in the different provinces and cities. The officers of the Ottawa local branch include two engineers: N. Cauchon, A.M.E.I.C., President; H. L. Seymour, A.M.E.I.C., Secretary-Treasurer.

Federal Orders-in-Council have been passed that make some $25,000,000 available to the Provincial Governments for loans for housing at an interest rate of only 5 per cent per annum. The general object as stated in the Order-in-Council of February 18th. (P.C. 374), is to promote the erection of dwelling houses of modern character to relieve congestion of population in cities and towns, to put within the reach of all working men, particularly returned soldiers, the opportunity of acquiring their own homes at actual cost of the building and land acquired at a fair value, thus eliminating the profits of the speculator and to contribute to the general health and well-being of the community by encouraging suitable town planning and housing schemes.

The four general conditions on which the loan will be made are specified and standards are recommended for Provincial Housing schemes. The amount of the loan for the acquisition of the site, the construction of the necessary local improvements and the erection of the dwelling is limited bv the Order-in-Council. The amount of loan varies as the type of house to be erected, the maximum being $4,500. No actual limit is set to the cost of house, land or improvements, but in order to ensure that loans are made only to those who need it, it is recommended that no person in receipt of an income exceeding $3,000 per annum should be eligible as a purchaser or tenant of a house erected with the aid of Government funds in any schemes carried out by Provincial Governments, Municipalities, Housing Associations or owners of lots. The proportion of the cost of land and local improvements to the cost of dwelling is also specified in the recommendations.

A matter of significance to engineers is that the Order-in-Council recognizes that a house is considered to consist of three things: (1) the site—the land on which it stands; (2) local improvements—pavements, sidewalks, sewers, etc., provided for access and drainage; (3) the building. In the first two, and especially the second, the engineer is particularly interested.

According to Orders-in-Council the Housing Committee of the Cabinet is authorized to secure the assistance and co-operation of Mr. Thomas Adams, the Town Planning Expert of the Commission of Conservation, and of any other person or persons specially qualified to advise or assist the said Committee in carrying on its work. To assist in carrying out the general objects in view, the experts of the Federal Government are available for conference with the officers and experts of the Provincial Governments regarding the details of schemes and preparation of general provisions or standards, and any other matters on which the officers of the Provinces may desire to confer. On Mr. Adams' staff are the following Engineers:—

A. G. Dalzell, A.M.E.I.C., formerly Assistant to the City Engineer, Vancouver, B.C. Mr. Dalzell is acting as Engineering Assistant for the Western Provinces, in connection with all housing and town planning schemes.

H. L. Seymour, A.M.E.I.C., formerly Town Planning Assistant to the Commission of Conservation. Mr. Seymour is acting as Engineering Assistant for Eastern Provinces.

C. G. Moon, A.M.E.I.C., of Messrs. Moon & Silverton, Consulting Engineers, Vancouver, B.C. Mr. Moon is compiling statistics, and making researches into municipal conditions of Canadian cities.

G. H. Ferguson, A.M.E.I.C., of the Commission of Conservation staff. Mr. Ferguson is making investigations into engineering matters connected with housing and town planning.

The Architectural section is in charge of W. D. Cromarty, M.R.A.I.C., formerly acting professor of architecture in the University of Alberta.

Attention is drawn to the following recommendations of the Federal Government with regard to matters connected with houses which involve engineering assistance, usually left to be dealt with as something distinct from housing. The engineer is here definitely linked up with the architect in the planning and development of the complete dwelling. This connection is established by introducing town planning as an element in house construction:

"To facilitate proper planning and to secure economy in connection with housing schemes comparatively large sites should as a rule be so chosen as to permit of comprehensive treatment. Such sites should be conveniently accessible to places of employment, means of transportation, water supply, sewers and other public utilities.

"Where Housing Schemes are proposed the sites as well as the buildings should be properly planned to secure sanitary conditions, wholesome environment and the utmost economy.

"In cities and towns, local improvements, comprising necessary sewers, pavements, sidewalks, water-mains and lighting services, should be constructed as far as practicable prior to, or simultaneously with, the building of houses, and no house should be permitted to be occupied until provided with proper means of drainage and means of sewage disposal and an adequate supply of pure water.

"All dwellings erected in cities and towns should face on streets so constructed as to provide dry and convenient means of access to such dwellings, or on approved courts opening on to such streets and in no case on lanes or alleys.

"In cities and large towns, sewers and water-mains should be provided to enable connections to be made as buildings are erected; and in small towns, villages and rural areas where no sewers exist, there should be proper sanitary provision for sewage disposal, to the satisfaction of the Board of Health or Sanitary Engineer of the Province.

All dwellings should have connected to them an adequate supply of pure water before occupation is permitted for purposes of habitation.

"No building should be erected on a site which shall not have been drained of surface water, or which shall have been filled up with any material impregnated with faecal matter, or with animal or vegetable matter, unless and until such matter shall have been removed, and the ground surface under such building shall be properly asphalted or covered with concrete or other dry and hard material to a thickness of six inches at least."

New Canadian Pacific Locomotives

New Canadian Pacific Railway Locomotive No. 5302.

W. H. Winterrowd, M.E.I.C., Chief Mechanical Engineer.

Ten of the largest locomotives ever built in Canada have lately been designed and built in the Angus Shops of the Canadian Pacific Railway under the direct supervision of W. H. Winterrowd, M.E.I.C., Chief Mechanical Engineer.

These locomotives are of the heavy Mikado type and are designed for freight service. The weight of the engine and tender in working condition is 500,000 lbs., the engine along weighing 323,000 lbs. The diameter of the driving wheels is 63 inches. The cylinders are 25½ inches in diameter by 32-inch stroke, which with 200-lbs. boiler pressure makes these locomotives capable of exerting a maximum tractive effort of 36,000 lbs. The diameter of the boiler is 80 inches at the front end and 90 inches at the back end. The fire box is 84 inches wide and 120 inches long, and the grates are moved by steam grate shakers. The tender has a capaticy for 12 tons of coal and 8,000 Imperial gallons of water.

The cab is of the vestibule type, which is the C.P.R. standard, and every effort has been made to make the accommodations for the enginemen as comfortable as possible. One side of the cab is fitted with a clothes locker 14 inches by 20 inches wide, in which clothes can be hung and lunch pails carried.

One of these locomotives No. 5302, was recently inspected by E. W. Beatty, President, and Grant Hall, Vice President, Canadian Pacific Railway.

CORRESPONDENCE

Improving Professional Status

Editor, *Journal:*

In a recent editorial of the Canadian Mining Journal (April 16th, 1919) under the title "Class Legislation for Engineers," certain arguments were presented against the policy of *The Engineering Institute* in the matter of obtaining legal recognition. Now while the futility of these arguments (which I will discuss later) is so apparent to a man of experience that they hardly merit the trouble of refutation, nevertheless on account of the wide circulation that they necessarily obtain, they must be considered as exceedingly pernicious owing to the influence that they have on the public mind, and on the younger and less experienced members of the profession. They are of a type of propaganda which has had a wide dissemination by sundry technical journals, quasi professional organizations, and, I regret to say, by a certain section of engineers who ought to know better. As the fallacies spread in this manner have rarely been openly controverted, they have caused a complete misunderstanding of the aims of *The Institute*, and are largely responsible for the opposition to its efforts to improve the status of the profession. In my undergraduate days, as a result of this propaganda, I received an incorrect idea of the character of the Society, which only the practical experience of years effaced, and no doubt the same thing happened in numberless other instances, so that in my opinion what is badly needed is an organized effort on the part of *The Institute* to combat this evil, so that when a statement of this kind appears, its absurdities will not be allowed to go unchallenged and influence the public mind to the detriment of *The Institute*.

In the editorial above mentioned, the following points are taken. First, that for any society to secure legislation giving it the right to define the status of engineers is to allow it to usurp the functions of government, and hence not to be permitted. It is to be inferred from this that such a privilege conferred on any professional body constitutes an evil, the nature of the evil however is not made clear. Second, that *The Engineering Institute* by its activities is endeavouring to draw professional members away from the Canadian Mining Institute, and hence injure the latter institution. In the course of his article, the editor admits that the technical professions generally are underpaid, and that furthermore they have the right to organize to protect their interests. Such being the case, it appears difficult to escape the implication that an endeavour to obtain legal recognition of their status follows as a natural corollary to their admitted right to organize.

As to the contention that giving an engineering society the right to define the legal status of engineers is allowing it to usurp the functions of Government, that is exactly what is done in the case of the professions which have already a recognized legal standing, such as law and medicine. The Government does not exercise its control directly, but delegates it to a professional society. In view of this fact it appears evident that if this procedure is wrong with respect to engineering the same conclusion equally applies to the other professions mentioned. On this point however the editor is not very clear, and leaves us in some doubt as to whether he is in favor of the introduction of quackery into all the professions, or is content merely to restrict it to engineering. In short, the absurdity and contradictions of the arguments become manifest even on a superficial analysis. As to the inference that *The Engineering Institute* is trying to draw professional members away from the Mining Institute, the incorrectness of such an assumption is obvious, as the two societies, in spite of a certain similarity in their personnel, occupy different spheres of action, and as, furthermore, those who join them do so from distinct and different considerations in each case, there can be no conflict between them except in the imagination of certain parties.

As to mining engineering, from my own experience, having practised that profession for seventeen years, in the three principal political divisions of this continent, I would say, that there is *no* profession more in need of legal regulation, it is overrun with pretenders and imposters who are the curse not only of the profession, but of the industry as well. I have repeatedly seen thousands of dollars squandered on the advice of some plausible quack whose entire stock-in-trade consisted of a smooth exterior, and a glib enunciation of technical phrases. I well remember one of these gentry, who, on the strength of his supposed geological knowledge, succeded in being appointed consulting engineer to a large mining company (still operating) in Mexico; shortly after securing this position, he attempted to make a topographical and geological map of the area adjoining the mine, and in so doing demonstrated his ignorance of the principles governning the use of an ordinary transit. Instances of this sort are without number, and in general, it can be said that the public, including a considerable section directly interested in mining are quite unable to distinguish between the genuine and spurious in the matter of mining engineers. As for the titles of M.E. and E.M., anybody is at liberty to use them, so that they mean nothing. In my own experience I have found a greater number of imposters using them than genuine mining engineers. From consideration of these facts, it is evident that some sort of government supervision of mining engineers is in order, and it is necessary in the interest of the public apart from any benefit it may confer on the profession.

Needless to say, the best way to accomplish this is through a recognized professional society, in good standing, and in this connection two societies come up for consideration, namely, the Canadian Mining Institute and *The Engineering Institute of Canada*. The first-named, however, is, strictly speaking, an industrial, rather than a professional organization, a fact which unfits it to take the leading part in such a matter. The second on the other hand, is the only purely professional engineering body of national importance in the Dominion, and consideration of its ideals, history, and personnel clearly show that it is the one best adapted to bring the matter to a successful conclusion.

Finally, I may say, that it is my opinion that the two societies above mentioned ought to co-operate to achieve this end, as improvement of the status of mining engineers is bound to react advantageously to the industry as a whole.

Yours truly,

Cobalt, April 29th, 1919. J. A. REID.

Congratulations from the United States

Fraser S. Keith,
The Engineering Institute of Canada,
176 Mansfield Street,
Montreal.

Gentlemen:

Referring to your favor of January 30th, we wish to congratulate you and the entire Engineering Profession of Canada on the fact that you have already succeeded in organizing the Profession so well in your Country, and have no doubt you will reap great benefit from your strong and generally inclusive organization.

We are hoping that we may be able to have a similar effective organization to properly represent the entire Engineering Profession in the United States.

Yours very truly,

O. H. Dickerson,

Chairman, Committee on Engineering Unity,
Duluth Engineers' Club,
Duluth, Minn.

April 24th, 1919.

* * *

The Status of the Engineer

Editor, *Journal:*

We are living in an age of re-construction, and I trust that the coming years will witness an age of scientific research and of investigations, on sound economic principles, into the development of our natural resources.

To attain this object, however, it behoves us to build our structure on a sure foundation—a foundation of highly educated and qualified men.

In the past century the pivotal figure in man's wonderful material progress has been the engineer who is mainly responsible for the benefits that have been conferred on the human race, but whose achievements have not brought him the appreciation he merits principally due, no doubt, to his abhorrence of self-advertisement and newspaper notoriety.

The time has come, however, when we must all recognize the status of the engineer and the technical expert, and appreciate more fully the services rendered by the engineering profession and the practically trained university graduate.

The engineer has to play an even greater part than ever in the future, and now that the Government is the largest single employer of technical men in the whole Dominion and by having lately taken over two transcontinental railways has become the employer also of a large proportion of all the technically trained workers in Canada it is absolutely necessary to secure the advice of the most competent engineers and scientists if we wish to protect the public from the wilful expenditures of public money, due to incompetent engineering advice or supervision.

But how are we going to procure these trained experts unless we elevate the status of the engineer and encourage scientific pursuits by giving greater remuneration to the technically trained men?

At the present time the engineer in the Government employ has a very precarious standing. If he is on the Inside Service he is usually classified as a clerk and is in the habit of receiving the same annual increase as the messenger. He cannot, as a rule, be promoted unless a clerk (in 90 cases of a 100, a clerical clerk) ahead of him dies, resigns or is superannuated.

Not much inducement is held out to the young men of our Universities to pursue the science and engineering courses, when we see over and over again an advertisement similar to the following, that appeared in the Canada Gazette of June 1st, 1918:—

> " Technical clerk required in the Topographical Surveys Branch, who is a graduate in Applied Science, honour mathematics, or physics. Salary $1300 per annum."

Yet in this same issue of the Canada Gazette appeared advertisements for twenty-five draughtsmen in the Department of Public Works at a minimum salary of $1500 per annum, a law clerk in the office of the Auditor General at $2100 per annum and mark this, a motion picture camera man in the Department of Trade and Commerce at $2400 a year. The picture man whose education probably cost him very little receives the highest salary. The honour graduate in mathematics is offered the least—only $1300 per annum.

Numerous illustrations could be given of such discrepancies between the salaries of the technical and non-technical men in the Government employ. No wonder it is that the Government repeatedly loses the services of some of its most highly trained experts who have gone over to the United States where their work has been fully appreciated and well rewarded. In this way especially have the Geological, the Topographical and the Geodetic Survey branches of the Service suffered. In passing I would like to point out to you the great work carried on by the Geodetic Survey of Canada—work that is but little understood by the public owing to its exceedingly high technical nature and which consequently is not appreciated, but this work nevertheless is absolutely indispensable to the surveys of the Militia Department, the Department of Public Works, the Hydrographic Surveys of the Department of Naval Service, the Irrigation and Water Power Surveys of the Interior Department and for all map making departments of the Federal and Provincial Governments. A country without a geodetic survey has not reached the state of civilization. Yet in this branch of the Federal service there are to be found highly educated engineers receiving salaries considerably less than the average salary* paid to the employees of the United States Steel Corporation.

A little while ago I read a report which brought to my attention the great scarcity of men in Canada who were trained in the science of forestry. This is indeed very serious and very much to be regretted in view of the fact that it is most essential, for the proper administration of our forest resources which are far from being inexhaustible as we were formerly prone to believe, that they should be studied most scientifically if we are going to learn the conditions that control growth and reproduction in our forests and to devise remedies to overcome the diseases that every year ruin acres upon acres of excellent timber. Yet look at the encouragement the Government gives to the student of forestry when it advertises in the Canada Gazette of March 8th, 1919, for an entomological assistant who possesses a university degree and has had training in entomology, expecially of forest insects. Salary $1400 per annum.

In the reorganization of the Civil Service I hope that the engineers of the Service have had adequate technical representation by the Civil Service Commission and I would impress upon the members of the Government that in the interests of the public and the engineering profession a high standard of professional ability should be adopted for the different classes of work embraced in the engineering branches of the Service and that a scale of remuneration be fixed that is high enough to encourage the young men of our universities in industrial and scientific research and to attract and keep men of ability.

Superintendent of a Government Department,
A.M.E.I.C.

*$1685 (V. Financial Post, April 5th, p. 8.)

Message from India

Editor, *Journal:*

My luck is in at last, and I am about to leave India to spend one month's leave in England. I have been two and a half years in the East and am longing to see the fine green fields of England, or the pine forests of British Columbia—and I am going to have my wish gratified at last.

I leave Bangalore on Friday (to-morrow) and hope to sail from Bombay on Tuesday, 1st April. I do not expect to return to India, although I am only going on leave, as I expect I shall be able to get my demobilization completed soon after I arrive in "Blighty." Please cancel my present address, and direct all correspondence, until further orders, to my old home "Rose Lea," Uddingston, Lanarkshire, Scotland. I may be there for a time after which I hope to return to British Columbia, if conditions there warrant my return. I enclose a copy of an Illuminated Address presented to me yesterday along with a handsome hunter's walking stick. My stay in India has been most agreeable and I have enjoyed training the Indian Sappers. They are wonderfully smart and intelligent and they are as keen as mustard if handled properly. It was a great surprise to me to be so honored as I have been, for one scarcely expects such tangible tokens of esteem for doing one's duty. I shall treasure these gifts highly, and shall always look back with pride to my two and a half years connection with the Corps of Second (Queen Victoria's Own) Sappers and Miners.

All the same, I shall be glad to return to civil life again, and I am looking forward with much pleasure to the free life in Canada. It is hard to knuckle down to red tape and discipline after enjoying the freedom of the West, and I shall be glad when I am at last engaged in the pursuits of a quiet, peaceful life.

Your *Journal* is as greatly appreciated as ever. It is the one link I have with the life and thought of Canada, and I always read it with the greatest of pleasure and appreciation.

Yours faithfully,
D. B. McLay, Capt., R.E.,
Late Commanding 67th Field Co'y., 2nd Q.V.S. & M.
Bangalore, India,
27th March, 1919.

To

Capt. D. B. McLay, R.E.,

Officer Commanding,
No. 67, Field Company,
2nd "Q. Y. O." Sappers and Miners,
BANGALORE.

Honored Sir,

WE, the INDIAN OFFICERS, N.C.O's and Men who serving under your honor's command, beg leave to avail ourselves of this opportunity of your honor's departure home, to express our sentiments of respect and love to your honor and specially to bid your honor "Adieu."

In a word your honor's command is a "Cheerful Command."

If we are not unduly praising, we beg to state that we enjoyed under your honor's "Regime" Even Treatment, Fair Justice and Fair Play in all matters connected with the company Your honor's cheerful appearance mingled with the sense of duty and discipline, enabled us to carry on our work with cheer and pleasure and everything went smooth and soft

The way your honor appreciated the help and advice of the I. O's, the zeal exhibited by N C.O's and the instruction given by them to Sappers in Field Works, other Coy, duties and the neat turn-out of men on Parade is almost like a Good Conduct Medal, awarded to the full Coy

It will not be out of place to state that the advice given by your honor regarding N.C.O's commanding respect from juniors, words of command and improvement in education, is deep seated in our minds.

We duly promise your honor that we will not shrink a bit in the trust to serve under your honor's successor Lieut. W. H. Knox, R.E., with the same zeal and interest and thus work for the honor of the Coy: and keep-up the prestige of the "2nd Q. V. O." Sappers and Miners.

In conclusion we with one heart and one voice proclaim in the major key "Good-bye" and pray for your honor's longevity and prosperity

We beg to remain,
Honored Sir,
THE I. O's, N. C. O's and MEN
of 67th Field Coy.,
2nd (Q. V. O.) Sappers and Miners.

Assaye Lines,
Bangalore,
26th March, 1919

* * *

Many many thanks for the gift of cigarettes and the welcome Christmas Greeting of *The Engineering Institute of Canada.* Both are extremely welcome and I am very grateful for such reminders. I long to be back in dear old Canada, and I do hope I shall be there soon. Best of luck to you.

D. B. McLay, Capt., R.E., A.M.E.I.C.,
O.C. 67th Field Co.,
2nd Q.V.O., Sappers & Miners,
Bangalore, India.

* * *

I wish to thank the Council and members of *The Institute* for their Xmas gift of cigarettes, which have only just reached me.

Yours sincerely,
T. C. McConkey,
(Major, 79th Depot Battery, C.E.F.)
Russia, Dec. 8th, 1918.

REPORT OF COUNCIL MEETINGS

An adjourned meeting was held at the headquarters of *The Institute* on Tuesday May 6th.

Legislation: The Minutes of the previous meeting having been confirmed, the question of legislation was taken up and the list for Members of Council, giving views as to whether a letter should or should not be sent out with the Ballot to the Members, concerning the proposed Act for Professional Engineers.

It was resolved that the letter of transmittal sent in by the Special Legislation Committee with the Draft Act, be printed in the June issue of *The Journal*, and that the ballot should call attention to the Act printed in the May issue, and to the letter in the June issue of *The Journal*.

It was resolved that a Committe of Council, consisting of—Walter J.Francis, Arthur Surveyer, H.H.Vaughan, G. H. Duggan and R. A. Ross, be appointed to draw up a Pro and Con circular, giving the reasons advanced for and against the proposed bill, and that this circular should be printed and sent out with the ballot.

It was resolved, in order to allow of a discussion through *The Journal*, of the proposed Act before the vote was taken, that the ballot be sent out on June 15th.

The Secretary was instructed to advise all members of the Legislation Committee of this action and ask their approval.

Winnipeg Branch: Pending the consideration and approval of By-laws as submitted by the Manitoba Branch, the suggestion made of changing the name to "WINNIPEG" Branch, was approved.

Canadian Mining Institute Proposal: It was resolved that the proposal of the Canadian Mining Institute to urge the Government to send out parties prospecting, calculating to employ mining engineers and others returned from the front, be given hearty approval. The Secretary was instructed to wire Sir James Lougheed approving of the plan and urging immediate action.

Concrete Investigations: A suggestion from the Director of the Bureau of Standards, Washington, that we appoint a member of *The Institute* to join them in a meeting of the Advisory Committee to be held in June in connection with the investigation to determine the effect of alkali salts in soils and waters on cement drain tile and other concrete structures, was considered. The Secretary was instructed to ask the Committee on this subsject to appoint one of their members.

National Railways Commission: A telegram from the Manitoba Branch stating that the Federal Government was about to appoint a commission of six to handle national railways and requesting Council to urge appointment of an engineer, was presented. The Secretary was instructed to ask the Ottawa Branch to advise regarding this commission.

Earth Roads Specifictions: A letter was presented from the Chairman of the Honorary Advisory Council for Scientific and Industrial Research with reference to earth road specifications. The Secretary was instructed to advise Dr. Macallum that the Research Council would have the hearty support of *The Institute* in this matter and to point out that Council was awaiting the report of the committee already appointed on this subject.

Soldiers Civil Re-Establishment: A letter from Col. C. N. Monsarrat, advising that a committee of the Ottawa Branch, consisting of Lieut.-Col. Duncan Macpherson, Major T. C. Keefer, Dr. A. F. Macallum and Lieut.-Col. C. N. Monsarrat, convener, was appointed to assist the Department of Soldiers' Civil Re-Establishment, was considered and the committee approved.

Memorial to Government: Further replies to the memorial to the different Governments, received from T. L. Norris, Premier of Manitoba, and A. S. Barnstead, Deputy Provincial Secretary of Nova Scotia, were noted.

Society of Chemical Industry — 2nd Annual Convention: A letter to the Chairman of the Society of Chemical Industry, offering the members of the Society the privileges of *The Institute's* Headquarters and extending the goodwill of *The Institute*, was approved.

Canadian Engineering Standards Association: In response tc a request from Capt. R. J. Durley for nominees to the Canadian Engineering Standards Association, Messrs. H. H. Vaughan, W. F. Tye and Walter J. Francis were appointed.

The regular monthly meeting of the Council was held at the rooms of *The Institute*, 176 Mansfield Street, on Tuesday, May 20th, at 8.15 P.M.

Legislation: (a) Pro and Con Circular: The committee reported progress. It was understood that a complete report of this committee would be submitted to Council at the adjourned meeting to be held on June 3rd.

(b) Definition of "Professional Engineering." The Secretary submitted a definition of "Professional Engineering," the work of the Legislation Committee of the Engineering Council. It was noted that a copy had been sent by Mr. Surveyer to each member of th Special Legislation Committee.

(c) The letters from Councillors, in response to a request for their views for publication, and from the Toronto and Edmonton Branches, were noted.

Revision of By-laws — Scrutineers' Report: The report of the scrutineers appointed to examine the letter ballot on the adoption of the amendments to the By-laws showed that of four hundred and seventy-six ballots cast, four hundred and six voted "Aye". The report of the scrutineers was accepted and the amendments to the By-laws declared adopted.

Convention A.A.E: The Secretary reported that he attended the convention of the American Association of Engineers, in Chicago and gave an address on the aims and ideals of *The Engineering Institute of Canadal*

Salaries: A letter from the Secretary of the Civil Service Commission was read, pointing out the situation regarding the Civil Service Commission's relations to the present salaries. It was resolved that this letter be published, provided the consent of the writer be given.

In consideration of the request from the Quebec Branch that a committee be appointed to meet the Executive Council of the Province of Quebec, in Montreal, regarding salaries, the Secretary was instructed to ask the Quebec Branch to report to Council a list of the engineering positions, with present salaries and suggested salaries and to prepare a classification of engineering positions in the Government service.

Committee, St. John Branch: A committee appointed by the St. John Branch to act as an employment bureau for New Brunswick was noted, as follows:— G. N. Hatfield, Chairman, F. G. Goodspeed and J. A. Waring, and the Secretary instructed to co-operate with same.

Royal Commission on Industrial Relations: In response to a request from the Halifax Branch for advice, the Secretary was instructed to advise that the Montreal Branch, who had first made the suggestion in connection with the Royal Commission, had decided to take no action at the present time.

Scientific Research: A letter from the Clerk of the Committee on Scientific Research asking if *The Institute* wished to be heard in connection with matters referred to the Committee, was presented, and Professor Ernest Brown and Julian C. Smith were appointed to act with the Secretary in drafting a reply.

Town Planning: The Secretary was instructed to published in *The Journal* information regarding the Town Planning Institute, to keep the members informed on this important matter.

An invitation from the National Conference on City Planning to the Eleventh National Conference to be held in Niagara Falls-Buffalo, May 26th-28th, was presented. It was decided to ask the Niagara Peninsula Branch to send representatives to this Conference.

Draftsmen Union: A photostat copy of a circular describing the draftsmen union, forwarded by Mr. Walter J. Francis was noted. It was further noted in a letter from Toronto that a Canadian draftsmen union was being formed.

Legislation Committee, Quebec Branch: The Legislation Committee of the Quebec Branch was noted as follows: Messrs. A. O. Barrette, A. Fraser, J. E. Gibault, A. Larivière, A. B. Normandin.

Canadian Engineering Standards Association: Two letters from Captain R. J. Durley, M.E.I.C., Secretary of the Canadian Engineering Standards Association were presented, proposing intimate co-operation regarding the issuance of engineering standards. In regard to the Specification for Steel Railway Bridges, it was proposed that the Committee of *The Institute* become a sub-committee on Steel Railway Bridges of the Canadian Engineering Standards Association, together with such other members as might be needed to ensure that all interests concerned had been consulted, it being intended that this sub-committee should consider the E.I.C. Specification and make recommendations to the Canadian Engineering Standards Association regarding its adoption.

Regarding the Specification for Steel Highway Bridges, it was proposed that the Specification already adopted by *The Institute* be considered by the Committee on Steel Railway Bridge Specifications and any important modifications that might be found necessary in the Specification for Steel Railway Bridges be incorporated therein, and the Specification dealt with in a manner similar to that proposed for Steel Railway Bridges.

It was further proposed by the Canadian Engineering Standards Association that other Specifications of *The Institute* be similarly dealt with. These suggestions were heartily approved.

Classifications: Classifications were made for a ballot returnable at the regular meeting in June. The meeting adjourned until Tuesday, June 3rd, at 8.15 P.M.

* * *

Contracting Plants Wanted

A Member in England writes that it would be advantageous for any parties having plant for sale, to advertise them in *The Journal*, as there is a scarcity at the present time.

* * *

Central Station Developments

Progress and developments in the U. S. A., in 1918, are reviewed. In some cases the cost of coal increased 500 per cent. The four largest concerns in North and Central California, comprising 90 per cent of the power business 40,000 sq. ml., were interconnected. Similar schemes were carried out in other States. Agitation is still proceeding for a Federal water-power scheme.

A 25,000 h.p. Francis turbine and a 45,000 kw. impulse steam turbine were placed in service. A 70,000 kw. cross compound unit was ordered for a Government nitrate plant; at the other extreme, high-speed turbines of 7½ kw. are now available for driving auxiliaries. Instruments are being introduced in boiler rooms on an unprecedented scale. Substitutes are being sought for alloy condenser tubes.

Automatic and outdoor substations represent an important development. The inferior quality of coal marketed has hastened the utilisation of pulverised fuel. A number of the smaller stations purchased second-hand plant with satisfactory results, and this policy is likely to be continued. Co-operation between stations in purchasing lamps, etc., effects economy. The elimination of isolated power plant (in many cases on the order of the Fuel Administration) has been an important development; where isolated plant is more economical than central station service during winter months, owing to heating requirements, it is still possible to obtain a valuable off-peak load for the central station during the summer. A number of central station have acquired control of coal mines, the electrification of which has incidentally been hastened. (Electrical Review, Chicago.)

BRANCH NEWS

Halifax Branch

Frederick R. Faulkner, M.E.I.C., Sec'y.-Treas.

At a meeting of the Executive Committee of the Halifax Branch, held in the reading room of the Nova Scotia Technical College on Friday, May 7th, the resignation of K. H. Smith, A.M.E.I.C., as Secretary-Treasurer of the Branch was received, and accepted, with considerable regret, as Mr. Smith has been a leading factor in the activities of the Halifax Branch since its formation.

By virtue of the power conferred upon the Executive Committee at a general meeting held on April 25th, Professor F. R. Faulkner, of the Nova Scotia Technical College, was appointed to fill the vacancy for the remainder of the year.

Montreal Branch

Frederick B. Brown, Sec'y-Treas.

A ballot was recently issued to the membership of the Branch and the following were chosen as Members of the Executive Committee for 1919-21:—

Chariman	Walter J. Francis. (By acclamation)
Vice-Chairman	Arthur Surveyer. (By acclamation)
Sec'y.-Treasurer	Frederick B. Brown. (By acclamation)
Executive	F. P. Shearwood, W. Chase Thomson, H. G. Hunter, K. B. Thornton, de M. J. Duchastel, S. F. Rutherford.

* * *

A questionnaire on Legislation was recently issued to the Branch membership. The replies were as follows:—

Question 1. 146 are in favour of a closed corporation, 18 are against, 3 did not answer.

" 2. 140 are in favour of legislation embracing all engineering works, 17 favour public works only, 10 did not answer.

" 3a. 53 are in favour of entrance through colleges only, while 114 believe otherwise.

" 3b. 140 are in favour of candidates being obliged to pass examinations for admission to study, and 27 believe this is not necessary.

" 3c. 133 are in favour of examinations for admission to practice and 32 are not in favour, 2 did not answer.

" 3d. 139 think candidates should serve a period of apprenticeship and 20 think this is not essential, 8 did not answer.

" 3e. 77 are in favour of the joint board, while 51 prefer the corporation only or other (13) forms of board. 26 did not answer.

" 3f. 110 are in favour of exemption from examinations and 46 are not, 10 did not answer.

" 3g. It is impossible to briefly classify these replies. 78 are in favour of exempting the graduates of engineering colleges from all examinations; 33 are in favour of exempting them from some of the examinations; 44 do not want them exempted from any examinations and 12 did not answer.

" 3h. 140 think it essential that graduates of engineering schools should have experience before taking charge of engineering work, and 18 think this is not necessary. 8 did not answer.

The committee believe it would be in the interests of *The Institute* to publish in *The Journal* the questionnaire sent out to the members, together with the above summary of the answers received, and I, therefore, take pleasure in requesting that this be done.

The questions are given on pp. 26 and 27 of the January *Journal.*

Yours very truly,

Frederick B. Brown,

Secretary-Treasurer.

Ottawa Branch

M. F. Cochrane, A.M.E.I.C., Sec'y.-Treasurer.

The third meeting of the Ottawa Branch was held on April 17th, when Dr. W. Bell Dawson, by request, read his paper on "Mean Sea Level as a General Datum for Canada," which he presented at the Annual Meeting. At the same time Mr. Uniacke made a report to the Branch on the work done at Montreal by the Special Legislation Committee.

The fourth meeting of the Branch was held on May 8th, when Capt. H. W. B. Swadey, the late officer in charge of steel inspection for the Imperial Ministry of Munitions, gave an account of the production and inspection of steel for munitions in Canada during the period of the war.

Capt. Swabey's paper forms a record of the highest importance, and many of the methods described will be of permanent value to all those interested in the production and manufacture of steel.

On the 15th May, James White, M.E.I.C., of the Commission of Conservation, gave an interesting account of the hydro-electric system in course of construction by the Aluminum Company of America, which when completed will be one of the largest in North America.

In order to assist engineers who have served in the military forces overseas to find suitable positions on their return to civil life, a Committee of the Ottawa Branch has been formed to co-operate with the Department of Soldiers Civil Re-Establishment. This Committee consists of:— Col. C. N. Monsarrat, Convener; Major T. C. Keefer; A. F. Macallum; Col. Duncan MacPherson.

Toronto Branch

W. S. Harvey, A.M.E.I.C., Sec'y.-Treas.

An open meeting of the Branch was held in the lecture room of the Engineer's Club, 96 King Street, West, at 8.00 P.M. on Thursday, April 24th, 1919. The evening was spent as a "Smoker," and an enjoyable musical programme was provided. There will be no further regular meetings of the Branch till the autumn.

A *special* general meeting of the Branch was held in the lecture room of the Engineer's Club, 96 King Street, West, at 8.15 P.M. on Monday May 19th, for the purpose of considering and discussing the Draft Bill of the proposed Legislation. The meeting heartily approved of the proposed Act.

The Branch intends to make a revision of its membership list for the purpose of issuing a Year Book for 1919, and has sent out to each of the members a post card to be filled in by him, giving his name, grade, home address, business address, house phone number and business phone number.

Niagara Peninsula Branch

R. P. Johnson, S.E.I.C., Sec'y.-Treas.

A meeting of the Branch was held on May 9th at the Engineers' Club, Thorold, for the purpose of discussing and forming a Branch policy on legislation and ways and means of improving engineering compensation.

Before turning to this matter the chairman called upon two visitors for a short description of the Regional and Town Planning Movements.

H. L. Seymour, A. M. E. I. C., of the Ottawa Branch and Dr. W. J. Donald, Secretary of the Chamber of Commerce of Niagara Falls, N.Y., each outlined these projects, acknowledged their dependence upon engineering skill, and advised the meeting of the forthcoming Regional Planning Conference at Niagara Falls towards the end of May.

As there are a large number of Civil Service employees in the Branch, the discussion on compensation reverted largely to the forthcoming Civil Service Act, and considered the procedure to be taken by the Branch at the time the exact figures of the salary schedule embodied in the Act should become known.

A resolution was passed and a committee appointed along the same lines as that of the Toronto Branch, to draw up a salary schedule for all branches of the profession.

A committee was also appointed to ascertain the salaries which are really being paid for various positions.

The former committee was instructed to be ready to report to a meeting of the Branch to be called on or about July 15 and the latter committee to have its data ready for forwarding to Headquarters along with the approved salary schedule at this time.

It was decided to ask the other Branches to take similar action if they had not already done so.

The subject of legislation was not taken up at this meeting, partly because the hour was late but largely because the speakers who, it was intended, should lead the discussion, were unable to be present. It should be said that the exact nature and progress of *The Institute's* legislation programme is not fully understood by the members of the newly formed Niagara Peninsula Branch and, as yet, no definite Branch policy in this connection has been worked out.

Coffee, sandwichs and 'smokes' provided by the members of the Engineers' Club of Thorold, were much appreciated at the close of the meeting.

The first affiliate of the new Branch has just been elected in the person of F. H. Byrn of the Toronto Power Co., Niagara Falls, Ontario.

Several members of the Branch have signified that they are acting upon the important suggestion in the April *Journal* with regard to interesting members of parliament in connection with the proposed Civil Service Act which embodies a higher schedule of salaries for the engineers of the Civil Service. Members are writing letters to those members of Parliament who are personal friends irrespective of whether they are the members for the local constituencies or not.

A great deal of interest in *The Institute* is being shown by engineers in the Niagara District who are not already connected with *The Institute.* Many have applied for application forms for membership; so much so that the supply has been temporarily exhausted. Fourteen applications for membership in *The Institute* have been made by engineers within the Branch radius since the Branch was organized two months ago.

The membership of the Branch is growing rapidly as the following personal notes indicate.

E. P. Johnson, A.M.E.I.C., formerly resident engineer on the Port Colborne harbor work, has taken up the duties of resident engineer of Section 1 of the Welland Ship Canal.

C. L. Kate, A.M.E.I.C., formerly of Montreal, has joined the staff of the Welland Ship Canal on Section 3 at Thorold, Ont.

E. J. Bolger, A.M.E.I.C., is with Doheny, Quinlan and Robertson, contractors for Section 3, Welland Ship Canal, at Thorold.

C. E. Hogarth, Jr. E.I.C., has returned from overseas and is again on the staff of the Welland Ship Canal on Section 1—Address, St. Catharines.

Gerald M. Hamilton, A.M.E.I.C., has returned from overseas and rejoined the staff of the Welland Ship Canal.

R. C. MacLachlan, Jr. E.I.C., of Ottawa, has returned from overseas and joined the staff of the Welland Ship Canal, Section 1—Address, St. Catharines.

* * *

The following resolution was passed at a meeting of the Niagara Peninsula Branch, held at Thorold.

Whereas there is great need of, and justice in, securing greater remuneration for engineers in all branches of the profession, and

Whereas *The Engineering Institute of Canada* has committed itself to actively take up this matter:

Be it resolved that the Niagara Peninsula Branch appoint a committee to study the salary situation and bring in a report as to what they consider to be a fair schedule of salaries for all the usual positions of all branches of the profession.

This committee to consist, as far as possible, of members representing Civil, Mechanical, Electrical, Chemical and Mining Engineering and with power to add to its numbers.

This committee to be appointed at this meeting by vote of the members present, with instructions to report to a meeting of the Branch to be called on or about July 15, 1919, for the purpose of approving or revising the schedule.

And be it further resolved that a committee consisting of W. H. Sullivan, A.M.E.I.C., and A. C. D. Blanchard, M.E.I.C., be appointed to ascertain the salaries that are really being paid for various positions within the Branch radius. The data gathered by this last committee to be forwarded to Headquarters along with the approved schedule of salaries.

And be it further resolved that copies of this resolution be forwarded to each of the other branches with a request that they take similar action if they have not already done so.

And be it further resolved that Council be requested to use this data as a guide in drawing up a salary schedule to be adopted by *The Institute*, and that the final approved schedule be printed in pamphlet form and copies mailed to each member of *The Institute* for their guidance in engaging assistants or in seeking new positions.

A copy of this resolution was sent to all the Branches of *The Institute*.

Sault Ste. Marie Branch

Newton L. Somers, A.M.E.I.C., Sec'y.-Treas.

At a meeting of the Sault Ste. Marie Branch held on the 24th April, the following officers were elected:— Sec.-Treas., Newton L. Somers, Box 412, Sault Ste. Marie, Ont; Executive, A. G. Tweedie, J. H. Ryckman (for 2 years), B. E. Barnhill, R. S. McCormick (for 1 year).

Two additional committee-men were also elected from the affiliates, these being Thos. R. Wilkes and F. A. Ritchie.

N. L. Somers reported his attendance at the Legislation Committee, and it was resolved to have a discussion on the draft act as soon as the May issue of *The Journal* was received.

The following short paper on Forest Engineering was read by W. F. V. Atkinson, affiliate member of the Branch:—

The Forester

What is a Forester? The Forester has sometimes been called a *Tree Farmer* and failing a more concise description we will let it go at that. The farmer is a producer, so is the forester. The farmer produces at a low cost or he cannot subsist by his labors. To do this requires a knowledge of his work. The more knowledge he has, and the more use he can made of that knowledge in his work, the better success he is. He needs to know his soil, climate, irrigation, drainage and fertilization; the most suitable grains, roots and other crops, including fruits and fruit trees; their various qualities, productiveness and diseases; methods of preparing for them and harvesting; and, lastly, the available markets and how to get his products to them. In all this work he has to deal with human nature, machinery, transportation, trade and its requirements. If he is an idealist he can also grow for his personal use and satisfaction some things not necessarily marketable.

The general lines are somewhat parallel to forestry, but forestry is not, as is frequently supposed, confined to arbor culture or even to silviculture. A forester though often an idealist has from his training been taught that values are the final test whether these are present or future. His whole training has been the apportioning of these values correctly, allotting to each subject its proper place in the scale and expressing these in dollars and cents. For the purposes of this sketch it is not necessary to go into the training and studies required by a forester at the university, but rather to deal with his general work.

A forester is likely to specialize along certain lines and there is plenty of room for such work. Investigations and research are never really absent from his mind although he may be employed most of his time in one district and in dealing with a limited number of tree species and conditions.

Again, he may attain to a position where details must be delegated to assistants, and special conditions to those whom, as I have said, have specialized on these particular points, such as tree diseases and pests, fungi, insects, etc. This brings us to the protection of the forest under his charge, which must be attended to and for which almost continual inspection is necessary, including, amongst other things, protection against man, adverse possession, forest fires, wasteful methods, etc.; against animals grazing and pasturing in some places, and against other mammals, destructive and useful; against insects affecting the trunk and bark, twigs and seeds, leaves, etc.; and against fungi, which like the insects, breed upon waste and dying species; and against erosion, shifting sands, noxious fumes, waters and drainage. There is quite a little scope in these matters alone. Birds are wholly useful.

The chief object of his work is to produce the woods required by trade at the least cost and to continue to do so. Some of the woods now in demand were of little or no market value years ago and some which are at present of no market value will undoubtedly be of value in the future. Thus, the history of forestry, including the wood trade, is essential. The first work required in the practice of his profession is to locate the various species of trees in the district placed under his charge, to learn how these are producing wood and the conditions affecting this production. This necessitates surveys of land, including topography, and of soil. He must also keep climatic records; hence the necessity for accurate history and current records of meteorological conditions. Type maps showing the production of certain species and their inter-relationship is a second step. The availability of woods required relative to the means of transportation, such as roads, streams and railroads, and the respective cost of each method is part of this study. He must also study how to eventually harvest those trees which are not, under present conditions, in situations commercially available. A course in logging practice in the woods, which can only be acquired by personal experience in the actual work both in the camps and on the rivers, is necessary. If the local conditions should necessitate a change of methods when his work takes him elsewhere, his experience and training will most likely enable him after close observation to recommend improvements in road making, tools and camp paraphernalia generally, all tending towards the most economical methods. Thus, logging engineering is one line of a forestry training and includes a certain class of railroad construction, steam and cable hauls in some parts of the country, road and bridge building, as well as the more primitive methods. Stream flow control and improvement, for which actual experience in river driving is necessary, is a further part of this work. The various methods employed in logging, from the tree to the mills, differ in each locality. Custom and the methods employed for many years are retained with a wonderful tenacity by the workman, and new ideas take a long time to appeal to those who are really skilled in local methods. I have seen suggestions made ineffective time and time again, and later, when adopted, become as much the logger's creed as their former methods were.

But if the administrative position is the forester's lot, he will have to leave this most fascinating part of the work for the larger idea. The engagement, control and supply of logging gangs is not the object of his training, but he can assist this work by tactful co-operation with the superintendents and foremen. He should know that the logging outlay is proportionate to the quantity of wood to be produced in each operation and, amongst other matters, that the cost of buildings, and particularly roads and bridges, are proportionate to the required tonnage, both immediate and future. I believe that a great change will be made before many years in the methods of control and direction of logging operations.

One of the forester's first duties is to know if the demand for certain species will be regular and continuous, and whether this demand is not for such quantities and dimensions as are inimical to the best results from the available source of production, that is to say, the forest under his charge, and what percent of loss is entailed in producing the specified timber, in the forest, in transportation, and in the manufacture. This entails inspection at all stages and places of the work.

Measurements at all points therefore are of interest and these are not only of bulk, board measure, cubic feet, cords, or otherwise but also of the weight of the material.

If the demand is fixed as to quantity and quality and defined as to species, then, from his type maps and topography, growth studies and volume tables, he can fix working plans of the areas and for the required quantities, with regulations as to selection methods in sizes and species. The plan of a total clean-up (clear cut) is not usual in this country and thus like other drastic methods must be undertaken only when the whole forest policy is fixed, including tenure, dues, rents, taxes, interest rates and prospective costs at all stages, etc.

If the annual demand is not greater than the area can produce under accelerated and improved growth conditions, he can fix upon rotation cuttings of the required timber; growth increment in untouched forests is not often greater than the natural losses. A rotation of cuttings, under the present conditions in this country, is not a fully accepted idea by the timber owners but it is the ideal, and it is the method accepted in countries where foresters are considered a necessity. Where the cuttings must be annual, as is usual in Canada, and the production required is large, timber areas must be extremely large to establish a rotation, and the protection and assistance to the immature crop becomes an important branch of the work, in this respect, drainage, light by thinnings and protection from fire are amongst the larger issues. On these points many interesting facts which have been noted would surprise the non-technical observer.

Again, the immature crop can be augmented by judicious planting, making a greater yield per acre and per mile of haul. This should only be done for commercial purposes where the soil is suitable and the logging inexpensive. Further, there is the method of acquiring really suitable ground for a new forest of the required species, laying it out in roads and sections for the purposes of cheap logging, and afterwards planting it with the most suitable species, in point of growth rapidity, of the wood required for the purposes in view. Seeding in the forest for this purpose is not sufficiently certain or rapid to be satisfactory.

The introduction and use of new kinds of wood in the different trades is another line of investigation. Our forest products laboratories have helped the forest administration very greatly in this respect. This work is also a line of specialization.

From these remarks it will be seen that forestry opens many avenues for work and study; that it aims like the farmer to produce material required for the use of man. The number of cubic feet of wood used (per capita) is increasing continually. The exact quantity, however, is hard to estimate in a country, like this, which exports large quantities of the manufactured products of the forest and where waste, owing to ignorance of the rapidly diminishing supply, is so great.

The forester is continually in touch with the civil engineer, as these few remarks show, and from his work and accumulated data has special advantages in regulating the waters in the rivers draining his districts, which rivers supply not only the means of transport for such woods as will float, but also supply the power where his 'Civil' confrere has constructed his mills or power-house. The maintenance or change of forest cover are no small factors in stream control. A great deal of the information acquired by the forest engineer should be of use to civil engineers, undertaking new developments, and will generally be found minutely and carefully charted, such as curves for tree growth, volume tables, etc. Speaking for the profession, I may say that co-operation, lucidity and professional etiquette are points on which all foresters are united.

Calgary Branch

C. M. Arnold, M.E.I.C., Sec'y.-Treas.

Minutes of a meeting held in the Board of Trade Rooms on the evening of March 21st, 1919.

The meeting was preceded by a talk given by Brigadier-General McDonald, a member of the Branch, touching upon the work of the Engineers during the war, as seen from the viewpoint of the *fighting man*, his work being with the infantry and with any engineering branch of The Service.

About thirty-five members and friends attended the meeting and, incidentally, Major Muckleston, M.E.I.C., was given a hearty welcome upon his return from overseas.

After the address the business meeting was called to order by A. S. Dawson, A.M.E.I.C., in the absence of G. W. Craig, M.E.I.C., and the secretary read the minutes of the last executive committee meeting, which were adopted upon the motion of A. S. Chapman, A.M.E.I.C., seconded by F. H. Peters, M.E.I.C.

The secretary read the report of the committee appointed to consider the movement introduced by A. G. Dalzell, A.M.E.I.C., of Vancouver, at the last general meeting, and also letter received from the Secretary of *The Institute* on the same matter.

The report which recommended that no action be taken by this Branch as a body was adopted on the motion of M. H. Marshall, M.E.I.C., seconded by B. L. Thorne, M.E.I.C.

In the course of the discussion, the reading of a letter from Secretary Keith brought out the fact that a Bill was to be introduced into the Dominion Parliament this session providing for more adequate remuneration for engineers employed in the service of the Government.

F. H. Peters, M.E.I.C., moved that the Secretary get into communication with the local members of Parliament, and that a wire be sent asking for their support of this measure. Seconded by G. N. Houston, M.E.I.C. Carried.

The meeting adjourned at 10.30 p.m.

* * *

Minutes of a meeting of the Executive Committee in the office of the secretary at 5 P.M., April 14th, 1919.

Present:—Messrs. Craig, Thorne, Dawson, Chapman and the secretary.

The minutes of the general meeting held March 21st were read and approved.

Communications:

Letters from Sec'y Keith and the Edmonton Branch re Summer Meeting. From Sec'y Keith re matter of securing increased salaries for engineers in Government employ. Wire and letter from secretary,Calgary Branch to our Calgary Members of Parliament and to Dr. Thompson sent under instructions of resolution of general meeting of March 21st, were read as well as replies from them acknowledging receipt of same. Letter from Sec'y Keith re employment of returned men who are engineers. It was considered that for the present the secretary do all in his power to aid such men in giving them information, etc. Letter from Mr. Goldman of Toronto Branch re matter of engineering fees and salaries: it was thought that the Sec'y should indicate to Mr. Goldman that Calgary Branch thought that after his Committee had formulated something along this line the Calgary Branch could then take it up and get out schedule of fees and salaries consistent with our conditions in this province. Letter from Sec'y Keith re standard stationery enclosing samples: Secretary stated that Branches would be supplied with stock of letter heads: decided to ask for 1000 letter heads as per sample of Montreal Branch.

It was decided to concur in suggestions of Mr. Gibb re summer meeting except for Calgary Branch taking entire charge of Papers Committee. It was thought control of Papers Committee should be in Edmonton though we would co-operate in every way possible.

Suggested that discussion on Concrete be continued and it was thought that we could again get the attendance of Mr. Williams and Prof. Abrams at the meeting.

Mr. Dawson mentioned the meeting, with Alberta Government, to take up question of good roads. Messrs. Thorne, Dawson and Craig were appointed to represent the Branch at this meeting.

The meeting adjourned at 6.15 P.M.

PERSONALS

E. A. Crawley, B.A.,A.M.E.I.C., who has been overseas as Lieutenant in a Pioneer Battalion, has recently returned to Canada, and has taken up his residence in Wolfville, N.S.

Major William T. McFarlane, Jr. E.I.C., of the Canadian Engineers returned to Canada in April last, and is now employed in the Reclamation Service, Department of the Interior, Ottawa.

M. B. Watson, B.A.Sc., A.M.E.I.C., has resigned his position with the Department of Highways, and has accepted the appointment of Director of Engineering, Central Technical School, Toronto.

Lieut.-Col. H. F. Meurling, D.S.O., M.C., Croix de Guerre, M.E.I.C., has recently returned from overseas on the R.M.S. Scotian. Colonel Meurling went overseas as a Lieutenant in 1915.

Robert H. Harcourt, A.M.E.I.C., has returned to Canada recently from overseas. Mr. Harcourt enlisted in September 1914, and served as Lieutenant with a Divisional Ammunition Column. He has now been appointed Assistant Engineer, Welland Ship Canal.

Leslie S. MacDonald, B.Sc., S.E.I.C., who went Overseas with the P.P.C.L.I., has recently returned and expects to take up his residence in Edmonton. Mr. MacDonald served two years with the P.P.C.L.I. and was later transferred to the R.A.F.

H. A. Dixon, B.A.Sc., O.L.S., M.L.S., A.M.E.I.C., has been appointed chief engineer, western lines, Canadian National Railways, to succeed the late A. T. Fraser, A.M.E.I.C., who was recently killed in a snow slide at Mount Robson. Mr. Dixon was formerly district engineer of the Pacific District with offices at Vancouver.

E. G. Horne, A.M.E.I.C., who for a number of years was a member of the firm of Grant & Horne, engineers and contractors, St. John, N.B., has severed his connection with the firm and will, on July 1st, take over the entire management of Lockwood & Green Company of Canada.

W. B. Hutchison, Jr. E.I.C., Lieut. Canadian Engineers, has returned from overseas after spending eighteen months in Germany as a prisoner of war. Mr. Hutchison has been appointed Inspection Engineer, Department of the Interior, Irrigation Branch, Calgary, with which Branch he was associated before going overseas.

James Fergusson, A.M.E.I.C., whose home is in Perthshire, Scotland, and who has been overseas for the past four years, returned on April 10th, to Canada. Mr. Fergusson went overseas as Sergeant, and was later promoted Lieutenant. He is resuming engineering work with the Engineering Staff of the Canadian National Railways, Montreal.

Major John R. Grant, M.C., M.E.I.C., returned to Canada on the S.S. Corsican, arriving in St. John on April 25th. Major Grant, whose home is in Vancouver, went Overseas in the early days of the War and during the big push of 1918 was O.C. 2nd Field Company Royal Engineers. On May 17th 1918, at the Chemin des Dames, the Germans broke through and he was one of the many thousands taken prisoner at that time. He was a prisoner of war till the Armistice was signed. He proposes returning to Vancouver to resume his engineering practice.

Professor R. F. Faulkner, M.E.I.C., of the Nova Scotia Technical College has accepted the secretaryship of the Halifax Branch of *The Institute*, owing to the resignation of K. H. Smith, A.M.E.I.C., whose present activities require his prolonged absence from the city. Mr. Smith was one of the active organizers of the Halifax Branch and much of its success is due to his untiring efforts. In his successor, Professor Faulkner, the Branch has a secretary who has already shown his interest in the profession in a tangible manner. Through his influence seventy-five per cent of the 1918 graduating class of the Nova Scotia Technical College have joined *The Institute*, while of the 1917 class every one has applied for membership.

Lt.-Col. H. J. Lamb, D.S.O., M.E.I.C., who before the War was Engineer of Public Works at Windsor, Ontario, returned to this country on the S.S. Minnedosa on April 17th, after a distinguished career at the Front. Col. Lamb volunteered for the Expeditionary Force on August 10th 1914, and joined at Valcartier Camp on the 21st August. Going to France with the 1st Contingent, Col. Lamb served as General Staff Officer of the 1st Canadian Division until March 1917, when he was invalided to England. In August 1916, he was awarded the D.S.O., and in January and April 1917 mentioned in despatches. On September 19th he was seconded to the War Office under the Director of Fortifications and Works in the Aviation Department, and later was appointed Deputy Assistant Director in this Department. In January 1918 he was made Staff Officer, 1st grade, and Assistant Director of Works and Buildings, Air Ministry. In October he was appointed Commander Royal Engineers under Major General Twing, D.F.W., on the construction of the American Rest Camp, Knotty Ash, Liverpool, which provided for fifteen hundred men, with a hospital for twenty-five men.

E. R. Marien, S.E.I.C., of the Quebec Branch of *The Institute*, has recently been appointed Commissioner of Industries for the City of Quebec.

Mr. Marien was born the seventeenth of February, 1893. After having taken a commercial course at the Mont St. Louis College, classics at the Montreal College and philosophy at the Seminary, he entered the Laval Polytechnic School from which he graduated in 1916, with the degree of B.A.Sc. in the Department of Civil Engineering. After graduation, Mr. Marien was employed on the testing of materials by the Montreal Western Division of the Imperial Ministry of Munitions, and, in 1917, when all the laboratories in the Montreal district were transferred to McGill University, Mr. Marien had charge of tests.

E. R. MARIEN, S.E.I.C.

On January 22nd, last, Mr. Marien was called by the Quebec Board of Trade to co-operate with them in the industrial progress of the city.

This appointment of a highly educated professional engineer proves the growing recognition of the services of the engineer to the community, and reflects credit upon those responsible for his appointment.

* * *

OBITUARY

Ernest Marceau, B.A.Sc. M.E.I.C.

Engineers throughout Canada will regret to learn of the death of Ernest Marceau, Treasurer of *The Institute*, on Friday, May 23rd. Mr. Marceau has been President, Vice-President and Member of Council. Memoir of his career will appear in the next issue of *The Journal*.

EMPLOYMENT BUREAU

Situations Vacant

The Civil Service Commission of Canada hereby gives public notice that applications will be received from persons qualified to fill the following positions in the Civil Service of Canada:—

A Motion Picture Photographer, Salary $2,600 per annum.

1. A Motion Picture Photographer for the Exhibits and Publicity Bureau, Department of Trade and Commerce, at an initial salary of $2,600 per annum. Applicants must have had experience in laboratory and motion studio work on photoplay production.

A Chemist, Department of Mines, Salary $2,100 per Annum.

2. A Chemist for the Explosives Division, Department of Mines, at an initial salary of $2,100 per annum. Candidates must be graduates of some recognized university and must have specialized in Chemistry. They must have had subsequent practical experience in the testing of explosives and if possible, also in inspection work.

A Male Clerk, Department of Trade and Commerce, Salary $1,600 per annum.

3. A Male Clerk for the staff of the Trade Mark and Copyright Branch, Department of Trade and Commerce, at a salary of $1,600 per annum. Candidates should have ability to supervise the work of clerks and give ordinary information to the public, ability to acquire facility in examining indexes and registers, to pass applications and keep registrations indexed. A knowledge of both languages is desirable.

Assistant Chemist, Dept. of Trade and Commerce, Salary $1,300 to $1,400 per Annum.

4. An Assistant Chemist for the Dominion Grain Research Laboratory at Winnipeg, Department of Trade and Commerce, at a salary of $1,300 to $1,400 per annum. Applicants must have education equivalent to graduation in Science from a recognized university, with special training in qualitative and quantative chemical analysis, and a through knowledge of general organic and inorganic chemistry. They must have had experience in chemical analysis, preferably in a commercial laboratory. They must be in good physical condition and not more than 25 years of age. Preference will be given to residents of Manitoba.

Bookkeeper, Department of Indian Affairs, Salary $1,400 per Annum.

5. A Bookkeeper in the Office of the Commissioner for Greater Production on India Reserves in Manitoba, Saskatchewan and Alberta, Department of Indian Affairs, at a salary of $1,400 per annum; the office to be located at Regina. In connection with this position a written examination will be held on June the 12th in Bookkeeping, Commercial Arithmetic and Typewriting. Penmanship and neatness will be considered in connection with the paper in bookkeeping. Applicants must be residents of Manitoba, Saskatchewan or Alberta; they must be between the ages of 18 and 35, except in the case of returned soldiers. A fee of $8.00 will be required from all condidates who are not returned soldiers. Candidates will be notified later of examination centres.

Application forms properly filled in, must be filed in the Office of the Civil Service Commission for positions numbers 1, 2, 3 and 5 not later than May the 27th and for position number 4 not later than June the 10th. Application forms may be obtained from the Dominion-Provincial Employment Offices, or the Secretary of the Civil Service Commission, Ottawa.

By order of the Commission,
W. Foran,
Secretary.

Ottawa, May 1, 1919.

* . * *

The Civil Service Commission of Canada hereby give public notice that applications will be received from persons qualified to fill the following positions in the Civil Service of Canada:—

A Petroleum Engineer, Department of Interior, salary $2,700

1. A Petroleum Engineer for the Mining Lands and Yukon Branch of the Department of the Interior with headquarters in Alberta, at a salary of $2,700 per annum. Candidates must be graduates in Applied Science of a recognized university. They must have had at least 3 years' experience in the study of the geological structure and in the practical development of petroleum and natural gas deposits in the Provinces of Saskatchewan and Alberta. They must have a thorough knowledge of the technology of well-drilling and must be competent to assume responsible charge of and direct the same.

An Officer for Poultry Div., Dept. of Agric., in N.B., Salary $1,800

2. A Representative of the Poultry Division, in the Province of New Brunswick, Live Stock Branch, Department of Agriculture, at a salary of $1,800 per annum. Candidates should be, preferably, graduates of a recognized agricultural college. They should have proven in the past, in Government or private work, ability to organize. They must have practical knowledge of poultry, which will enable them to lecture and demonstrate. They should have the education necessary to prepare news articles and handle the general work of an office.

An Asst. in Cereal Div., at Exp. Farm, Ottawa, Salary $1,700 per annum

3. An Assistant in the Cereal Division at the Experimental Farm at Ottawa; Department of Agriculture, at an initial salary of $1,700 per annum, Grade D of the First Division. Applicants must be graduates of an Agricultural College and must have had special training in regard to cereals. A good knowledge of English and at least a reading knowledge of French are essential.

An Asst. to Superintendent of Exp. Station at Fredericton, Salary $1,400

4. An Assistant to the Superintendent of the Experimental Station at Fredericton, N.B., Department of Agriculture, at a salary of $1,400 per annum. Applicants should be graduates of a recognized Agricultural College.

Assistant Chemist, Dept. Trade and Commerce, Salary $1,300 to $1,400

5. An Assistant Chemist for the Dominion Grain Research Laboratory at Winnipeg, Department of Trade and Commerce, at a salary of $1,300 to $1,400 per annum. Applicants must have education equivalent to graduation in Science from a recognized university, with special training in qualitative and quantitative chemical analysis, and a thorough knowledge of general organic and inorganic chemistry. They must have had experience in chemical analysis, preferably in a commercial laboratory. They must be in good physical condition and not more than 25 years of age.

Selections for eligible lists of applicants qualified to fill similar vacancies which may occur in future may be made from applications for these positions.

Acording to law, preference is given to returned soldier applicants, possessing the minimum qualifications. Return soldier applicants should furnish a certified copy of their discharge certificate.

In the case of positions numbers 1, 2, 4 and 5 preference will be given to residents of the provinces 'n which the vacancies occur.

Application forms, properly filled in, must be filed in the office of the Civil Service Commission not later than June the 10th. Application forms may be obtained from the Dominion-Provincial Employment Offices, or the Secretary of the Civil Service Commission, Ottawa.

By order of the Commission,
Wm. Foran,
Secretary.

Ottawa, May 8th, 1919.

Appointment in Civil Engineering.

The Board of Governors will proceed shortly to appoint a Professor of Civil Engineering to take charge of the department. Initial salary, $3,500. Applications, accompanied by full statement of training and experience, and ten copies of testimonials, will be received up to July 15th, 1919, by

The Secretary,
Board of Governors,
University of Manitoba,
Winnipeg, Canada.

Electrical Engineer.

Operating and construction engineering position for electrical engineer. Salary from $3,00 to $3,600 a year. Box No. 37.

Electrical Engineer—Temporary.

Temporary position for about six months for an electrical engineer. Salary from $200. to $250 a month. Box No. 38.

Engineering Salesman.

Engineer required to manage branch office of engineering concern. Must have had some practical engineering experience, be a good mixer, of pleasing appearance, a man of balance and good judgment, possessing the essential qualifications necessary for a good engineering salesman. He will be responsible for making reports and designs and other operations connected with the engineering staff. Salary depending upon qualifications. Box 39.

Situations Wanted

Civil Engineer.

Civil engineer, age thirty-seven, graduate R.M.C., with experience in surveying, railroad location and railway engineering, is anxious to secure a position in charge of survey work or resident engineer on construction. Box No. 3 P.

Engineer.

Engineer – lately in charge of inspection of steel for munitions for period of four years. Fourteen years previous experience on railway, dock and other engineering and inspection work. Box 2 P.

* * *

Manufacture of Milling Cutters

The use of high-speed tools has almost become general practice, but the carbon steel cutter still has its uses, such as for the cutting of fibre, which can be done better with a tool of carbon steel, than with one of high-speed steel.

The blanks are first cut off to length in specially designed slow speed band saws. The saws leave a comparatively square face and the wastage of metal in the cut is small owing to the use of the thinnest type of paring-off tool. If there is any fear of seams or laminations in the metal, the stock may be turned before the cutting off operation, to give the inspector an opportunity to reject the bar before much labor has been expended upon it.

After cutting off and turning, the blanks are chucked in an ordinary four-jaw chuck on a rigid-type engine lathe, and are bored out near to size, with an allowance left on for grinding. If the steel is valuable and the bore large, it may pay to use a hollow mill for the boring, so that the core can be saved and used for a smaller tool.

The blanks are then mounted on arbors and faced; small blanks are ground, several together, on the magnetic chuck of the surface grinder, which may be either of the vertical or horizontal type. They are then set up on the universal milling machines and the teeth cut. Several blanks may be mounted on one arbor and cut together. Afterwards the side teeth are cut, the blanks being mounted on a special indexing fixture on a plain milling machine for the purpose.

The special cutters required in gun, rifle and sewing machine manufacture are also made in the above-described way, but the backing-off of these irregular contour cutters presents considerable difficulty. By means of cams on the backing-off machine or lathe, the cutting tool is fed inwards as the blank slowly revolves, and as the end of each tool is reached the cutting tool springs back to its original position. The cutters are next hardened and tempered, which is the most important operation of all, and one to which the greatest consideration should be given. After hardening the cutters are sand-blasted and finish-ground.

A factory equipped for milling cutters should provide facilities for the final inspection of the cutters, including testing for hardness. (Jacobs, Iron Trades Review.)

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* For 1919 † For1919-20 ‡For 1919-20-21

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KINGSTON
Activities discontinued until the close of the war.

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D. O. LEWIS
R. W. MacINTYRE

Preliminary Notice of Application for Admission and for Transfer

20th May, 1919.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in July, 1919.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ANDERSON—JOHN NOEL, (Lieut.) of Vancouver, B.C. Born at Glasgow, Scot., Dec. 25th, 1884. Educ., Royal Tech. Coll., Glasgow. 1903-05, pupilage with Chas. D. Barker, contractor engr.; 1905-11, asst. engr., Caledonian Ry. Co.; dsgn., constrn. and maintenance, etc.; 1911-16, asst. engr., Vancouver; 1916-19, on active service as lieut., 9th Batt. Can. Ry. Troops, at present pending release.

References: C. Brakenridge, A. G. Dalzell, P. Phillip, F. S. Easton, F. L. MacPherson, W. H. Powell, C. E. Cooper, J. W. Blackman.

BERESFORD—GEORGE WILFRID, of Ottawa, Ont. Born in India, Aug. 15th, 1888. Educ., Christs Hospital, London, 1898-1905. 1907-10, rodman, etc., C.P.R.; 1910 (6 mos.) leveller, with A. H. N. Bruce; 1910 (4 mos.) in chg. of survey, G.T.R.; 1910-11, asst. with Prof. C. Harris on survey; 1911-13, res. engr., on Que. & Sag. Ry.; 1913-14, in chg. of location, M. & O. Elec. Ry.; 1914-15, in chg. of constrn. on Erie & Ont. Ry.; at present officer in C. E. F.

References: G. A. Mountain, J. B. McRae, R. F. H. Bruce, T. L. Simmons, A. A. Belanger, R. L. Latham.

BIGWOOD—HORACE MALCOLM, of Victoria, B.C. Born at Wolverhampton, England, Dec. 25th, 1883: Educ. higher grade sch. Wolverhampton, science & arts exam. mach. constr. drawing; 1899-1903 apprenticed going through all depts. Wellington Engr. & Foundry Co. Wolverhampton; 1903-05 asst. res. engr. during erection, etc. of Mond Gas Co. South Staffordshire; 1905-10 asst. works mgr. same company; 1911 drfts'man, Bullens, Esquimalt, B.C.; 1912-16 asst. engr. city engr's dept. Victoria, B.C., engaged on roads, sewers & survers & surveys; estimates designs & survey for original North West sewer scheme, tidal currents off Victoria harbour, etc.; 1912-13 instructor for class in mach. drawing for Y.M.C.A. evening classes; 1916 inlisted as sapper; 1916-to date Lieut. Can. engineers, C.E.F.

References: R. W. Macintyre, A. O'Meara, J. B. Holdcroft, F. C. Gamble, A. E. Foreman, E.G. Marriott, A. F. Mitchell, W. M. Stokes.

BLOCK—JESSE FRANKLIN, of Calgary, Alta. Born at St. Cloud, Minn., Jan. 30th, 1885. Educ., B.S.A., Univ. of Alta. 1918. 1913-18, agricultural eng. (chiefly investigation); Apr. 1918 to date, asst. to ch. agric. engr., Dept. of Interior, Calgary; also served as non-com. officer in No. 10 Eogrs. & Ry. Constru. Corps.

References: V. M. Meek, F. H. Peters, M. H. Marshall, N. A. Pearson, C. M. Arnold.

BRADLEY—CLAUDE, of Calgary, Alta. Born at Bradford, England, Oct. 10th, 1886. Educ. Western coll. Harrowgate, Eng. 1902-05, pupil with J. C. Clark, architect and surveyor; 1905-08, eng. dept. Bradford Byers Ass'n, work including dfting for bldgs, etc.; 1908-11, eng. Bleacher Ass'n Ltd., Manchester, Eng. preparation of specifications, supervision of constrn., surveying, etc.; 1913-17, ch. dfts'man. townsite-branch, Dept. of Nat. Resources, C.P.R.; May 1917 to date asst. surveyor, ch. of party laying out new townsites, etc.

References: D. T. Townsend, C. M. Arnold, W. Pearce, B. L. Thorne, J. B. Riddall.

BURBANK—MAURICE A., of Winnipeg, Man. Born at Yarmouth, Maine, U.S.A., Oct. 24th, 1879. Educ. Univ. of Vermont, 3 yrs.; 1 yr. rodman Mich. Cent. Rly.; instrument man & res. engr. Mich. Cent. rly., 2 yrs.; 13 yrs. res. engr., asst. engr., dist. engr., & office engr. G.T.P.Ry.; on location and constrn., later in chg. of all survey work; 2 yrs. on gen. rly. work in France as ch. engr., 4th Bn. Can. Ry. Troops.

References: J. A. Heaman, G. C. Dunn, W. E. Davis, R. P. Graves, J. G. Legrand, R. W. Ross, W. H. Tobey.

CAMPBELL—HAROLD MONTGOMERY, of St. Catherines, Ont. Born at St. Catherines, Dec. 17th, 1891. Educ. B. A. Sc. (honors) mech. eng. Toronto univ. 1914; 1910-11 (5 mos.) Crocker Wheeler Shops; 1911-12 (5 mos.) with Packard Elec. Co.; 1912-13 (5 mos.) on lock foundation tests; 1913 (5 mos.) in head office; 1914 mech dftsman, Welland Ship Canal; since Oct. 1914 on active service with 2nd Div. Cavalry.

References: W. H. Sullivau, J. L. Weller, R. W. Leonard, A. J. Grant E. P. Johnson, R. W. Angus.

CAMPBELL—WALTER ROY, of Campbellton, N.B. Born at Moncton, N.B., July 6th, 1882. Educ., high school, partial course RR eng., I.C.S. 1902-13, with I. C. Ry., Moncton, N.B., as follows:—1902-07, rodman, etc.; 1907-12, dftsman; 1912-13, asst. to engr. of maintenance; Sept. 1913 to date with C. N. Rys., as first asst. to res. engr., Campbellton.

References: R. A. Black, C. B. Brown, R. H. Emmerson, A. R. MacGowan, J. Edington, G. E. Martin, W. R. Devenish, A. G. Tapley.

CROMBIE—WILLIAM BRADSHAW, of Niagara Falls, Ont. Born at Picton, Ont., Sept. 30th, 1886. Educ., Rothesay Coll. School. 1907-08, rodman, T. & N. O. Ry.; 1909, transitman, O. L. S., Sutcliffe & Neelands; 1909-10, topographer; 1910-11, with C. P. R., western lines; 1911-12, res. engr., C. P. R.; 1912-13, transitman, T. & N. O. Ry.; 1913-14, res. engr., Viele, Blackwell & Buck, N.Y., in connection with Northern Canada Power Co., storage dams and plants; 1915, transitman, Toronto Civic Transportation Committee; 1915-18, in chg. of contour survey, Sutcliffe & Neelands; 1918 (7 mos.) in chg. of contour survey, Viele, Blackwell & Buck; at present, inst'man, hydro Elec. Power Development, Chippawa Creek.

References: F. F. Busteed, G. F. Cairnie, S. B. Clement, C. S. Moss, G. Stead, H. P. Rust, W. A. James, H. W. Sutcliffe.

DAWSON—FRANCIS MURRAY, (Capt., M.C.), of Westmount, Que. Born at Truro, N.S., Sept. 3rd, 1889. Educ., B.Sc. (C.E.) N.S. Tech. Coll. 1910, M.C.E., Cornell Univ., 1913, 2 yrs. lecturer in C.E., at N.S. Tech. Coll. 1906-07, rodman, etc. with I.C.Ry., also timekeeper on constrn.; 1908 (5 mos.) bookkeeper and mgr. with Stewart Bros., contractors; 1909 (5 mos.) in chg. of geological surveys of gypsum deposits in N.S.; 1910 (4 mos.) land surveying in B.C., in chg. of party; 1911 (4 mos.) in dsgn. office of Dom. Bridge Co.; 1912-13, installed hydraulic laboratory and testing laboratory at N.S. Tech. Coll.; 1913, special investigations of timber bridges and bridge surveys; 1913-15, asst. engr., in chg. laying out work on Halifax Ocean Terminals; Feb. 1915 to Apr. 1919, on active service as follows:— 1915-1918, lieut., 40th Batt.; 1916, promoted to Capt., Can. Engrs., mentioned in despatches and awarded M.C., at present member of firm Monks, Mauhard & Dawson, engrs. agents and contractors, Montreal.

Rerefences: A. C. Brown, J. McGregor, F. W. W. Doane, J. L. Allan, J. W. Roland, F. W. Cowie, F. J. Dawson.

FRANZEN—JOHN LEVERN, of Medicine Hat, Alta. Born at Radcliff, Iowa, Dec. 29th, 1884. Educ. B.Sc. (C.E.) Washington State coll. 1910; 1910-11, with U.S. Reclamation service as transitman on gen. constrn.; 1911 (4 mos.) ch. of party on constrn.; 1913 (6 mos.) inspector of materials and contrn., Naches Power Canal; 1913-17 with Southern Alberta Land Co. as follows:—2 mos., transitman on main canal location; 1913-14 res. engr. on constrn.; 3 mos., in responsible chg. of div'n.; 1914-17, res. engr., and office work; June 1917 to date, div. engr. work including constrn of canals, dams, etc., Canada Land & Irrigation Co.

Rerefences: D. W. Hays, S. Porter, F. H. Peters, G. N. Houston, C. M. Arnold.

HUGHSON—THOMAS LEO, of Niagara Falls, Ont. Born at Niagara Falls, Ont. Jan. 26th, 1891. Educ. B.Sc. (Civil) Queen's Univ. 1916; 1909-11, construction office, Ont. Power Co.; Summers 1912-15 asst. city engr. Niagara Falls, Ont.; 1914-15 field party Salmon River Power Co., Altmar, N.Y., 1916-17, Asst. supt. in Field Turner Construction Co. New York; 1917-1919, overseas; Jan. 1919 to date, Hydro-Elec. Power Comm. Constrn. Dept.

References: L. Malcolm, T. H. Hogg, W. Jackson, G. F. Hanning, A. Macphail, A. D. Huether, J. H. Jackson.

JANSSEN—WALTER A., of Montreal. Born at Davenport, Iowa, July 1885. Educ., B.S., Ch. E. Univ. of Wisconsin, 1907. 1903-08, in drafting room, Bettendorf Col., Davenport, Iowa; 1908-17, ch. chemist and metallurgist, asst. supt. steel foundry, supt. of constrn., etc., Bettendorf Co.; 1917 to date, operating manager, Can. Steel Foundries, Ltd.

References: W. S. Atwood, K. W. Blackwell, W. F. Angus, H. H. Vaughan, M. J. Butler.

JOHNSTON—SECOR WINSLOW, of Niagara Falls, Ont. Born at Scarboro, Ont., May 4th, 1886. Educ. I.C.S., 1907, county drainage work; 1907-08 and 1913 on high tension power line location and constrn.; 1913-14 inst'man on storage surveys, etc., Hydro-Elec. Power Comm.; 1914 (6 mos.) in chg. of field party on Niagara Development; 1914-15 in chg. of survey in vicinity of Jordan, Ont.; Mar. 1915 to date, in chg. of party on surveys, Niagara Development, Hydro-Elec. Power Comm.

References: J. B. Goodwin, A. C. D. Blanchard, H. L. Bucke, T. H. Hogg, H. G. Acres, F. N. Rutherford.

KENNEDY—FRANK W., of Niagara Falls, Ont. Born at Parry Sound, Ont., Dec. 1st, 1885. Educ., high school and matric. 1906-08, rodman, timekeeper, pile inspector, etc., C.N.R.; 1909, concrete inspector, N.T.C.Ry.; 1910-12, inst'man on constrn. 1912, res. engr., C.N.R.; 1913, inst'man on location, C.P.R.; 1913-14, res. engr. C.P.R., double track work; 1914, inst'man on location, I.C.Ry.; 1915-16, ballast pit foreman, Victoria Constrn. Co.; 1916, with Can. Inspection Co.; 1916 (6 mos.) cost accountant, Welland Ship Canal; Jan. 1917 to date, inst'man, Hydro Elec. Power Comm., Chippawa Development.

References: A. C. D. Blanchard, H. L. Bucke, J. R. MacKenzie, H. T. Hazen, H. M. Belfour, H. G. Acres, J. B. Goodwin.

LAMB—JONH MURRAY McCORDICK, of St. John, N.B. Born at Perrys Point, N.B., Mar. 23rd, 1893; Educ. 3 yrs. (engr.) univ. of N.B. 1909-12; 1912 (8 mos.) as rodman & topographer St. John & Que. Rly.; 1913, asst. engr. D.P.W. harbour development at Courtenay Bay; 1915 with C.E.F.; engr. officer, for 1st Can. Training Brigade, Shorncliff; 1917 to date temporarily employed as works officer for N.B. under the Can. Engrs.

References: C. M. Steeves, A. R. Crookshank, F. B. Tapley, A. R. Sprenger, W. C. Ewing, A. B. Blanchard.

LOWRY—GEORGE HAROLD, of Niagara Falls, Ont. Born at Leeswater, Ont., Jan. 16th, 1885. Educ., high school, special studies. 1906 (6 mos.) and 1907-08, rodman on constrn., G.T.Ry.; 1908 (5 mos.) inst'man on rly. constrn., G.T.P.; 1908 (3 mos.) res. engr., on rly. constrn., G.T.P.; 1909 (4 mos.) asst. on topog. surveys, Ont. Bureau of Mines; 1909 (3 mos.) asst. on survey of mining claims; 1912-13, transitman on subdiv. of Leaside township, C.N.R.; (3 mos.) inst' work, right of way dept., C.N.R.; 1913-16, ch. of party in chg. of prelim. location for rly. dept. Hydro Elec. Power Comm.; 1916-17, in chg. of party prelim. survey, Niagara Power Development; June 1917 to date, res. engr., Hydro Elec. Power Comm.

References: H. G. Acres, J. B. Goodwin, W. R. Rogers, A. C. D. Blanchard, H. L. Bucke, J. N. Stanley, G. Hanning.

MACKENZIE—WILLIAM JAMES, of Vancouver, B.C. Born at Lucknow, Ont., Oct. 12th, 1882. Educ. 3 yrs. C.E. Michigan Agricultural coll. Summers 1905-06, rodman and instr'man, Copper Range Consol. Mining Coy.; 1907-09 asst. engr. with same firm ,in chg. of underground surveys and surface constrn.; 1910-11, with O.W.R.R. & Nav. Co.; in chg. of surveys and inspection of reinforced concrete retaining wall and bridges, Seattle, Wash.; 1911-14, with C.N.P. Ry. as follows;— 1911-12, dfts'man in ch. engrs. office; 1912 (4 mos.) transitman with location party; 1912-14 in chg. of location party; Aug. 1914-17 on active service, with 3rd. Field Co., Can. Engr., wounded July 1917; Nov. 1918 to date ch. dftsman in ch. engr's office, in chg. of all plans, estimates, etc., C.N.P. Ry.

References: T. H. White, D. O. Lewis. W. G. Swan, H. L. Johnston, S. H. Sykes, H. E. C. Carry.

MACLAURIN—JAMES GLADSTONE, of Sault Ste. Marie, Ont. Born at Lachute, Que., Apr. 19th, 1886. Educ., B.A.Sc., Toronto Univ., 1912. 1905-07, office, rodman, maintenance of way, C.P.R.; 1907 (5 mos.) rodman on rly. constrn., C.P.R.: 1907-09, field dftsman on final location, N.T.C. Ry.; 1910 (3 mos.) transitman in chg. of party, recentering, ballasting and spiralling old curves, C.P.R.; 1911 (3 mos.) in chg. of party, ditching and draining; 1912 (4 mos.) transitman, in chg. of laying out rly. yard; 1912-13, asst. res. engr., E.B. Eddy Co., Hull, Que., on constrn. of pulp mill and power house; 1913-16, asst. engr., in chg. of civil eng. and hydrographic work, water power dept., Algoma Steel Corp.; 1916, mgr. of hydro elec. power plant; 1916-17, mgr., of plant and in chg. of collecting water power data; 1917-18, asst. to power engr. and mgr. of constrn. coy.; July 1918 to date, mgr. ,water power dept., Algoma Steel Corp.

References: J. LeB. Ross, J. S. H. Wurtele, F. F. Griffin, B. E. Barnhill, J. C. Holden.

MACLEAN—CHARLES SALMON, of Halifax, N.S. Born at Chipman, N.B. May 16, 1891; Educ. B.Sc. (Elec. engr.) Univ. of N.B. 1913; B.A. same univ. 1911; 1913-14 in graduate apprentice course, test dept. Can. Gen. Elec. Co.; 3 yrs. machinist, elec. tug-boat engr; 1 yr. sawmill work, etc. with Can. Forestry corps, England; 1916-17 (20 mos.) military service; 1914-15 (4 mos.) with Nor. Light & Power Co., Cobalt, on Elec. operation & maintenance; 1917 to date, instructor at N. S. Tech. Coll., in re-educ. classes. dept. soldier's civil re-estb.

References: J. W. Roland, F. R. Faulkner, J. A. Stiles, F. A. Bowman, L. H. Wheaton.

MALLOCH—EDMUND SENKLER, of Ottawa, Ont. Born at Hamilton, Ont., Oct. 2nd, 1885. Educ., B.Sc., Queen's Univ., 1910; 18 mos. eng. course, Can. Westinghouse Co.; one yr., constrn. foreman, Railway Signal Co.; 3 yrs., shop supt., Gen. Ry. Signal Co., and at present, asst. tech. engr., fuels and fuel testing div., Mines Branch, Ottawa.

References: B. F. C. Haanel, J. Blizard, G. G. Gale, E. Stansfield, L. W. Gill, J. Murphy.

MALLOCK—NORMAN, of Niagara Falls, Ont. Born at Arnprior, Ont., Mar. 4th, 1888. Educ., B.Sc., Queen's Univ., 1912. 1905-07, rodman, etc., C.N.R.; 1907 (3 mos.), prospecting under A. M. Campbell: 1911 (4 mos.) recorder and dftsman. Topographical Survey; 1912 (5 mos.) inst'man in chg. of party, land subdiv., Montgomery & Marrier, Prince Albert, Sask.; 1913-14, asst. dftsman (acting leveller) C.P.R.; 1914-15, inst'man on stadia topog. surveys, Hydro Elec. Power Comm; 1915-17, prelim. surveys for constrn. of Niagara Power Development; June 1917 to date, in office of ch. field engr., compiling and tabulating field reports.

References: T. H. Hogg, H. G. Acres, J. B. Goodwin, A. C. D. Blanchard, H. L. Bucke, F. N. Rutherford, J. C. Moyer.

McANDREW—JOSEPH BENEDICT, of St. Catharines, Ont. Born at St. Catharines, Nov. 13th, 1889. Educ., B.A.Sc., Univ. of Tor. 1912. 1910-11, transitman on prelim. survey, Welland Ship Canal. 1912-16, on Welland Ship Canal, 15 mos., as dftsman., later instr'man on constrn., and 2 yrs in office on dsgn. of steel and concrete structures; Feb. 1916 (16 mos.) with C.E.F., as officer with 7th Can. Ry. Troops, in chg. of narrow and standard gauge rly constrn., at present dsgning engr., Welland Ship Canal.

References: A. J. Grant, W. H. Sullivan, J. L. Weller, E. P. Johnson, F. S. Lazier.

McCOY—LYLE, of Montreal West. Born at Washington, Iowa, Oct. 4th, 1885. Educ., 2½ yrs., Armour Inst. of Tech., Chicago, M., A.S.M.E. 8 yrs., elec. engr. and master mechanic, Bettendorf Co., Davenport, Iowa; 3 yrs., same duties for Can. Car and Can. Steel Foundries, Montreal; at present, in chg. of all new eng. work and maintenance, Can. Car & Foundry Co. and Can. Steel Foundry.

References: K. W. Blackwell, W. S. Atwood, H. B. R. Craig, W. F. Angus, H. H. Vaughan.

McDONALD—NORMAN GEDDES, of Niagara Falls, Ont. Born at Cresswell, Ont., Aug. 4th, 1893. Educ., B.A.Sc., Toronto Univ., 1918; 1916-17 (10 mos.), as inspector and machinist on munition work; (5 mos.), asst. ch. examiner of steel at the British Forgings Plant, Toronto, employed by the Imperial Ministry of Munitions, in chg. of staff of twenty-five men, also chg. of inspection of steel, checking, office work, etc., in connection with fracture plant; 1918, to date, drsftsman employed by the Hydro-Elec. Power Comm. on the Ont. Power Co. extension.

References: W. Jackson, P. Gillespie, G. F. Hanning, L. T. Rutledge, T. H. Hogg.

McDONALD—WILLIAM SUTHERLAND, of Calgary, Alta. Born at West Zorra, Ont., Apr. 28th, 1890. Educ., B.A.Sc., Univ. of Alta., 1915. 1915-16, as asst. on D.L.S., at present hydrometric engr., on staff of Comm'r of Irrigation, Calgary.

References: P. M. Sauder, A. L. Ford, M. H. Marshall, C. M. Arnold, V. A. Newhall.

McDOUGALL—JAMES CECIL, of Montreal, Que. Born at Three Rivers, Que., July 4th, 1886. Educ., B.Sc., 1909, B. Arch., 1910, McGill univ., A.R.I.B.A.; studied 2 yrs. in Europe; 1913, to date, practicing architecture; dsgned numerous bldgs., factories, etc.

References: J. C. Smith, V. I. Smart, R. J. Durley, A. F. Byers, P. W. St. George, M. D. Barclay, H. H. Vaughan.

MILLS—THOMAS STANLEY, of Ottawa, Ont. Born at Kingston, Ont., Jan. 26th, 1889. Educ., B.A., 1910, B.Sc. (honors C.E.), 1911. Queen's univ., D.L.S., 1915. 1910 (5 mos.), res. engr. in chg. of laying out and constrn of highway; 1911 (8 mos.), res. engr. in chg. of constrn. of reinforced concrete water reservoir; 1912 (3 mos.), asst. to engr. in chg. Mil. Dist. No. 3, Kingston; 1912 (6 mos.), on location survey, Trent Canal; 1912-13, tech. asst. Topog. Surveys, Dept. of Interior; 1913-14, asst. to city engr., Prince Albert, Sask.; 1914-15, asst. to M. H. Baker on D.L.S. work; Mar., 1915, to date, acting ch. engr., Dom. Parks Branch, Dept. of Interior, Ottawa; responsible for supervision of all eng. work, etc.

References: J. A. Bell, A. Macphail, G. B. Dodge, T. H. G. Clunn, A. W. Gray, O. S. Finnie, J. A. S. King, B. E. Norrish.

MITCHELL—WILLIAM CHARLES, of Regina, Sask. Born at Sydney, N.S., Jan. 5th, 1888. Educ., High Sch., 1905. 1910, concrete inspector; 1912, supt. of contracts with Jausse-Mitchell, Calgary; 1913-14, res. engr., E. D. & B. C. Rly.; 1915, highway engr. on highway location, Banff Nat. Park.; at present res. engr. with Parsons Engineering Co., Regina.

References: A. S. Dawson, J. M. Wardle, W. R. V. Smith, H. G. Dimsdale, J. D. Peters.

MONTGOMERY—WILLIAM GEORGE, of Peterboro, Ont. Born at Gamebridge, Ont., Sept. 19th, 1888. Educ., one yr. app. sc. Queen's Univ. 1906-10, rodman, etc., on constrn. and surveys, Trent Canal; 1910-12, making canal surveys, plans, estimates, etc.; 1912, to date, asst. engr., responsible for making of surveys, dsgning plans of structures, etc., Trent Canal.

References: A. J. Grant, L. Sherwood, F. S. Lazier, E. B. Jost, E. G. Cameron, G. Kydd, A. L. Killaly, J. A. Aylmer.

MORGAN—RALPH CARLETON, of St. Catherines, Ont. Born at Farran's Point, Ont. June 14th, 1889. Educ., grad., R.M.C., 1909. 1909, rodman, N. T. Ry.; topographer, J. & L. M. Ry.; 1910, res. engr.; 1910-12, inst'man and dftsman, C. P. R.; 1912-13, res. engr., C. P. R.; 1913-14, inst'man and 1919, dftsman, Dept. Railways & Canals.

References: A. J. Grant, W. H. Sullivan, F. S. Lazier, F. C. Jewett, E. P. Johnson.

NEWLAND—SAMUEL GEORGE, of Sandwich, P. O., Ont. Born at East Toronto, Nov. 30th, 1890. Educ., high school. 1909, with C.N.R.; 1911-14, res. engr., North Bay dist., C.N.R.; 1914-16, with Hydro Elec. Power Comm., as transitman, later ch. of party; 1916, asst. engr. on paper mill constrn., Morrow & Beatty; 1917 (5 mos.), with Hydro Elec. Power Comm., on hydrographic work; 1917-18, asst. to engr. in chg. of constrn. work, Can. Steel Corp.; July, 1918, to date, engr. in chg. of constrn. work, Great Lakes Dredging Co., Ojibway, Ont.

References: H. Thorne, H. G. Acres, J. A. Beatty, G. P. MacLaren, H. A. Morrow, J. S. Nelles, G. Kahn.

PAYNE—ALBERT IRVING, of Calgary, Alta. Born at Brooklyn, N.Y., Feb. 7th, 1871. Educ., C.E , Princeton Univ., 1896. 1896-97, dftsman, Hay Foundry & Iron Works, Newark, N.J.; 1897 (3 mos.), asst. constrn. engr., Economical Gas Apparatus Constrn. Co., Birmingham, Eng.; 1897-98, in responsible chg. of operation of plant; 1898 (2 mos.), in London office of same firm making up cost data, etc.; (2 mos.), inspecting finished steel and cast iron work for carburreted water gas plants, Gateshead-on-Tyne, Eng.; 1898-99, constructing engr. in responsible chg. of erection of plant, Halifax corp. Gas Works, Halifax, Eng.; 1899 (2 mos.), special designing work in office; 1899-1901, acting ch. engr., A.G.A.C. Co., also engr. in responsible chg. of erection and operation of several carburetor water gas plants in England; 1901-02, engr. and sole representative of A.G.A.C. Co., supervising erection and operation of plant for Tokio Gas Co , Tokio, Japan; 1902, in London office revising plans, etc.; 1902-03, engr. in responsible chg. of operation of plant, Leicester Corp. Works; 1903-05, mgr. & Sec'y, Nelson Coke & Gas Co., Nelson, B.C.; 1905-12, engr. and mgr., Calgary Gas Co.; 1912-17, conslt. gas engr., Calgary, Alta.; June, 1917, to date, engr. with P. Burns & Co. Ltd., dsgning and supervising engr., in responsible chg. of sewers, water supply, etc.

References: G. N. Houston, C. M. Arnold, M. H. Marshall, C. W. Craig, W. J. Gale.

PENNOCK—WILLIAM BRITTON, of Ottawa, Ont. Born at Ottawa, Ont., Aug. 23rd, 1893; Educ., B.Sc., McGill Univ., 1915; 1909, Rodman, geodetic survey of Canada; 1910, Harbour construction work, Port Arthur, asst to govt. engr.; 1911-12, recorder geod. survey of Canada; 1913, in chg. of sounding party, Sask. river survey; 1916-17, Lieut., Canadian Engrs., C.E.F., France; Nov. 1917, to date, dist. vocational officer, Dept. of Soldier's Civil Re-establishment of Canada.

References: H. E. T. Haultain, G. G. Gale, E. Brown, C. J. Armstrong, E. D. La Fleur.

REID—FRASER DANIEL, of Cobalt, Ont. Born at Kingston, Ont., Feb. 20th, 1881. Educ., B.Sc., Queen's Univ., 1904. 1899-1900, on D.L.S.; 1904-05, chemist, Can. Corundum Co.; 1906-07, concentrator supt.; 1907, to date, with Coniagas Mines Ltd., as follows:—1907-15, concentrator Supt.; 1915, to date, manager.

References: R. W. Leonard, H. E. T. Haultain, A. V. Redmond, A. D. Campbell' J. A. Reid.

ROSS—OTHMAR WALLACE, of St. Catherines, Ont. Born at Burlington, Ont., Jan. 15th, 1890. Educ., B.A.Sc., Toronto Univ., 1912; 1½ yrs. with city engr., Brantford; 1½ yrs. bridge & Structural work, Dominion Bridge Co., Montreal; 8 mons. asst. to Dominion land surveyer; 1½ yrs. in chg. location and right of way party on Welland Ship Canal work; 1½ yrs. as asst. to O. L. Surveyer, placing boundaries for Welland Ship canal; 1½ yrs., Lieutenant, C.E.F.; 1½ yrs. as Lieutenant and Capt., Ryl. Air Force; April, to date, asst. engr., section 1, Welland Ship canal.

References: J. L. Weller, A. J. Grant, W. H. Sullivan, T. H. Jones, D. C. Tennant, E. P. Johnston.

ROY—L. DE BOUCHERVILLE, of Ottawa, Ont. Born at Beauharnois, Que., Mar. 25th, 1892. Educ., 2 yrs. at Polytechnic., 18 mos. private tuition. 1911, entered D. P. W. summer on survey of Sask. River: 3 summers following, on surveys and metering and winters in office dfting.; 1913-16, asst. engr., on constrn. of combined roadway and wharf at Kingston; Fall of 1916-18, in D.P.W., Ottawa; April, 1918, took commission in Can. Engrs., C.E.F.; at present asst engr., Dept. Public Works, Ottawa

References: E. D. Lafleur, S. J. Chapleau, C. R. Coutlee, R. deB. Corriveau, A. St. Laurent, A. Langlois.

RUNCIMAN—ARTHUR SALKELD, of Montreal. Born at Goderich, Ont., 11th, 1890. Educ., grad., S.P.S., 1911. Summer, 1909, on constrn. work, G.T.R. shops, Stratford; 1910, with Gen. Elec. Co., at hydro-elec. stations, Kitchener, Preston and Stratford; 1911, with Calgary Power Co., at Horseshoe Falls; 1912-14, asst. supt., light and power dept., Prince Albert, Sask.; 1915, with Can. Westinghouse Co., on constrn. at Grand Mere; Jan. 1916, to date, with Marconi Wireless Telegraph Co., first at receiving station at Louisburg, later at transmitting plant, Glace Bay; 1917, asst. mgr., Montreal, and at present on experimental work.

References: W. Chipman, G. H. Power, C. H. Attwood, F. S. Rutherford.

SHAW—CHARLIE BERFORD, of Hawkesbury, Ont. Born at Pembroke, Ont. Oct. 14th, 1887. Educ., home study and I.C.S.; 1907, tracing, Dobbie Fdry & Machine Co., Niagara Falls, N.Y.; 1908, drafting, Lincoln Paper Mills Co.; 1909, with Can. Crocker Wheeler Co.; 1910, Can Steel Co., Hamilton; 1912-13, field engr., constrn., Ont. Paper Co., Thorold; 1914-17, eng. drfts'man under engr. in chg., Welland Ship Canal; 1918, to date, engr. drfts'man, Riordon Pulp & Paper Co. Ltd.

References: C. B. Thorne, J. L. Weller, W. H. Sullivan, A. S. Cook, J. J. Aldred.

SILCOX—HARRY ROY, of Toronto, Ont. Born at Mount Brydges, Ont., Jan. 16th, 1888. Educ., B.Sc., McMaster univ., 1912, course in structural dsgn., Toronto Tech. school; 1906-15, with C. P. R. as follows:—1906-10, trackman, etc.; 1911, rodman; 1912-13, drtsman and inst'man in chg. of small surveys; 1913-15, inst'man in charge of surveys, track centering constrn work, etc.; 1916-17, inspector of dredging. crib work, piling, etc., Can. Stewart Co.; 1917, inst'man, C. P. R.; 1917-18, res. engr., C. P. R.; June 1918, to date, field engr., railway dept., Hydro-Elec. Power Comm.

References: T. U. Fairlie, A. C. Hertzberg, J. C. Krumm, A. P. Walker, E. G' Hewson, W. E. Bonn.

TAYLOR—WILLIAM CAVEN, of Stonewall, Man. Born at Toronto, Ont. May 21st, 1883. Educ., S.P.S., B.S.E., Univ. of Man., 1911, M.L.S.; Summers, 1904-05-06-07, rodman and inst'man, C. P. R.; 1908-10, chg. of party, C. P. R.; 1911-18, private practice, land surveying, drainage system and highway constrn.; 1918, to date, with Winnipeg Elec. Rly. on reinforced concrete sub-stations and investigations electrolysis, at present on appraisal of property.

References: S. Wilkins, E. E. Brydone-Jack, W. Aldridge, A. A. Young, G. B. McColl, H. Edwards, J. A. H. O'Rielly.

TROWDALE—RUSSELL S., of Calgary, Alta. Born at Crapand, P.E.I., May 25th, 1883. Educ., Prince of Wales Coll. 1903-12, with Robb Eng. Co., as follows:—1903-07, apprenticeship; 1906-07, asst. to ch. engr., in chg. test dept.; 1907-09, in chg. of power plant constrn. in N.S.; 1909-12, in chg. of plant constrn. in Alta. and B.C.; 1912-17, dist. engr., Can. Allis-Chalmers in Alta.; 1917 to date, dist. engr., in Alta., for Can. Gen. Elec. Co. and Can. Allis-Chalmers.

References: G. W. Craig, A. S. Dawson, E. L. Miles, C. M. Arnold, R. MacKay' C. Chalmers.

WANG—SIGMUND, of Hawkesbury, Ont., Born at Christiania, Norway, July 7th, 1887. Educ., chem. engr. coll. of Christiania, 1909; 1909-11, apprentice, Norwegian Sulphite mill; 1912-14, chemist, Oxford Paper Co., Rumford, Me.; 1914, to date, ch. chemist in chg. of laboratories, Riordon Pulp & Paper Co., Ltd.

References: C. B. Thorne.

WAY, ERNEST OWEN, of Ottawa, Ont. Born at London, Eng., Jan. 13th, 1881. Educ., Lady Owen School, matric., London Univ.; Evening classes, Battersea Polytech., during his apprenticeship.; 1898-1903, mech'l apprentice; 1903-07, erecting mechanic, L. & S. W. Ry., London, Eng.; 1908-11, asst. to ch. inspector of weights and measures and scientific adjuster, Ottawa; 1911-12, acting ch. inspector, in chg. of Dom. Standards Branch of weights and measures and Dom. Inspection Service; 1912, to date, ch. inspector, in full chg. of same.

References: A. B. Lambe, G. B. Dodge, K. M. Cameron, R. J. Durley, F. B. Reid, R. C. F. Alexander.

WIGHTMAN—JOHN FREDERICK CARMAN, of Amherst, N.S. Born at Lawrencetown, N.S., Oct. 25th, 1893. Educ., 2 yars. in arts, Prince of Wales coll., 2 yrs. eng. course, Mt. Allison univ.; gen. surveying certificate, N. S. Tech. coll.; Spring, 1913, in chg. of inst' work on highway bridge constrn; Fall, 1913, inst'man on final alignment and grade of branch line, G. T. P. Ry.; 1913-14, asst. instructor in surveying, in chg. of field work, Mt. Allison univ.; 1914-15, inst'man work on crown land survey; 1915-18, on active service, made minor surveys, dsgned and made plans for barracks, mess rooms, etc.; at present town engr., supt. of streets, water works and sewers, Amherst.

References: H. C. Burchell, C. M. O'Dell, Kenneth Pickard.

YOUNG—FRANK BENNET (Major), of St. John, N.B. Born at Lethbridge, Alta., Aug. 27th, 1892. Educ., Prince of Wales Coll., Deputy Land Surveyor, N. B. Crown Land Surveyor, etc. Rodman on location and constrn., T. C. Ry., in N. B.; 1910-12, transitman and res. engr., irrigation dept., C. P. R., Alta., topographical work, including constrn. of dam, canals, etc.; 1913, private practice, Crown Land surveyor for N.B., at present with 26th Batt., B.E.F.

References: G. G. Murdoch, R. H. Cushing, J. K. Scammel, G. C. Dunn, H. Longley.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

BRAKENRIDGE—CHARLES, of Vancouver, B.C., Born at Whitehaven, England, June 5th, 1885; Educ., Tech. educ. classes, Askatrid Agric. coll., Whitehaven tech. coll., England, and Ryl. Tech. coll., Glasgow; 1901-05, articled pupil under the late J. S. Moffatt, civil and arch. engr. and land surveyer, Whitehaven; 1905-06, contractors res. engr., contractors of Oughterside colliery br. rly. 1906-07, asst. engr., Caledonian rly., Glasgow; 1907-08, drfts'man G. T. P., Edmonton, Alta. and Skeena river; 1908-09, drfts'man and instr'man, Yukon Gold Co., Dawson; 1909-11, ch. drfts'man, city engr's office, Vancouver; 1911-15, asst. city engr., Vancouver, in chg. of roadways, public utilities, etc.; 1915-18, deputy city engr., Vancouver; 1918, to date, private practice, Vancouver, B.C.

References: A. G. Dalzell, H. M. Burwell, N. J. Ker, H. Rindal, D. Cameron, W. H. Powell, C. E. Cooper.

COCKBURN—JAMES ROY, of Toronto, Ont. Born at Beaverton, Ont., Oct. 25th, 1879. Educ., B.A.Sc., Toronto, Univ., 1902. 1901 (2 mos.), dftsman, N. Y. Shipbuilding Co., Camden, N.J.; 1902 (4 mos.), dftsman, Wellman, Saever, Morgan, Eng. Co., Cleveland, Ohio; 1902-03, dtsman, Polson Iron Works, Toronto; 1904 (5 mos.), dftsman and inspector, Pittsburgh Reduction Co.; 1905 (5 mos.), transitman, in chg. of survey party, D.L.S.; 1906 (5 mos.), transitman in chg. of party, under H. S. Holcroft, D.L.S.; 1907, reporting on quantities of earth and concrete in connection with hydro-elec. power development, Town of Gravenhurst, Ont.; 1913, with Thor Iron Works, Toronto, looking after constrn. of 2 steel scows and one steel barge, also dsg ned and looked after constrn of 3 small steel steamers; 1913, to date, asst. professor of descriptive geometry, Univ. of Toronto; Oct. 1916 to Feb. 1919, on active service with 58th Bn. in France and Royal Engrs. in France and Palestine.

References: C. H. Mitchell, W. Chipman, P. Gillespie, C. R. Young, E. W. Oliver, A. H. Harkness, E. L. Cousins, N. D. Wilson.

FERGUSON—GEORGE Hendry, of Ottawa, Ont. Born at Toronto, Ont., Jan. 20th, 1883. Educ., B.A.Sc. (C.E.), Univ. of Toronto, 1905. D.L.S. Summers, 1903-04-05, asst. on surveys, N. Ont. and W. Canada; sessions 1906-08, on staff of Faculty of App. Science, Toronto Univ., in addition to private work; engr. in chg. of constrn. and erection of bldgs., Dom. Radiator Co., also in chg. of drainage surveys, etc.; 1907, asst., Geodetic Survey; 1908, asst. surveyor on layout and sub-div. of coal lands, S. Alta.; 1909, in chg. of surveys for water power development; 1909-11, asst. engr. on staff of Hydro Elec. Power Comm. on constrn. and survey of water-power, etc.; 1911-15, asst. engr. on staff of Comm. of Conservation, in chg. of field work, surveys, etc.; 1915-18, officer with C.E.F., Can. Engrs., at present, asst. engr., Comm. of Conservation.

References: J. White, H. G. Acres, A. F. Macallum, P. Gillespie, J. Murphy, E. G. Hewson.

HODGSON—JOSEPH POLLARD, of Vancouver, B.C. Born at London, Eng., Sept. 6th, 1880. Educ., Battersea Polytech., A.M.I.C.E., 7 yrs., engaged in inspection of dsgns and supervision of constrn. of numerous bridges, piers, harbour improvements, etc.; 4 yrs., engr. and agent for H. Arnold & Sons, contrctors, Doncaster, on constrn. of water works, reservoirs, bridges, etc., England; 5 yrs., with Howarth Erskine Ltd., Singapore, on erection of bridges, screw pile wharf and various other works; 3 yrs., branch mgr. for Howarth Erskine, Ltd., Rangoon, Burma, dsgn and constrn of numerous bridges, wharves, etc.; 7 yrs. on works for Dom. and Pro. Gov'ts and private concerns as engr. contractor; at present carrying out river protection work on Fraser River for Dom. Gov't.

References: A. D. Creer, A. G. Dalzell, F. L. Fellowes, E. G. Matheson, C. E' Cartwright, D. Cameron, H. K. Dutcher, C. Brakenridge.

HOLMES—ARCHIBALD RETTIE, of Toronto, Ont. Born at Hantsport, N.S., July 18th, 1872. Educ., B. Eng., King's Coll., 1895. 1893 (3 mos.), asst. to W. R. Butler, as dftsman, inst'man on water and sewerage works, etc., in N.S.; 1895, dftsman, with C. E. W. Dodwell, res. engr., D. P. W., Halifax; dftsman on maintenance of way, I. C. Ry., Moncton, N.B.; leveller and transitman on surveys and constrn., etc.; dftsman, steel dsgning dept., Boston Elev. Ry.; checker and dsgner, bridges and bldgs., N. Y. C. Ry.; structural engr., United Coke & Gas Co., N.Y.; 7 yrs. structural engr., Link Belt Co., and Dodge Coal Storage Co., Philadelphia; 7 yrs. sec.-treas., of MacKinnon, Holmes & Co. Ltd., Sherbrooke, Que., mfrs. of steel structures; at present, president, Archibald & Holmes Ltd., Toronto, engr. and bldrs. of reinforced concrete, steel, stone structures, etc.

References: W. R. Butler, C. E. W. Dodwell, W. B. MacKenzie, G. A. McCarthy, I. E. Vallee, J. T. Morkill.

MILES—HAROLD ROY, of Lethbridge, Alta. Born at Kewatin, Mar. 14th, 1879. Educ., Grammar school. 1894, on B. & A. Ry.; 1895 (6 mos.), rodman on constrn.; 1896, asst. on survey, Grand Falls water power, inst; transit and level work; 1897-99, leveller, Washington Co. Ry., Me.; 1899, leveller on location, Van Buren Extension; 1900-01, in chg. of constrn., A. C. Ry., later transitman on location; 1901-02, asst. engr., to G. L. Wetmore, C. P. R.; 1902, to date, with C. P. R., in chg. of all maintenance of way work, also in gen. mgr's office, Montreal, as asst. to eng. of maintenance-of-way, at present div. engr., Lethbridge, div.

References: J. M. R. Fairbairn, C. T. De Lamere, A. C. MacKenzie, W. B. Russell, C. L. B. Miles, C. L. Wetmore, C. H. N. Connell, J. W. Orrock.

NEVITT—IRVING HEWARD, of Toronto, Ont. Born at Toronto, Ont., July 24th, 1882. Educ., B.A.Sc., Toronto Univ., 1904. 1899, on constrn., A. & S. Ry. 1900-03 (summers), machine shop, power station and telephone work; 1904-05, dftsman, roadways dept., Toronto; 1905, testing dept., Can. Gen. Elec. Power Comm.; Schenectady, N. Y.; 1907, transitman on prelim. surveys, Hydro-Elec. Power Comm.; 1909, transitman, main drainage works, Toronto; 1910, asst. to engr. in chg., sewerage disposal branch, main drainage works, and res. engr. in chg. of constrn. of sewage disposal works, including tanks, etc.; 1913, to date, supt. and asst. engr. in chg. of operation of main sewage disposal works, etc.

References: G. A. McCarthy, P. Gillespie, G. G. Powell, J. Milne, C. L. Fellowes, E. W. Oliver, W. Gore, C. H. Rust.

SPRENGER—Aloys Reginald (Major), of Montreal, Que. Born at Bareilly, East India, Sept. 3rd, 1877. Educ., R.M.C., Sandhurst, 1897, City of Guilds Tech. Inst., London; 1 yr., surveying on Afghan frontier and China; 15 mos., dfts'man and inst'man on construction and location, C.P.R.; 9 mos, dfts'man on constrn. T.C.Ry.; 4 yrs. res. bridge engr., including supervision of constrn. of foundations; 3 yrs., dist. bridge engr. in chg. of all bridge and steel water tank constrn., T. C. R.; 2 yrs., engr. in in chg. of constrn. of steel arch, St. John, N.B., also highway bridge, Newcastle; Nov. 1915. to April, 1919, with C.E.F., in chg. of constrn of 45 Aerodromes in England; served in France with 2nd. bn., Can. Engineers as co. comm'dr.; at present, dist. supt'g engr. for Eastern Canada, Dept. Soldiers' Civil Re-establishment.

References: R. F. Uniacke, A. H. Willett, F. P. Shearwood, E. A. Hoare, C. M. Steeves, G. L. Mattice, W. A. Duff.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

FORD—JOHN WILLIAM, of Niagara Falls, Ont. Born at London, Ont., Nov. 9th, 1889. Educ., B.A.Sc., Toronto Univ., 1915; 1911 (5 mos.), dfts'man, city of N. Vancouver; 1912-13, transitman, C.N.R., on Leaside & Trenton sub-div'ns, etc.; 1913-16, transitman, leveller, topographer on rly location, office work and collector of revenue statistics on hydro-radial schemes, Hydro-Elec. Power Comm; 1916, to date, dsgning dfts'man, in constn. office, Niagara Power Development, H. E. P. Comm.

References: H. L. Bucke, A. C. D. Blanchard, J. B. Goodwin, N. R. Gibson J. A. P. Marshall.

FRENCH—MERRITT HENRY, of Calgary, Alta. Born at Rice Lake, Wis., Mar. 1st, 1886. Educ., 1 yr. Arts and 1 yr. eng., Univ. of Minnesota, passed prelim. and final exams, for D.L.S. 1904-05, rodman, mining and surveying, Mahoning Ore Co.; 1905, rodman, Longyear Exploration Co., including underground mining surveying, and surface surveying; 1906 (3 mos.), inst'man, with city engr., Virginia, Minn.; 1906-10, farming; 1910 (3 mos.), asst. Dom. Topog. party near Moose Jaw; 1910-11, asst. to asst. ch. engr., on constrn. S. A. Land Co.; 1911-12, hydrometric engr., Maple Creek; May, 1912, to date, hydrometric and irrigation engr., including inspection, dsgn. and location, etc., Cypress hills irrigation dist.

References: F. H. Peters, R. J. Burley, E. L. Miles, P. M. Sauder, J. S. Tempest, V. A. Newhall, S. G. Porter.

GREGORY—ALEXANDER WATSON (Capt., M.C.), of St. Stephen, N.B. Born at St. Stephen, Dec. 2nd, 1884. Educ., 3 yrs. eng., Univ. of N.B., 1906. 1906-07, inst'man on constr., James Bay Ry.; 1907-09, asst. to div. engr. on constrn., Q.M. & S. Ry.; 1909-10, inspector and inst'man on constrn., N.T.Ry.; 1911-15, asst. engr. in chg. (ch. engr's branch), P. W. D., Ottawa; 1915-19, on active service with 26th Infantry Batt., France, as capt.; at present, asst. engr. in chg. (ch. engr's branch), P. W. D., Ottawa.

References: H. M. Davy, A. Gray, H. H. Donnelly, C. R. Coutlee, A. G. Tapley.

HARKNESS—ROBERT BRUCE, of Toronto, Ont. Born at Tamworth, Ont., Feb. 27th, 1889. Educ., Renfrew Coll. Inst. 1905-07, rodman, etc., on location and constrn., G.T.P. Ry., Fort William and Edmonton; 1908-09, level and transitman; 1909-11, res. engr. on bridges later on constrn., G.T.P.; 1912, engr. on installation and trackage, MacLeod Collieries; 1912-13, supt. of constrn. with Philan-Shirly Co. on C.N.R. contract; location engr., E. D. & B. C. Ry.; 1913, div. engr. on constrn.; Winter, 1913-14, location engr., A. & G. W. Ry.; 1914, Div. Engr. on constrn,. E. D. & B. C. Ry.; June, 1915, on active service, commanded 19th Batt. Welsh Reg't. from Aug., 1918-Feb., 1919, at present in chg. of Niagara dist., Soldiers' Civil Re-establishment.

References: H. E. T. Haultain, W. R. V. Smith, R. W. Jones, C. Ewart, M. E. Davis.

MacGILLIVRAY—JOHN ALEXANDER, of Winnipeg, Man. Born at New Glasgow, N.S., Jan. 7th, 1889. Educ., 2 yrs. eng., Dalhousie univ. 1905-08, rodman, topog. and instr'man on municipal and railroad work in N. S. and N. B.; 1909-10, rodman and inst'man on constrn. of Wpg. Hydro-Elec. Power plant; 1910-11, asst. field engr. on same, in chg. of layout of power house and dams; 1911-12, res. engr. on constrn., I.C.R. branch line; 1912 (8 mos.), supt. and engr. in chg. of constrn. of reservoir, Standard Constrn. Co.; 1913-14, chg. of constrn. of concrete sewer, Transcona, Man.; 1915-16, asst. bridge engr., Man. Good Roads Board; 1917-18, res. engr. on power house extension, Wpg.; at present on valuation staff of Man., Public Utilities, valuating Wpg. Electric Ry.

References: W. M. Scott, E. V. Caton, W. P. Brereton, G. L. Guy, J. M. Leamy, M. A. Lyons.

MacLACHLAN—ROBERT CAVAN, of St. Catherines, Ont. Born at Lochaber, Que., Nov. 26th, 1892; Educ., B.Sc., McGill Univ., 1916; 913-14-15, rodman, instru'-man, asst. res. engr. on construction work, C.N.R.; 1916, asst. engr. on harbour construction work on Hudson Bay terminal at Port Nelson; (18 mos.), with Can Forestry corps in France in chg. of mill producing aeroplane spruce; (5 mos.), 2nd in command of a company; at present asst. res. engr. Welland Ship Canal.

References: H. M. MacKay, E. Brown, C. B. Daubney, D. W. McLachlan, A. J. Grant, E. P. Johnson, J. T. Johnston.

NORRIS—JAMES HILLYARD, of Montreal, Que. Born at Montreal, Que. Sept. 21st, 1890; Educ., B.Sc. (Mechanical), McGill Univ., 1912: 1909-10, G. T. R. locomotives shops, Stratford, Ont.; 1911, Byers & Anglin Contractors; 1912, in chg. of construction of 24 houses for City Realty Investing Co.; 1913-15, constructed 16 houses on own account; 1916-18, with Imperial Munitions Board in chg. of 18 pd. shrapnel production in eastern div., also construction and layout of storage warehouses; 1919, to date, partner in firm of Douglas Bremner & Co. Ltd., Montreal.

References: E. Brown, H. M. MacKay, D. Bremner, W. S. Atwood, C. M. McKergow.

SHAW—JOCK BROWN, of Victoria, B.C. Born at Berwick, N.S., July 29th, 1885. Educ., 2½ yrs. high school, 1½ yrs. C. E. course, Stanford Univ., Cal. 1905-06, (11 mos.), rodman on T. C. Ry. surveys; 3 mos., tapeman on C. P. R. double tracking; 1906-08, rodman, topographer, etc., on G. T. P. surveys; 1909-10 (5 mos.), rodman. and acting instr-man on residency, G. T. P. constrn., Skeena River; 3 mos., asst. dftsman on V. & B. S. Ry.; 6 mos., transitman on land surveys in Northern B.C., 1911-13, on surveys of Victoria as transitman; 1911-12 (4 mos), transitman on surveys and constrn., Sooke Lake water supply for Victoria; June 1913 to date, asst. engr; D. P. W., Vancouver Island Dist.

References: A. F. Mitchell, E. G. Marriott, E. P. McKie, R. W. Macintyre, D. O. Lewis.

STEWART—JAMES CROSSLEY (Lt. Col., D.S.O.), of Ottawa, Ont. Born at Kingston, Ont., Feb. 17th, 1891. Educ., grad., R.M.C., 1911, Col. Inst. Summer, 1910, on surveys, middle channel, St. Lawrence River; and work in office of S. J. Chapleau, P. W. D.; 1911-14, asst. engr , P. W. D., Ottawa, as follows: 1911-12, res. engr. on constrn., French River Regulation Works and in chg. of surveys; 1913, res. engr. and supt. of constrn. on dam, French River, also reconnaisance surveys, etc.; 1913-14, supt. of removal of shoal, Brockville, surveys and borings, Fort William Harbor; 1914-19, with Can. Field Artillery in Belgium, France and Germany, building pits, mine dugouts, shelters, etc., at present asst. engr. to S. J. Chapleau, P. W. D

References: S. J. Chapleau, W. J. Stewart, C. R. Coutlee, D. MacPherson, J. L. H. Bogart.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

BARCELO—JEAN EDOUARD, of Montreal, Que. Born at Montreal, Que., Dec 2nd, 1893. Educ., B.S.A. and C.E., Laval Univ., 1916. 2 summers (4 mos. each), asst engr., P. W. D.; 1 summer (2 mos.), inspector munitions plant; June, 1916, to date with Quebec Streams Comm. as follows:—1916, inst'man on Lake Kenogami survey; 1917, gen. office work; 1917-18 on storage dam constrn as concrete inspector and later asst. res. engr.; July, 1918, to date, gen. office work and gauging of rivers.

References: O. O. Lefebvre, J. B. D'Aeth, E. J. Lavigne, F. C. Laberge, L. G. Papineau.

LOIGNON-HILAIRE H. BRUNO, of Outremont, Que. Born at Montreal, Que. Jan. 14th, 1894, Educ., B.A.Sc., L'Ecole Polytechnique (Laval), 1917. Post graduate in industrial chemistry, 1918; 1916 (3 mos.), mech. dftsman at Canada Cement Co. munition plant; 1915, at A. & E. Loignon, Engrs., Montreal; 1917 (5 mos.), asst. engr. constrn. of Pulp & Paper Mills of Mattagami, P. & P. Co., Smooth Rock Falls, Ont; 1918; chemist at Canadian Explosives Co., Beloeil, Que.; 1919, constrn. of Ottawa & Hull Power & Mfg. Co., asst. dsgner of concrete constrn. for Wm. Kennedy, Jr.; at present with E. Loignon, C.E.

References: W. Kennedy, A. Frigon, W. Scott, J. Dick, S. A. Baulne.

RICHARDSON—ALBERT ANGUS (Capt.), of Peterboro, Ont. Born at Lakefield, Ont., June 20th, 1892. Educ., B.A.Sc. (C.E.), Toronto Univ., 1915. Summers, from 1906 to 1911, on constrn., chiefly concrete work on Trent Canal; 1912 (5 mos.), with W. J. Francis & Co., on Moose Jaw water supply as inspector; 1913-15, on staff of supt., Trent Canal, preparing navigation charts, placing buoys, etc.; 1914 (5 mos.) and 1915 (4 mos.) asst. city engr., Peterboro, in chg. of pavements, sewers, etc.; 1915-16, with Can. Stewart Co., as engr. in chg. of operation of hydraulic dredge on Toronto Harbour improvements; Mar. 1916, enlisted as lieut. in Can. Infantry, later promoted to Capt., Can. Engrs., in chg. of constrn. and maintenance of lines, etc., received O. B. E., and mentioned in despatches.

References: W. J. Francis, R. H. Parsons, P. Gillespie, C. R. Young, C. R. Crysdale, E. H. Pense.

WARD—ROY CECIL, of Toronto. Born at Toronto, Ont., Nov. 25th, 1893. Educ., B.A.Sc., Toronto Univ., 1916. 1912, rodman, etc., with Toronto Niagara Power Co , on high voltage elec. transmission; 1916-18, estimator and designer on structural steel and steel plate work, Toronto Iron Works, Ltd., responsible for sll estimating and dsgning; 1918, appointed asst. engr., Leaside Munition Co., directly responsible for dsgn. of foundations for presses, furnaces, etc., location of all machinery and gen. layout, etc., at present estimating and dsgning, Toronto Iron Works.

References: P. Gillespie, W. Chipman, A. H. Harkness, H. G. Acres, H. E. T. Haultain, R. O. Wynne-Roberts, W. S. Harvey, W. E. M. Bonn.

ENGINEERING INDEX

In this department will be published from month to month the titles of current engineering papers with the authors and source and a brief extract of the more important. It is designed to give the members of The Institute a survey of all important articles relating to every branch of the engineering profession.

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MINING ENGINEERING

BASE MATERIALS

ASBESTOS. Famous Mineral Localities: The Pelham Asbestos Mine, Massachusetts, Earl V. Shannon. Am. Mineralogist, vol. 4, no. 4, Apr. 1919, pp. 37-39. Characteristical feature is granular material, olivine colored dark by magnetite or chromite dust, containing scattered square phenocrysts of bronzy enstatite up to 3 cm. in length, the whole forming a typical fresh saxonite.

BUILDING ROCK. Mineral Deposits and Building Rock Beds of the Argentine Republic (Los yacimientos de minerales y rocas de aplicacion en la Republica Argentina), Ricardo Stappenbeck, Ministerio de Agricultura de la Nacion, Direction General de Minas, Geologia e Hidrologia, boletin no 19, series B, 1918, 107 pp., 1 fig. Summary of notes gathered by various explorers, particularly on genetic formation of ore deposits.

GRAPHITE. Preliminary Report of an Investigation into the Concentration of Graphite from Some Ontario Ores. Can. Min. Jl., vol. 40, no. 12, Mar. 26, 1919, pp. 189-197, 11 figs. Account of experimental work conducted by staff of Dept. of Min. Eng., University of Toronto. From results of tests a system of concentration was outlined.

LIME. The Lime Industry in 1918. Cement & Eng. News, vol. 31, no. 4, Apr. 1919, pp. 35-38. General condition and statistics of production.

COAL AND COKE

ACCIDENTS. Reducing Accidents in Coal Mining, Charles P. McGregor. Coal Indus., vol. 2, no. 4, Apr. 1919, pp. 149-150. Duties of officials with reference to inspections, visits, discipline and machinery.

BY-PRODUCT PLANTS. Some Striking Features of a By-product Coke Plant. Coal Age, vol. 15, no. 15, Apr. 10, 1919, pp. 654-657, 7 figs. Boosters are used to increase pressure of coke-oven gas after by-products are extracted.

Going In for the Production of By-Products Linked with many Important Considerations, L. W. Alwyn-Schmidt. Am. Gas Eng. Jl., vol. 110, no. 15, Apr. 12, 1919, pp. 309-311. Observes that production of by-products can not be neglected by small gas works.

Research and Progress in By-Product Coking in Great Britain—IV, John B. C. Kershaw. Coal Age, vol. 15, no. 17, Apr. 24, 1919, pp. 752-756, 6 figs. Coals are usually crushed and mixed before coking. Arrangement of coke oven plant at Newton Chambers & Co. collieries is given as example of practice followed.

CANADA. Coal Resources of Western Canada—I, James White. Coal Age, vol. 15, no. 17, Apr. 24, 1919, pp. 744-748, 3 figs. Distribution: analysis of coal samples; production of coal in Alberta during 1917. (To be concluded.)

CLASSIFICATION. The German System of Coal Classification and the Future Economic War—III. Colliery Guardian, vol. 117, no. 3038, Mar. 21, 1919, pp. 660-661. It is presumed that future economic war will involve restriction of freedom of mine owner in respect of winning and treatment of coal, by introduction of methods based on communal economics.

COKE-OVEN GAS. Coke-Oven Gas. Colliery Guardian, vol. 117, nos. 30-40, Apr. 4, 1919. pp. 773-774. Future development of coking industry will take place, writer believes, in two main directions; coke-oven plants becoming large heat, light and power producers, or becoming large centers of chemical activity.

CUTTER. Coal-Cutter Invented by a Working Miner. Iron & Coal Trades Rev., vol. 98, no. 2666, Apr. 4, 1919, p. 415, 2 figs. Sketch plan showing details.

GAS. Bumps and Outbursts of Gas in the Crowsnest Pass Coal Field. Coal Age, vol. 15, no. 15, Apr. 10, 1919, pp. 660-665, 5 figs. Field covers 230 square miles and is estimated to contain 845 billion tons of coal. From Bulletin No. 2, 1918, British Columbia Department of Mines.

KENT COALFIELD. The Evolution and Development of the Kent Coalfield, A. E. Ritchie. Iron & Coal Trades Rev., vol. 98, nos. 2661, 2664, 2665, 2666, 2667, Feb. 28, Mar. 21, 28, Apr. 4, 11, 1919, pp. 257-258, 356, 381, 414, and 447-448, 3 figs. From 1897 to 1900.

Mar. 21: Nationalization of Westphalian Coal Syndicate from accounts in German newspapers; Mar. 28: from 1912 to 1918; Apr. 4: from 1901-1905. Apr. 11: Diagram of borings put down by Kent Coal Concessions, Ltd. up to Dec. 1906.

SPANISH INDUSTRY. Geological History of Coal and Its Present Value.—II. Actual Conditions of Spanish Coal Industry: Its Future (La hulla en el pasado geologico y en el presente historico. II. Estado actual de la industria hullera espanola; su porvenir), D. Pablo Fahrega. Revista Minera, vol. 70, no. 2680, Mar. 16, 1919, pp. 129-135. Presentation of various theories concerning origin of coal; comparison of activities in coal industries of various nations. Conference given before Instituto de Ingenieros Civiles.

STRIPPING. Coal Stripping in the United States—IV, Wilbur Greely Burroughs. Coal Indus., vol. 2, no. 4, Apr. 1919, pp. 143-146, 6 figs. Features of stripping and loading shovels and dragline excavators.

Methods of Mining Coal, W. C. Bochert. Pahasapa Quarterly, vol. 8, no. 2, Feb. 1919, pp. 41-52, 7 figs. Practices followed in U. S. A. in connection with stripping or open-cut mining, and mining under ground or under cover.

SURFACE SUPPORT. The Effect of Coal Mining on the Overlying Rocks and on the Surface, W. D. Lloyd. Colliery Guardian, vol. 117, no. 3041, Apr. 11, 1919, pp. 837-839 and (discussion), p. 842. Writer indicates lines on which he believes further observations should be made on the effect mining operations will have on the support of the surface. Paper read before Midland Inst. Min., Civil & Mech. Engrs.

TRANSPORTATION. The Carriage of Coal by Rail in India, H. Kelway-Bamber. Ry. Gaz., vol. 30, no. 14, Apr. 4, 1919, pp. 603-606, 6 figs. Development in Indian coal output and forecast of future coal consumption. (To be continued.) Paper read before Indian Section, Roy. Soc. of Arts.

GEOLOGY AND MINES

ADIRONDACK REGION. Pegmatite, Silextite, and Aplite of Northern New York, William J. Miller. Jl. Geology, vol. 27, no. 1, Jan.-Feb. 1919, pp. 28-54, 8 Figs. Examination of accepted genetic theories in view of phenomena presented by occurrences in Adirondack region.

ALASKA. The Nelchina-Susitna Region, Alaska, Theodore Chapin. Dept. of the Interior, U. S. Geol. Survey, bul. 668, 1919, 67 pp., 14 figs. Location, area and geology of drainage basins of Copper and Susitna Rivers.

AMERICAN GEOLOGY, BIBLIOGRAPHY OF. Bibliography of North American Geology, for 1915, with subject index, John M. Nickles. Dept. of Interior, U. S. Geol. Survey, Bul. 645, 1916, 144 pp. Includes publications bearing on the geology of the Continent of North America and adjoining islands; also Panama and the Hawaiian Islands. Textbooks and papers general in character by American authors are included; those by foreign authors are excluded unless they appear in American publications.

ARGENTINA. Geological and Hydrogeological Studies in the Region between the Mouth of the Rio Negro, San Antonio, and Choele-Choel (Estudios geologicos e hidrologicos en la region comprendida entre Boca del Rio Negro, San Antonio y Choele-Choel), Ricardo Wichmann. Republica Argentina, Anales del Ministerio de Agricultura de la Nacion, Seccion Geologica, Mineralogia y Mineria, vol. 13, no. 3, 1919, 44 pp., 5 figs. Data secured in survey of region.

Contribution to the Geology of the Argentine Republic (Contribucion al conocimiento geologico de la Republica Argentina), Ricardo Wichmann and Franco Pastore. Anales del Ministerio de Agricultura della Nacion, Seccion Geologia, Mineralogia y Mineria, vol. 13, no. 4, 1919, 45 pp., 8 figs. Geology of region between Rio Negro and Arroga Valcheta, with petrographic description of volcanic and metamorphic rocks.

BRITISH COLUMBIA. Was there a "Cordilleran Glacier" in British Columbia? J. B. Tyrell. Jl. Geology, vol. 27, no. 1, Jan.-Feb. 1919, pp. 55-60. Writer's observations had lead him to deny possibility of existence of a great longitudinally moving Cordilleran glacier in latitude 54 deg., and he believes that it was absent as far south as Quesnel in latitude 53 deg.

CRYSTALLOGRAPHY. Crystallography of Some Canadian Minerals: 8. Axinite, Eugene Poitevin. Am. Mineralogist, vol. 4, no. 4, Apr. 1919, pp. 32-36. Analyses made by Geol. Survey of Canada. Give table showing combination of gorms on nine measured crystals.

DAKOTA NORTH. The Geology of North Dakota, A. G. Leonard. Jl. Geology, vol. 27, no. 1, Jan.-Feb. 1919, pp. 1-27, 2 figs. Rocks are classified as being chiefly clays, shales and sandstones belonging to the Cretaceous and Tertiary periods, overlain in most places by the drift deposits of the Pleistocene.

ECONOMIC GEOLOGY. Contributions to Economic Geology (short papers and preliminary reports), part 11. Mineral Fuels, M. R. Campbell and David White. Dept. of Interior, U. S. Geol. Survey, Bul. 621, 1916, 375 pp., 42 figs. Descriptions of occurrences that have economic interest but are not considered of sufficient importance to warrant an extended account; preliminary reports on economic investigations, the results of which are to be published later in more detailed form; apparatus for determining percentage of ash and coal and instructions for its use.

IDAHO. A Preliminary Report on the Mining Districts of Idaho, Thomas Varley, Clarence A. Wright, Edgar K. Soper and Douglas C. Livingston. Dept. of Interior, Bur. of Mines, Bul. 166, 113 pp., 6 figs. Gives localities of mining districts, and nature of present operations and those that have been carried on in the past: geology is discussed in reference to types of ore deposits and character of ores.

Lava. Dacites and Dacitoides, With Reference to Lavas of Martinique (Dacites et dacitoides, à propos des laves de la Martinique), A. Lacroix. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 6, Feb. 10, 1919, pp. 297-302. Composition of volcanic rocks found in Martinique is adduced in support of theory that a number of lavas, which are considered as andesites, are in reality heteromorphic dacites.

Metalliferous Deposits. Original Formation of Metalliferous Deposits (Sur la formation originelle des gisements métallifères). Notes Provincales, (Notes de géophysique), no. 7, Feb. 19f9, pp. 18-21. On the genesis of exogenous deposits. Remarks on Stephen Tabor's paper, The Mechanics of Vein Formation, before Am. Inst. Min. Engrs. See Trans., A. I. M. E., Sept. 1918, pp. 1189-1222.

Nevada. The Yerington District, Nevada, Adolph Knopf. Min. & Sci. Press, vol. 18, no. 14, Apr. 5, 1919, pp. 455-458, 2 figs. Geological records; analysis of lime stone sample taken in district. From Professional Paper 114, U. S. Geol. Survey.

Texas. Geology of North Central Texas Field, Wallace E. Pratt. Oil & Gas Jl., vol. 17, no. 44, Apr. 4, 1919, pp. 54-56, Structure of surface beds; surface relation to subsurface; occurrences of water, oil and gas. Paper before Am. Assn. of Geologists.

Vancouver Island. Sooke and Duncan Map-Areas, Vancouver Island, C. H. Clapp. Can. Dept. of Mines, Geol. Survey, memoir 96, 445 pp., 19 figs. Topography, geology and natural resources.

IRON

Mesabi Range. Iron-Ore Concentration on the Mesabi Range, F. A. Kennedy. Eng. & Min. Jl., vol. 107, no. 16, Apr. 19, 1919, pp. 683-688, 5 figs. Tables and curves relating to performances of washers; suggestions for betterment of present methods.

LEAD, ZINC, TIN

Tin Mining. Tin-Mining in the Dutch Indies (Van het handgrondwerk naar het spuit-en pompbaggerhedrijf), J. C. Moilema. De Ingenieur, vol. 34, no. 5, Feb. 1, 19f9, pp. 68-79, 14 figs. Particulars of a number of installations.

Zinc-Ore Distillation. Refractories for the Zinc Industry, M. Grover Babcock. Jl. Am. Ceramic Soc., vol. 2, no. 2, Feb. 19f9, pp. 81-95. Requirements of clay retors used in distillation of zinc ores.

Zinc-Ore Mining. Operations at the Zinc. Camp, Arkansas, Tom Shiras, Eng. & Min. Jl., vol. 107, no. 14, Apr. 5, 1919. pp. 607-608, 2 figs. Mining confined to removal of siliceous ores.

MAJOR INDUSTRIAL MATERIALS

Manganese. Chrome and Manganese Ores in Cuba, Boletin de Minas, no. 5, 1918, pp. 57-70. Despite handicaps, it is believed that the outlook for a steadily increasing production in 1918 and 1919 is good. Reserves of manganese are estimated at 700,000 to 800,000 tons. The Spanish text for this article appears in pp. 41-56. From U. S. Geol. Survey, bul. 380, Sept. 1918.

Report on the Manganese Deposits of Georgia (Second Report on Manganese), J. P. D. Hull, Lawrence la Forge and W. R. Crane. Geol. Survey of Georgia, bul. 35, 295 pp., 39 figs. Divided into three parts, (1) relation of ore deposits to structural geology, (2) description of individual, properties and mode of occurrence of ore, and (3) methods of mining and cleaning ore. Prepared in co-operation with U. S. Geol. Survey and U. S. Bur. of Mines.

The Mining and Preparation of Manganese Ores in Tennessee, W. R. Crane and E. R. Eaton. Mining Jl., vol. 125, no. 4363, Apr. 5, 1919, pp. 213-214. Minerals found are pyrolusite, psilomelane, and manganite. (To be continued.) From Mag. of Tennessee Geol. Soc.

Manganese, T. G. Trevor, South African Jl. Industries, vol. 2, no. 1, Jan. 19f9, pp. 35-43. Occurrence and appearance of ores; metallurgical and chemical uses of manganese oxides; statistics of manganese production of the world for 1913 and 1916.

MINES AND MINING

Accidents. Quarry Accidents in the United States During the Calendar Year 1917, Albert H. Fay. Dept. of the Interior, Bur. of Mines, tech. paper 213, 62 pp. Tables indicating causes of accidents; safety rules promulgated by Nat. Lime Mfrs. Assn.

Africa, South. The Mineral Industry of South Africa and its Future—IV, V & VI, P. A. Wagner. S. A. Min. & Eng. Jl., vol. 28, parts 1 and II, nos. 1429, 1430 and 1432, Feb. 15, 22 and Mar. 8, 1919, p. 572, 597 and 27. Feb. 15: Iron, kaloin and lead mining. Feb. 22: Zinc, arsenic, magnesite, manganese, mica, soda, talc, tungsten. Mar. 8: Lime, rock phosphate, chert, gypsum, kieselghur, salt, cement, clay products and structural material. Presidential address read before S. A. Assn. for the Advancement of Science. (To be continued.)

British Columbia. History of Mining and Metallurgical Development in British Columbia. Min. & Eng. Rec., vol. 24, no. 1, Jan. 1919, pp. 6-11, 9 figs. From the discovery of gold in 1851 to construction of mill at Allenby, B.C.

Cuba. Historical Sketch of the Mining Industry in Oriente. Cuba (Resena historica sobre la mineria en Oriente, Cuba). Boletin de Minas, no. 5, 1918, pp. 26-40. Iron mining on northern coast. (Continued.)

Doors, Separation. Separation Doors at the Bottom of the Upcast Pit. Worked Automatically by Tubs Attached to Endless-Rope (Under-Tuh) Haulage, Clement Fletcher. Trans. Manchester Geol. & Min. Soc., vol. 36, part II, Mar. 1919, pp. 31-33, & 4 figs. on plate between p. 64 and cover. Doors work vertically in machined gun-metal grooves and are operated by two Hans Renold roller chains.

Drainage. Tapping and Draining a Deep Shaft, J. Fox. Colliery Guardian, vol. 117, no. 3038, Mar. 21, 1919, pp. 659-660, 3 figs. Sketches showing erosive action of water on borehole.

Drilling and Stripping. The Blow of the Drill Bit, Sharp or Dull, Frank Richards. Eng. & Min. Jl., vol. 107, no. 17, Apr. 26, 1919, pp. 735-736, 1 fig. Explanation of failure of steel to stand up under action is found in consideration of forces which act and react in drill-striking operation.

Heavy Drilling at Sacramento Hill, Robert T. Banks. Eng. & Min. Jl., vol. 107, no. 16, Apr. 19, 1919, pp. 690-691, 2 figs. Method adopted provides for series of benches which are operated simultaneously, steam shovels being used to load rock into cars after it has been drilled and blasted.

Stripping. Stripping and Drilling Methods at the Sacramento Hill Copper Mines. Eng. & Contracting, vol. 51, no. 16, Apr. 16, 1919, pp. 389-390, 4 figs. Hill laid off in benches and drilling is effected by Sullivan "Hyspeed" pistol drill with ¾-in. cylinder diameter.

Hoisting Machinery. Electric Cables at Mines. Iron & Coal Trades Rev., vol. 98, no. 2666, Apr. 4, 1919, pp. 405-407, 5 figs. Regulations proposed by various mining engineers in the light of their experience. Discussion of paper published in Iron & Coal Trades Rev., Feb. 21.

Laws. A Uniform Mining Law for North America, T. A. Godson. Can. Min. Inst. Bul., no. 84, Apr. 1919, pp. 399-405. Considers that present mining laws of Canada are not sufficiently adaptable to mining needs.

Revision of Mining Law of April 21, 1810 (Projet de revision de la loi des mines du 21 avril 1810), Couriot. Génie Civil, vol. 74, no. 12, Mar. 22, 1919, pp. 228-232. Modifications in regard to duration of concessions and sharing of profits with the state. Comparisons of French mining law with those of other nations.

Ore Handling. Unloading, Crushing, and Screening at the Arthur Mill of the Utah Copper Company, F. G. Janney. Min. & Sci. Press, vol. 118, no. 14, Apr. 5, 1919, pp. 464-470, 8 figs. Ore comes from mine in trains of 40 cars, which descend on 0.4 per cent grade over 150-ton Strait scale, equipped with Streeter-Amet automatic weighing and recording device, on which ore is weighed while train is moving at rate of two miles per hour.

Ore Reserves. Application of the Theory of Probability in the Determination of Ore Reserves, G. A. Watermeyer. Jl. Chem., Metallurgical & Min. Soc. of South Africa, vol. 19, no. 7, Jan. 1919, pp. 97-107 and (discussion), pp. 107-108, 5 figs. Studies whether there is a law governing distribution of values in determination of ore reserves. Object is to ascertain probability of predicting nature of ore penetrating to various depths from points sampled.

Pillar Supports. Pillar Supports in Fortuna Mines of Braden Copper Co., Chile (Método de explotacion en las minas Fortuna de la Braden Copper Co. de Chile Dejando columnas de sostenimiento), Charles Hollister. Ingenieria Internacional, vol. 1, no. 1, Apr. 1919, pp. 13-15, 2 figs. Results obtained by application of method used in Arizona of Ray Consolidated Copper Co.

Rand. Rand Mining in 1918, A. Cooper Key. Eng. & Min. Jl., vol. 107, no. 16, Apr. 19, 1919, pp. 702-703, 1 fig. Data showing past and present position of gold-mining industry.

Safety. Mine Officials and the Safety Problem, Edwin C. Curtis. Coal Indus., vol. 2, no. 4, Apr. 1919, pp. 141-142. Advises that an official be judged by good accident record rather than by his record of production.

Safety Lamps. Safety Lamp Gauges—IV, T. J. Thomas Colliery Guardian, vol. 117, no. 3039, Mar. 28, 1919, pp. 714-7f6, 3 figs. Velocities established in explosive mixtures: composition of air rendered extinctive by addition of dioxide and nitrogen; influence of inert gases on properties of firedamp mixtures; results of exposing methane and air mixtures to high temperatures without sparking.

Screening. Estimating Screen Efficiency, W. O. Bercherdt. Eng. & Min. Jl., vol. 107, no. 15, Apr. 12, 1919, pp. 651-653, 2 figs. Diagram of screen analysis on feed, undersize and oversize samples made on hand screen clothed with identical screening medium used on a mill screen.

Statistics. Mineral Statistics of Peru in 1917 (Estradistica Minera del Peru en 1917), Carlos P. Jimenez. Boletin del Cuerpo de Ingenieros de Minas del Peru, no. 95, 326 pp. Production of coal, oil, gold, silver, copper, lead, zinc, mercury, antimony, vanadium, molybdenum, tungsten, bismuth and natural salts.

Stripping. See Drilling and Stripping above.

Timbering. Safe and Efficient Mine Timbering—IV, R. Z. Virgin. Coal Indus., vol. 2, no. 4, Apr. 19f9, pp. 138-141, 4 figs. Cribbing, fore-poling under soft roof, timbering high places, inclined seams and using round, notched timber.

Ventilation. Mine Ventilation in the Coeur d'Alenes, Robert N. Bell. Eng. & Min. Jl., vol. 107, no. 14, April 5, 1919, pp. 603-604. Problem presented by air circulation at depth.

MINOR INDUSTRIAL MATERIALS

Barytes. Barytes, Percy A. Wagner. South African Jl. Industries, vol. 2, no. 2, Feb. 1919, pp. 143-146. Mode of occurrence and sources of supply; commercial uses; dressing and preparation; valuation and prices.

Magnesite. Magnesite on the Island of Margarita, Charles F. Z. Caracristi. Eng & Min. Jl.. vol. 107, no. 1, Apr. 12, 1919, pp. 645-647, 1 fig. Geological examination has led writers to believe that there are important magnesite deposits on Venezuelan Island.

Mercury. Quicksilver in 1917, F. L. Ransome. Dept. of Interior, U. S. Geol. Survey, Mineral Resources of U. S. A., 1917—Part I, pp. 367-455, Mar. 18, 1919. Statistics of production, including general review of important quicksilver deposits of the world, section on mining of quicksilver ores, and bibliography.

Saltpeter. Economics of Chile (Chile Economico), Pedro Luis Gonzalez. Boletin de la Sociedad de Fomento Fabril, vol. 35, no. 12, Dec. 1918, pp. 811-821. Special reference is made to mineralogy, metallurgy and saltpeter deposits.

TUNGSTEN. Wolfram Mining in Bolivia, G. F. J. Preumont. Eng. & Min. Jl., vol. 107. no. 14, Apr. 5, 1919, pp. 597-600. Development of industry in recent years. Bolivia is considered by writer as second in importance to Malay States in production.

Cobalt, Molybdenum. Nickel, Titanium, Tungsten, Radium, Uranium, and Vanadium in 1916, Frank L. Hess. Dept. of Interior, U. S. Geol. Survey, Mineral Resources of the U. S. A., 1916—Part I, pp. 775-807, Feb. 25, 1919. Statistics of production, importation and mining conditions.

OIL AND GAS

CALIFORNIA. Structure and Oil Resources of the Simi Valley, Southern California, William S. W. Kew, Dept. of Interior, U. S. Geol. Survey Bul., 691-M, Contributions to economic geology, 1918, part II, Apr. 3, 1919, pp. 323-347, Geology of oil fields.

DRILLING. The Percussion System of Drilling Oil Wells, Maurice A. Ockenden and Ashley Carter. Petroleum Times, vol. 1, no. 2, Mar. 22, 1919, pp. 219-222, 2 figs. Plant used in connection therewith. (To be concluded.) Paper read before Instn. Petroleum Technologists.

GAS TESTING. Testing Natural Gas for Gasoline Content, G. A. Burrell. Water & Gas Rev., vol. 29, no. 10, Apr. 1919, pp. 12-13, 2 figs. Apparatus which condenses gasoline vapor out of gas and measures yield.

GAS TRAPS. Traps for Saving Gas at Oil Wells, W. R. Hamilton. Dept. of the Interior, Bur. of Mines, tech. paper 209, petroleum technology 49, 34 pp. 19 figs. Types of traps; Their use is represented as advantageous in increasing gasoline content of gas and eliminating part of storage losses.

GEOLOGICAL SURVEYING. How a Petroliferous Region is Studied (Come is studia un giacimento petrolifero). Ingegneria Italiana, vol. 3, no. 63, Mar. 13, 1919, pp. 174-177. General examination, geoligical survey and financial study as preliminary steps before prospecting.

MONTANA. Anticlines in a Part of the Musselshell Valley. Musselshell, Meagher, and Sweetgrass Countries, Montana, C. F. Bowen. Dept. of Interior, U. S. Geol. Survey, Bul. 691-F, Contributions to economic geology, 1918, part II, Nov. 22, 1918, pp. 185-209, 1 fig. Previous investigators have asserted that there is an area in this region where the rocks have undergone considerable folding. On basis of this information work was conducted to determine measure and extent of folds and to examine possible occurrence of accumulations of oil and gas in them.

Oil and Gas Geology of the Birch Creek-Sun River Area, Northwestern Montana, Eugene Stobinger. Dept. of Interior, U. S. Geol. Survey. Bul.691-E, Contributions to economic geology, 1918, part II, Aug. 13, 1919, pp. 149-184, 4 figs. Presentation of unquestionable evidence having bearing on oil and gas prospects in specified area, including descriptions of broader features of geology and account of local structural characteristics which have been accounted as possible sources of oil and gas.

OKLAHOMA. New Development for Oil and Gas in Oklahoma during the past Year and Its Geological Significance, Geo. E. Burton. Bul. Am. Assn. Petroleum Geologists, vol. 2, pp. 53-59. From data submitted it is believed that the Pan. is much nearer the surface than it has been supposed.

PETROLEUM STRUCTURE. Petroleum Under the Microscope, no. 21, Spontaneous Ignition of Oil, James Scott. Petroleum World, vol. 16, no. 222, Mar. 1919, pp. 108-110, 3 figs. Showing formation of pyrites capable of inducing spontaneous ignition, owing to the comparatively large amount of space filled with gas.

SHALES. Oil Shales of the Great Uintah Basin, Utah, Don Maguire. Salt Lake Min. Rev., vol. 21, no. 1, Apr. 15, 1919, —. 21-26, 4 figs. Report of Mineralogical Survey. From Mineralogist & Metallurgist.

STORAGE. The Fireproof Storage of Petrol. Petroleum World, vol. 16, no. 222, Mar. 1919, pp. 128-132, 3 figs. Description of Martini and Hüneke pressure-type pumping plant. (To be continued).

TEXAS. Natural Gas Resources of Parts of North Texas. Dept. of Interior, U. S. Geol. Survey, Bul. 629, 1916, 129 pp., 20 figs. Estimates of gas remaining in development pool.

WATER. Water in Oil and Gas Wells, F. B. Tough. Petroleum Times, vol. 1, no. 2, Mar. 22, 1919, pp. 229-231. Formulæ for computing probable collapsing pressure for commercial sizes of casing.

PRECIOUS MINERALS

ARIZONA. Gold, Silver, Copper, Lead, and Zinc in Arizona in 1917, V. C. Heikes Dept. of Interior, U. S. Geol. Survey, Mines Report, Mineral Resources of U. S. A., 1917—Part I, pp. 509-548, Apr. 1, 1919, Figures of output in marketable form as obtained from smelters, refineries and mints; review of industries of entire country; production in terms of recoverable metal in ores and other material sold or treated during calendar year. Information relative to mining industry in respective states, counties and mining districts.

COLOMBIA. The Guamoco District of the Republic of Colombia—II, S. Ford Eaton. Eng. & Min. Jl., vol. 107, no. 14, Apr. 5, 1919, pp. 609-613, 2 figs. Peculiar transportation difficulties in gold mines.

IDAHO AND WASHINGTON. Gold, Silver, Copper, Lead and Zinc in Idaho and Washington in 1917, C. N. Gerry. Dept. of Interior, U. S. Geol. Survey, Mineral Resources of the U. S. A., 1917, part 1, pp. 457-507, Apr. 3, 1919. Statistics of production.

ONTARIO. The Gold-Quartz Lodes of Porcupine, Ontario, Ellsworth Y. Dougherty. Min. & Sci. Press, vol. 118, no. 16, Apr. 19, 1919, pp. 532-536, 8 figs. Occurrence of tourmaline and fledspar with coarsely crystalline and fluid enclosing ore-quartz led to classification of orebodies as high-temperature deposits, formed under great depth and pressure through the agency of igneous activity.

PLATINUM. An Investigation of Certain Canadian Platinum and Manganese Resources' G. C. Mackenzie. Can. Min. Inst. Bul., no. 84, Apr. 1919, pp. 425-434. Recovery from refining of Sudbury copper-nickel matte; report of examination of platinum occurrences in Alberta, British Columbia undertaken by Canadian Munition Resources Commission.

WASHINGTON. *See Idaho and Washington above.*

RAILROAD ENGINEERING

FOREIGN

ARGENTINA. The Railroad Development of the Argentine—I. Ry. Age, vol. 66. nos. 16 and 17, Apr. 18 and 25, 1919, pp. 1001-1005 and 1047-1050, 8 figs. Difficulties railways have been confronted with in the way of Government regulation, labor and taxation. Possible trend of future developments; figure of imports of railway material and discussion of possible markets for such supplies, Apr. 25: Problems in regulation, labor and taxation. Article sets forth that largest market for railway equipment is in South America.

AUSTRALIA. Australian Railways. Indus. Australian & Min. Standard, vol. 61, nos. 1582, 1583 and 1584, Mar. 6, 13 and 20, 1919, pp. 420-421 and 509, 463, 7 figs. General dimensions of Tasmanian and Western Australian types., Mar. 13; Queensland types of locomotives.

ENGLISH CHANNEL TUNNEL. The English Channel Tunnel. Sci. Am., vol. 120 no. 16, Apr. 19, 1919, pp. 398-399 and pp. 416-417, 5 figs. Plans for tunnel, showing its course, geological strata and system of drainage; also plans for tubes and a bridge.

The Channel Tunnel Scheme, A. E. Ritchie. Iron & Coal Trades Rev., vol. 98, no. 2666, Apr. 4, 1919, pp 403-404, 4 figs. Details of proposed scheme.

EUROPE. European Train Speeds. Ry. Gaz., vol. 30, no. 14, Apr. 4, 1919, pp. 607-609, 3 figs. Survey of highest, longest and fastest non-stop runs, speed of trains between two places and geographical distribution of important services. (Continuation of serial).

FOREIGN DEVELOPMENTS. Railway Developments in Foreign Countries, Ry. Age, vol. 66, no. 15, Apr. 11, 1919, pp. 957-962, 2 figs. Problem of unification of railways in China; shortage of railway equipment in Germany; electric railway projected from Stockholm to Goteborg; cross-section of proposed English Channel tunnel.

Railway Developments in Foreign Countries. Ry. Age, vol. 66, no. 17, Apr. 25, 1919, pp. 1056-1059. In Chile, Uruguay and China.

SPAIN. An Important Development in the Railways of Spain—III, F. Lavis, Ry. Age, vol. 66, no. 15, Apr. 11, 1919, pp. 945-949, 3 figs. Proposed direct line from France to Gibraltar through Madrid and its relation to other railways of Europe and those of South America.

URUGUAY. The Railways of Uruguay, William A. Reid. Ry. Rev., vol. 64, no. 16, Apr. 19, 1919, pp. 583-586, 7 figs. Agricultural interests served by three main systems.

BRAKES

STRAIGHT AIR BRAKE, AUTOMATIC. The Automatic Straight Air Brake. Ry. Mech. Engr., vol. 93, no. 4, Apr. 1919, pp. 195-198. Series of tests conducted by Bur. of Safety of the air-brake system of Automatic Straight Air Brake Co. of N. Y.

ELECTRIC RAILROADS

ELECTROPNEUMATIC DRIVING MECHANISM. Westinghouse Electro-Pneumatic Driving Mechanism of the Suburban Locomotives Used by the State Railways. (Equipment Westinghouse pour la commande électro-pneumatique des automotrices de banlieue des chemins de fer de l'Etat). L. Pahin. Industrie Electrique, vol. 28, no. 643, Apr. 10, 1919, pp. 128-131, 6 figs. Scheme of connections and diagram indicating closing order of the thirteen contacts. (To be continued).

RELAYS. A. C. Accessories, A. E. Tattersall. Railway Engineer, vol. 40, no. 471, Apr. 1919, pp. 77-80, 7 figs. Radial polyphase relays. (Concluded).

ELECTRIFICATION

ARGENTINA. Electrification of the Central Railway of Argentina (Electrificacion del ferrocarril central argentino). Ingenieria Internacional, vol. 1, no. 1, Apr. 1919, pp. 9-13, 4 figs. Details of power house.

ECONOMICS. Steam Railroad Electrification Calvert Townley. Can. Engr., vol. 36, no. 16, Apr. 17, 1919, pp. 387-388. Possibilities of electrification as affecting future railroading policies. Also in Proc. Am. Inst. Elec. Engrs., vol. 38, no. 4, Apr. 1919, pp. 541-547; Ry. Rev., vol. 64, no. 17, Apr. 26, 1919, pp. 615-616.

Railroad Electrification, F. H. Shepard. Southwestern Elecn., vol. 15, no. 2, Apr. 1919, pp. 18-19. Urgency of steam-railroad electrification is argued from veiwpoints of economy and service of electrical equipment. Paper presented at Annual Meeting of Eng. Inst. of Canada.

PANTAGRAPH FRAMES. Railroad Electrification Facts and Factors, A. J. Manson. Ry. Elec. Engr., vol. 10, no. 4, Apr. 1919, pp. 115-117, 6 figs. Construction details of pantagraph frames as determined by operating conditions.

WASHINGTON. Railway Electrification in Washington. Jl. Electricity, vol. 42, no. 7, pp. 311-313. Review of present status with description of equipment and construction work.

NEW CONSTRUCTION

BOILER POWER AND TRACTIVE POWER. Boiler Power Versus Tractive Power—I, William N. Allman. Boiler Maker, vol. 19, no. 4, Apr. 1919, pp. 106-108. Expressions for deriving tractive power for single-expansion locomotives.

Feedwater Heaters. Feed Water Heaters and Their Development—II, J. Snowden Bell. Railroad Herald, vol. 23, no. 5, Apr. 1919, pp. 109-112. From 1825-1849. (Continuation of serial.) Paper read before Am. Ry. Master Mechanics' Assn.

LOCOMOTIVES

Firing. Modern Locomotive Engine Design and Construction—XLVII. Railway Engineer, vol. 40, no. 471, Apr. 1919, pp. 69-77, 15 figs. Special methods of boiler firing: Liquid fuel; pulverized fuel.

Flues. Flues, George L. Price. Boiler Maker, vol. 19, no. 4, Apr. 1919, pp. 98-99. Methods employed in installing flues in stationary and locomotive boilers.

Gasoline-Electric Locomotive. Locomotive Notes and News, C. S. Lake. Model Engr. & Elecn., vol. 40, no. 936, Apr. 3, 1919, pp. 225-227, 3 figs. Gasoline-electric locomotive designed to haul 100 tons on the level, and built to run on 2-ft. gage. It is equipped with a 45-hp. four-cylinder gasoline engine, which drives through a flexible coupling, a 30-kw. ventilated-type direct-current generator.

Hanger Levers. General Observations of the Design of Hanger Levers for Locomotives, Victor M. Summa. Ry. & Locomotive Eng., vol. 32, no. 4, Apr. 1919, pp. 103-105, 5 figs. Stresses in a plain flat-bar lever subjected to forces lying in plane of bar.

Mallet. Latest Mallet Type of Locomotive for the Southern Railway—Baldwin's Fifty-Thousandth Engine. Ry. & Locomotive Eng., vol. 32, no. 4, Apr. 1919, pp. 97-99, 2 figs. Articulated type with 2-8-8-2 wheel arrangement in operation on Southern railway. Also in Ry. Jl., vol. 25, no. 5, May 1919, pp. 17-21, 4 figs.

P. & R. 2-8-2. P. & R. Large 2-8-2 Type Locomotive. Ry. Mech. Engr., vol. 93, no. 4, Apr. 1919, pp. 175-177, 5 figs. Tractive effort is 61,260 lb.; boiler has combustion chamber and 2-in. tubes 13 ft. 6 in. long.

French Express Locomotives. The Development of Express Locomotives in France, M. Herdner. Engineer, vol. 127, no. 3299, Mar. 21, 1919, pp. 270-272, 9 figs. From 1878-1918. Presidential address before Société des Ingénieurs Civils de France.

Standard Locomotives. Light and Heavy Standard Pacific Type Locomotives. Ry. Age, vol. 66, no. 15, Apr. 11, 1919, pp 950-954, 10 figs. Railroad Administration Standard designs having details interchangeable with other types.
Standard 2-8-8-2 Type Locomotives. Ry. Mech. Engr., vol. 93, no. 4, Apr. 1919, pp. 187-190, 5 figs. Locomotive is 6000 lb. heavier than that built by the Norfolk & Western; working steam pressure is 240 lb. per sq. in. tractive effort, compound, is 106,000 lb.

OPERATION AND MANAGEMENT

Accounting. Railway Accounting of Carriage Paid Goods Train Traffic, L. C. Webber Reed. Ry. Gaz., vol. 30, no. 13, Mar. 28, 1919, pp. 564-565. Arguments in favor of economies which writer claims would be effected if it were made compulsory that all freight-train traffic should be consigned carriage paid.

Car Equipment, Inspection and Maintenance. Unification of Inspection and Maintenance of Car Equipment, J. J. Tatum, Official Proc. Central Ry. Club, vol. 27, no. 2, Mar. 1919, pp. 575-579 and (discussion); pp. 579-606. Selection of inspectors; their duties and responsibilities.

Lighting. Railway Lighting and Its Maintenance, A. Cunnington. Ry. Gaz., vol. 30, no. 12, Mar. 21, 1919, pp. 525-527. Standardization of lamps; illumination measurements; system of distance control. Paper read before Illuminating Eng. Soc.

Road Motor Vehicle Department. Organization of a Railway Company's Raad Motor Vehicle Department. Ry. Gaz., vol. 30, no. 15, Apr. 11, 1919, pp. 639-645, 16 figs. Practice of Great Western R.R.

San Diego & Arizona Railway. Heavy Railway Construction Along Mexican Border. Ry. Age, vol. 66, no. 15, Apr. 11, 1919, pp. 931-934, 5 figs. Construction of San Diego & Arizona Ry.; seventeen tunnels are being driven in 11-mile gap.

Train Loading. Securing the Maximun Efficiency in Train Loading, T. H. Williams. Ry. Age, vol. 66, no. 17, Apr. 25, 1919, pp. 1051-1053. High ratio of actual tonnage moved to rating of engines. Heavy loading promotes fuel economy. Paper presented before Pac. Ry. Club.
Train and Engine Loading, T. H. Williams. Ry. Rev., vol. 64, no. 14, Apr. 5, 1919, pp. 507-508. Discussion of subject in regard to means for keeping up practice of loading engines up to full rating and losses accruing when such practice is not followed closely.

PERMANENT WAY AND BUILDINGS

Curvature. Effect of Curvature on Railway Maintenance of Way. Eng. & Contracting, vol. 51, no. 16, Apr. 16, 1919, p. 397, 1 fig. Graph indicating relation between wear of rail on straight line as compared with that on curves.

Slip. The Slip at Wembley Cutting, Great Central Railway. Ry. Gaz., vol. 30, no. 12, Mar. 21, 1919, pp. 528-534, 17 figs. Measures for reconstructing embankment and restoring traffic through cutting. Slip occurred in portion of cutting where maximum depth is about 60 ft.

Ties. Zinc Chloride Treatment for Railroad Ties. Eng. & Contracting, vol. 51, no. 16, Apr. 16, 1919, pp. 394-395. Influence of conditions of wood before treatment; leaching of zinc salt. From report of Committee on Wood Preservation of Am. Ry. Eng. Assn.
The Preservation of Railway Ties, H. K. Wicksteed. Can. Ry. & Mar. World, no. 254, Apr. 1919, pp. 174-176. Process based on coating to exlcude moisture.

Track Reclamation. The Reclamation of Electric Railway Track by Welding and Grinding, H. Jackson Tippett. Elec. Ry. Jl., vol. 53, no. 16, Apr. 19, 1919, pp. 773-776, 9 figs. Adaptability of various types of welding and grinding equipment to prevent rapid deterioration of rail joints, particularly of those in paved streets. Paper read before Conn. Soc. Civil Engrs.

Tunnel, Mount Royal. The Mount Royal Tunnel, J. L. Busfield. Jl. Eng. Inst. of Canada, vol. 2, no. 4, Apr. 1919, pp. 267-298, 40 figs. Construction of tunnel and terminal for Canadian railway at Montreal; tunnel is 16,315 ft. long and its construction required the excavation of 422,358 cu. yd. of rock.

RAILS

Stresses in Rails. Stresses in Rails (Détermination des efforts développés dans le métal des rails des voies ferrées), T. Godard and M. Pigeaud. Annales des Ponts et Chaussées, partie techinque, vol. 47, no. 6, Nov.-Dec. 1918, pp. 273-327, 8 figs. Formulæ for determining stresses due to supports not being on same level. Expressions are applicable when loads acting are or may be considered as static. A criticism is offered on Cuard's conclusions in this direction.

ROLLING STOCK

Coal-Hopper Cars. Broad Gauge Steel Coal Hopper Cars Built in Canada for Bengal-Nagpur Railway. Can. Ry. & Mar. World, no. 254, Apr. 1919, pp. 169-170. Some of general dimensions are: Length over buffers, 41 ft. 3 in.; length over end sill, 37 ft. 1 in.; length of body inside, 35 ft.; capacity, 100,000 lb.

Concrete Gondola Cars. Reinforced Concrete Gondola Cars. Eng. World, vol. 14, no. 7, Apr. 1, 1919, pp. 45-46, 2 figs. Design in accordance with U. S. R. R. Administration standards as a 100,000-lb. capacity coal car, plus 10 per cent for overload. Also in Ry. Mech. Engr., vol. 93, no. 4, Apr. 1919, pp. 193-195, 3 figs.

Frame Brake for Cars. Automatically Returning Frame Brake for Railroad Cars (Châssis-frein à retour automatique pour l'arrêt des wagons). Génie Civil, vol. 74, no. 13, Mar. 29, 1919, p. 257, 4 figs. Inclined girders cause car to move up inclined plane to horizontal rails where wheels are locked; motion of car drags frame; when car is moved in opposite direction it drags frame to starting place where buffer stop fastens frame; traction effort releases car.

Lumber for Freight Cars. Treated Lumber for Freight Cars. Ry. Mech. Engr., vol. 93, no. 4, Apr. 1919, pp. 198-200. Method of treating wooden parts of car construction.

SAFETY AND SIGNALING SYSTEMS

Automatic Train Control. Automatic Train Control on the Chesapeake & Ohio R.R. Ry. Rev., vol. 64, no. 14, Apr. 5, 1919, pp. 541-546, 9 figs. System installed is that of Am. Train Control Co. of Baltimore. Description of system and account of tests performed. Also in Ry. Signal Engr., vol. 12, no. 4, Apr. 1919, pp. 131-134, 7 figs.

Signal Failure. I. C. C. Report on the Collision on the Frisco. Ry. Signal Engr., vol. 12, no. 4, Apr. 1919, pp. 126-129, 4 figs. Accident reported to have been caused by dispatcher failing to transmit train order and engineman to obey signal indication.

Specifications. Specification for Electric Motor, Switch Operating and Locking Mechanism. Ry. Signal Engr., vol. 12, no. 4, Apr. 1919, p. 113. Concerns operating requirements, general design, dielectric tests, bearings and paint. Prepared by Committee of Am. R. R. Assn.
Specifications for Power Interlocking Machine. Ry. Signal Engr., vol. 12, no. 4, Apr. 1919, pp. 114-115. Prepared by Committee of Am. R. R. Assn.

SHOPS

Columbus Roundhouse. A Complete Modern Engine Terminal Installation. Ry. Age, vol. 66, no. 16, Apr. 18, 1919, pp. 994-997, 8 figs. Reinforced-concrete 20-stall roundhouse of Toledo & Ohio Central at Columbus.

Re-Boilering of Locomotives. The Re-Boilering of Locomotives. Ry. Gaz., vol. 30, no. 13, Mar. 28, 1919, pp. 575-576, 2 figs. Work done in shops of London & N. W. R.R.

Torrance Shops. New Car Shops at Torrance, Clifford A. Elliot. Elec. Traction, vol. 15, no. 4, Apr. 15, 1919, pp. 234-238, 3 figs. For the repairing and overhauling of equipment and the building of box cars.

Welding. Oxy-Acetylene Welding in Railroad Shops, W. L. Bean. Ry. Jl., vol. 25, no. 5, May 1919, pp. 21-23. Concerning ease and efficiency of operation. Also in Ry. Rev., vol. 64, no. 14, Apr. 5, 1919, pp. 513-515.
Spot Welding Applied to Railroad Tinware. Ry. Elec. Engr., vol. 10, no. 4, Apr. 1919, pp. 127-128, 3 figs. Process followed by Illinois Central.

SPECIAL LINES

Rack Railways. Rack Railways (Ferrocarriles de cremallera), Fabio Gonzalez Tavera. Anales de Ingenieria, vol. 26, nos. 309 and 310, Dec. 1918 and Jan. 1919, pp. 137-147. Weigh of locomotive in terms of total weight of train to be pulled up a given slope. Riggenbach, Bissinger, Abt. Strub, and Locher types of rack.

STREET RAILWAYS

Concrete Stations. Shelters and Stations on Pacific Electric's Interurban Lines, Clifford A. Elliott. Elec. Ry. Jl., vol. 53, no. 15, Apr. 12, 1919, pp. 733-734, 5 figs. Unit-slab concrete structure.

Subway Stations. Philadelphia City Hall Subway Station, Harry Gardiner. Eng. World, vol. 14, no. 7, Apr. 1, 1919, pp. 15-22, 12 figs. Details of supports showing series of I-beams, girders and concrete construction.

ZONE FARES. Zone Tickets Adopted for Portland. Elec. Ry. Jl., vol. 53, no. 15, Apr. 12, 1919, pp. 728-731, 2 figs. Fare system is based on central zone from 2.5 to 4 miles in radius and sub-division of all exterior lines into zones of varying length.

The Zone Fare in Practice—Aberdeen, Walter Jackson. Elec. Ry. Jl., vol. 53, no. 17, Apr. 26, 1919, pp. 814-822, 17 figs. Combination zone and universal fare in city of 165,000 is claimed to stimulate both short-haul and long-haul riding.

TERMINALS

CHICAGO. The Chicago Railway Terminals, E. J. Noonan Eng. World, vol. 14, no. 7, Apr. 1, 1910, pp. 29-35, 4 figs. Report of Chicago Railway Terminal Commission, and work of commission on yards and terminals of Am. Ry. Assn. Problem of transportation in Chicago is presented with illustrations of amount of work it involves.

SAN FRANCISCO. Railway Terminal Improvements on the San Francisco Water Front Charles W. Geiger, Ry. Rev., vol. 64, no. 16, Apr. 19, 1919, pp. 571-576, 9 figs. Spur track connections from piers to state-owned belt line behind water-front.

SEWELL'S POINT VIRGINIAN RAILWAY. The Virginian Ry. Co.'s Pier, Sewell's Point —I. Coal Trade Jl., vol. 50, no. 16 and 17, Apr. 16 and 23, 1919, pp. 404-406, 445-447, 7 figs. Plant includes double car dumper capable of handling two 60-ton railroad cars at the same time, completing cycle in 2 min. Apr. 23: Coal from the mines is dumped into self-cleaning and self-propelling transfer cars of 120 tons capacity for dumping, cars are raised to required level by transfer-car elevator.

ZURICH (SWITZERLAND). Enlargement of the Chief Railway Station at Zürich (Die Erweiterung des Hauptbahnhofes Zürich). Schweizerische Bauzeitung, vol. 72, nos. 22 and 23 and vol. 73, nos. 1 and 8:Nov. 30, Dec. 7, 1918, and Jan. 4.-Feb. 22, 1919, pp. 216-218, 223-225, 5-6 and 77-80, 24 figs. Discusses advantages and disadvantages of various proposals for arranging lines of railways converging on Zürich, some showing it as terminus and others as a through station. (To be continued.)

INDUSTRIAL TECHNOLOGY

ACETYLENE PRODUCTS. Principal Organic Compounds Derived from (Les principaux composés organiques dérivés de l'acetylène), D. Florentin. Génie Civil, vol. 74, no. 12, Mar. 22, 1919, pp. 235-236. Industrial synthesis of alcohol, acetic acid, acetic anhydride and the acetic ethers. (Concluded.)

AMMONIUM NITRATE. Effecting and Controlling Crystallization of Ammonium Nitrate. J. Esten Bolling. Chem. & Metallurgical Eng., vol. 20, no. 8, Apr. 15, 1919, pp. 401-405, 9 figs. Crystallizing process employed at U. S. Ammonium Nitrate Plant. Survey of air conditioning features involved and their relation to entire process of refrigeration.

AMMONIUM SULPHATE. Manufacture of Ammonium Sulphate from Cyanamide (La fabrication du sulfate d'ammoniaque en partant de la cyanamide). Journal du Four Electrique, vol. 28, no. 6, Mar. 15, 1919, pp. 44-46. Cyanamide is decomposed by water under pressure; the ammonia gas is then brought in contact with dilute sulphuric acid.

BENZOL. Manufacture of Benzol in Sestao Iron Works (Fabricaion de benzol en la fabrica de Hierro de Sestao). Revista Minera, vol. 70, no. 2678, Mar. 1, 1919, pp. 105-107. Process followed, with remarks on adaptation of installation to coke furnaces.

BY-PRODUCTS. Importance of By-Products During the War, C. G. Atwater. Gas Age, vol. 43, no. 7, Apr. 1, 1919, pp. 339-343, 5 figs. Light oil stills and accessory plant of Barrett Co.

COAL BY-PRODUCTS. Coal: Its Value as a Raw Material for Distillation Products—II, J. A. Wilkinson. South African Jl. Industries, vol. 2, nos. 1 and 2, Jan. and Feb. 1919, pp. 74-85 and 178-185. Liquid distillation products of coal and processes by which they are obtained. Feb. Distillation of coal tar, oils and pitch.

Coal and Gas-Tar Derivatives of Growing Importance, C. W. Botkin. Colorado School of Mines, Mag. vol. 9, no. 4, Apr. 1919, pp. 78-80, 3 figs. Chart indicating from whence these materials are derived, with description of their nature, properties and method of manufacture.

Carbonizing Processes and Coal Utilization and Conservation, W. A. Bone. Gas Journal, vol. 145, no. 2915, Mar. 25, 1919, pp. 632-635. Uses of coal in the United Kingdom in 1913. Works in which writer believes complete by-products recovery is possible; commercial prospects for low temperature carbonization. Address delivered before Roy. Soc. of Arts.

COATED PAPER. Casin and Coating Mixtures, E. Sutermeister. Paper, vol. 24, no. 7, Apr. 23, 1919, pp. 15-80 & 50. Suggestions for overcoming brush marks and froth pits in manufacture of coated paper.

DECOLORIZING CARBONS. Investigations on Vegetable Decolorizing Carbons, using "Carboraffin"—VI, Stanek. Int. Sugar Jl., vol. 21, no. 244, Apr. 1919, pp. 168-171, 1 fig. Preparation of vegetable carbons from cellulose according to Austrian patent and their use in sugar refineries. "Carboraffin" is said to be so powerful that its effect equals that obtained with 8-15 per cent of annual charcoal. From Tijdschrift der Vereeniging van Beetwortelsuikkerfabrikantem, no. 8, 1919, pp. 116-122.

ETHYLENE. Ethylene, William Malisoff and Gustav Egloff. Jl. Phys. Chem., vol. 23, no. 2, Feb. 1919, pp. 65-138. Collection of data on ethylene, covering physical and chemical properties; formation in chemical reactions by decomposition; decomposition; catalysis; analytical and biological data; research possibilities.

FRANCE. France's Chemical Industries as they are, Camille Matignon. Chem. Engr., vol. 27, no. 3, Mar. 1919, pp. 55-58. France is said to be fully equipped with series of chemical industries competent to supply the most of the republic's chemical needs.

FULMINATE MERCURY. Determination of Impurities in Fulminate of Mercury (Recherches sur le fulminate de mercure et quelques-unes de ses impuretés). Paul Nicolardot and Jean Boudet. Bul. Société Chimique de France, vols. 25-26, no. 3, Mar. 1919, pp. 119-122. Result of utilizing sodium hyposulphite in treatment of residues in manufacture of fulminate.

GALLIUM. The Purification of Gallium by Electrolysis, and the Compressibility and Density of Gallium. Theodore W. Richards and Sylvester Rover. Jl. Am. Chem. Soc., vol. 41, no. 2, Feb. 1919, pp. 133-134. Examination of methods recommended by various writers.

GAS MANUFACTURE. Low-Temperature Carbonization in Relation to the Production of Motor Spirit, Fuel Oils, Smokeless Fuel and Power Gas, F. D. Marshall. Iron & Coal Trades Rev., vol. 98, no. 2661, Feb. 28, 1919, pp. 251-254, 5 figs. Diagram showing heat losses per lb. of coal and low-temperature fuel, also products obtainable by low-temperature system of carbonization and gasification of smokeless fuel; example of results obtained by low-temperature carbonizing at under 1,200 deg. fahr.; installation of Tozer retorts.

GLASS. Optical Glass. Nature, vol. 103, no. 2578, Mar. 27, 1919, pp. 65-67, 3 figs. Developments in manufacture of homogeneous glass, particularly during time of war.

The Technique of Optical Glass Melting, Clarence N. Founer. Jl. Am. Ceramic Soc., vol. 2, no. 2, Feb. 1919, pp. 102-145, 7 figs. Activities of Geophysical Laboratory in its work of co-operation with manufacturers of optical glass.

An Improved Method of Optical Glass Manufacture, George W. Morey. Jl. Am. Ceramic Soc., vol. 2, Feb. 1919, pp. 146-150. Modification of filling operation to prevent surface becoming high in silica.

LIGHT, ULTRA-VIOLET. Ultra-Violet Light in the Chemical Arts—XXIII, Carleton Ellis and A. A. Wells, Chem. Engr., vol. 27, no. 3, Mar. 1919, pp. 73-74. Further conclusions regarding absorption spectra of some of primary alcohols, and of confectionery colors and dyes.

LIGHT OILS. What Can Be Done with Light Oil Plants, W. H. Fulweller. Gas Age, vol. 43, no. 8, Apr. 15, 1919, pp. 415-417, 1 fig. Fifty plants for recovery of tolulene from illuminating gas were built during war. Article discusses possibility of utilizing these plants for recovery of light oils from illuminating gas in competition with gasoline for motor fuel. Paper read before Am. Gas. Assn.

NITRIC ACID. The Theory of Absorption Towers for Nitric Acid Manufacture, J. R. Partington and L. H. Parker. Jl. Soc. Chem. Indus., vol. 38, no. 6, Mar. 31, 1919, pp. 75T-80T, 2 figs. Efficiency of a tower system said to depend on two factors, rapidity and completeness of absorption and concentration of solution produced.

NITROGEN PRODUCTS. How the Nitrogen Problem Has Been Solved, Henry Jermain Maude Creighton. Jl. Franklin Inst., vol. 187, no. 4, Apr. 1919, pp. 377-408, 14 figs. Five methods: Direct oxidation of nitrogen to its oxides with subsequent formation of nitric acid or nitrates, as exemplified in the arc process: direct combination of nitrogen with hydrogen to form ammonia,as typified by the Haber process; absorption of nitrogen by metals in form of nitrides (Sernek process); conversion of nitrogen into cyanides (Bucher process). (To be concluded.)

Oxidation of Nitrogen Bioxide by Dry Air (Sur l'oxydation du bioxyde d'azote par l'air sec), André Sanfourschc. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 6, Feb. 10, 1919, pp. 307-310. Measurement of influence of temperature on speed of oxidation. Temperature was varied from 50 to 525 deg. cent.

PITCH. The Softening Point of Pitch, Percy E. Spielmann and G. Campbell. Petrie Jl. Soc. Chem. Indus., vol. 38, no. 6, Mar. 31, 1919, pp. 68T-70T. 2 figs. Attempt to characterize it by numerical value. Recourse was had to biting test, change of appearance, twisting test, bending and sagging dropping tests.

RUBBER. Effect of Certain Accelerators upon the Properties of Vulcanized Rubber, G. D. Kratz and A. H. Flower. Chem. & Metallurgical Eng., vol. 20, no. 8, Apr. 15, 1919, pp. 417-420, 2 figs. Experimental data on activity of certain organic and inorganic accelerators. It is asserted that magnesia in small amount is less active than certain organic accelerators, and does not impart to mixtures physical improvement characteristic of latter.

RUBBER, SYNTHETIC. Development of Artificial Rubber During the War (Die Entwicklung des Künstlichen Gummis im Kriege), Dr. Duisberg. Kunststoffe, vol. 8, no. 11, June 1, 1918, pp. 121-122. The carbide process: Acetylene obtained from calcium carbide and water is changed into acetaldehyde and this is oxidized into acetic acid; this latter, when blown over a contact substance, yields acetone, carbonic acid being split off during the process.

SALT. The Recovery of Salt from Sea-Water, F. H. Mason. Min. & Sci. Press, vol. 118, no. 16, Apr. 19, 1919, pp. 528-530, 1 figs. Process followed by Western Salt Co. at San Diego, Cal.

SAMPLING (PULP). Sampling Practice at Independence Mill, Claude T. Rice. Eng. & Min. Jl., vol. 107, no. 15, Apr. 12, 1919, pp. 641-644, 6 figs. Some of features are mechanical bucking apparatus and sample mixer and divider, both of which devices are said to have proven satisfactory for final handling of pulp.

SELENIUM. Selenium and Its Present Uses (Le Sélénium et ses applications actuelles), Louis Ancel. Chimie & Industrie, vol. 2, no. 3, Mar. 1, 1919, pp. 245-259, 14 figs. Occurrences and properties of selenium in various allotropic states; its utilization in biological chemistry, glass and caoutchouc industries, electrical apparatus and electrochemistry.

SILICON TETRACHLORIDE. Silicon Tetrachloride, Otis Hutchins. General Meeting Am. electrochemical Soc., Apr. 3-5, 1919, paper no. 18, pp. 245-256. Experimental work undertaken by electrochemical plant in developing commercial process for preparing silicon tetrachloride.

The Role Played by Silicon and Titanium Tetrachlorides During the Past War, G. A. Richter. General meeting Am. Electrochemical Soc., Apr. 3-5, 1919, paper no. 13, pp. 187-195. Physical properties of these chlorides and study of their reaction with moisture, or with ammonia gas, or with both to produce smoke clouds; ship apparatus and trench apparatus used for producing smoke clouds.

Sugar. The Loss of Moisture from Sugar Samples Under Different Methods of Preservation, C. A. Browne and G. H. Hardin. La. Planter & Sugar Mfr., vol. 62, no. 15, Apr. 12, 1919, no. 233-234 Table of changes in moisture and polarization of sugar samples in unsealed tin cans; compiled from data obtained in N. T. Sugar Trade Laboratory. Paper before Am. Chem. Soc.

Sulphuric Acid. The Sulphuric Acid Industry, M. Rindl. South African Jl. Industries, vol. 2, no. 2, Feb. 1919, pp. 125-134. Production, uses, grades, prices, manufacture in Union of South Africa.

Erection of Hugh Sulphuric, Nitric, Mixed Acid and Denitrating Plant under War Pressure, H. E. and C. E. Hollister. Chem. & Metallurgical Eng., vol. 20, no. 8, Apr. 15, 1919, pp. 406-412, 11 figs. Construction of one of the largest acid plants in the country, under adverse climatic conditions and insufficient transportation facilities.

Tanning Materials. Notes on Australian Tanning Materials and the Manufacture of Sole-Leather, F. A. Coombs. Jl. Soc., Chem. Indus., vol. 38, no. 6, Mar. 31, 1919, pp. 70T-74T. Comparative tests conducted at Sydney Technical College to ascertain value of tannins in barks of E sideraphloia.

Tar Distillation. Tar Distilleries (Les distilleries de goudron), W. Solton. Journal des Usines à Gaz, vol. 43, no. 7, Apr. 5, 1919, pp. 97-104. 13 figs. Machines and process of distillation followed by Sulzer Frères of Winterthur. From Bulletin Technique de la Suisse Romande, no. 16, Aug. 11, 1917.

Water Gas. Bituminous Generator Fuel, R. G. Krumrey. Gas Rec., vol. 15, no. 7, Apr. 9, 1919, pp. 217-220, 1 fig. Comparison of operating data and results for coke and coal as generator fuel in a water-gas machine. Paper read at Wis. Gas Convention.

MARINE ENGINEERING

AUXILIARY MACHINERY

Compasses. The Gyroscopic Compass, Pac. Mar. Rev., vol. 16, no. 4, Apr. 1919, pp. 105-106, 1 fig. Sperry gyroscopic compass equipment for merchant vessels.

SHIPS

Concrete Ships. Economic Size of Concrete Ships, E. O. Williams. Eng. & Contracting, vol. 51, no. 18, Apr. 30, 1919, pp. 463-465, 1 fig. Curves showing various comparisons between concrete ships and steel.

Diesel Engine. Diesel Engine or Steam Engine, Shipbuilding & Shipping Rec., vol. 13, no. 13, Mar. 27, 1919, pp. 381-382. Discussion of relative economies in marine-engine practice.

Electric Propulsion. Electric Propulsion as Developed on Battleship New Mexico. Elec. Rev., vol. 74, no. 15, Apr. 12, 1919, pp. 579-584, 6 figs. Electrical features of propelling equipment, specially the two turbine-generators and four induction motors direct-connected to propellers.

Electrical Propulsion of Ships, J. F. Nielson, Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 432-437. Electrical transmission gears compared with mechanical gears. Emphasis is laid upon greater immunity from total breakdown possessed by electrical method, due to possibility of utilizing a plurality of motor and generator units.

Electric Drive of the U. S. S. New Mexico, Elec. World, vol. 73, no. 16, Apr. 19, 1919, pp. 780-783, 5 figs. Machinery is divided into two parts and ship is said to be able to make 17 knots with half of machinery disabled.

Electrical Equipment. Generating Machinery for Merchant Ships, F. P. Fenton. Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 451-453, 4 figs. Considered in various aspects, such as pressure of supply and type of current, character of primer mover and generator, type of coupling, position of plant in the ship and requirements of various classes of vessels.

Electric Light and Power Circuits on Board Ship, O. H. Kennedy, Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 438-443, 8 figs. Diagrams showing system and methods of control.

Propellers. Experimental Research of the Turning Action of a Propeller in a Ship Richerche sperimentali interno all azione evolutiva esercitata dalle eliche). N. Pecoraro. Revista Maritima, vol. 52, no. 2, Feb. 1919, pp. 175-192, 3 figs. Formula for angle to which rudder has to be inclined in order for the ship to maintain a straight course when only one propeller is operated; experimental confirmation of theoretical results.

Graphic Solution of Propeller Formulae, J. S. Redshaw. Shipbuilding & Shipping Rec., vol. 13, no. 15, Apr. 10, 1919, pp. 436-437, 2 figs. Charts for determining diameters for three-bladed propellers by solution of Taylor's formula and Taylor's *p* value.

Smokebox Locks. "Sturdun" Patent Smokebox Locks. Steamship, vol. 30, no. 358, Apr. 1919, pp. 234-235, 2 figs. Invention devised for locking smokebox door.

Standardized Ships. The "Standardized" Ship Schenectady. Am. Mar. Engr., vol. 14, no. 4, Apr. 1919, pp. 5-7, 3 figs. Vessel is designed for deadweight capacity of 7500 tons, total displacement loaded being estimated at 11,200 tons.

Typical U. S. Turbine Driven Carrier. Shipping, vol. 7, no. 4. Apr. 26, 1919, pp. 15-16 and 18, 4 figs. Mechanical equipment of geared-turbine-driven ship "Schenectady."

TERMINALS

Canadian Terminals. The Canadian Government's Ocean Terminals. Mar. Eng. of Canada, vol. 9, no. 3, Mar. 1919, pp. 112-114, 4 figs. Progress on project involving expenditure of $30,000,000.

Charleston. *See Wood Construction below*

Coaling. Coaling Ships Mechanically—I, Wilbur M. Stone. Coal Trade Jl., vol. 50, no. 18, Apr. 30, 1919, pp. 479-483, 5 figs. Mitchener coaling apparatus. Elevator automatically frees itself in case of overload without interrupting operations.

Electrical Equipment. Electrical Service at Great Seaboard Terminal. Elec. World, vol. 73, no. 16, Apr. 19, 1919, pp. 784-787, 4 figs. Electrical agencies include elevators, cranes and industrial tractors and trailers.

Elevators. Concrete Shipside Elevator and Warehouse. Concrete Age, vol. 29, no. 6, Mar. 1919, pp. 10-11, 3 figs. Dimensions and operating equipment.

Mechanical Equipment. The Port of Seattle, G. F. Nicholson. Eng. World, vol. 14, no. 8, Apr. 15, 1919, pp. 11-14, 3 figs. Mechanical equipment for handling miscellaneous freight.

New Orleans. New Orleans Army Base Improves Facilities of the Port, George H. Davis. Eng. News-Rec., vol. 82, no. 17, Apr. 24, 1919, pp. 823-826, 5 figs. Three concrete warehouses tied to 2000-ft. wharfhouse on river by bridges permitting access to all floors.

St. John, N.B. Wooden Shipbuilding Activities at St. John, N.B. Mar. Eng. of Canada, vol. 9, no. 3, Mar. 1919, pp. 110-111. Description of harbor and port.

San Francisco. Port Facilities and Freight Handling. Jl. Electricity, vol. 42, no. 7, Apr. 1, 1919, pp. 294-297, 5 figs. Plans for the improvement of San Francisco Harbor through the adoption of mechanical freight-handling devices.

Seattle. *See Mechanical Equipment above.*

Wood Construction. Wood Construction Feature of Charleston Port Terminal, Hunley Abbott. Eng, News-Rec., vol. 82, no. 15, Apr. 10, 1919, pp. 702-706, 6 figs. Particulars of quartermaster depot for storage and shipment of materials.

YARDS

Castings. Castings Used in Ship Construction, Ben Shaw and James Edgar. Foundry Trade Jl., vol. 21, no. 207, Mar. 1919, pp. 151-156, 17 figs. Preparation of molds for stem pieces.

Concrete Car Floats. Hudson River Shipyard Layout to Build Concrete Car Floats, H. W. Eldridge. Eng. News-Rec., vol. 82, no. 15, Apr. 10, 1919, pp. 732-734, 5 figs. Concrete placed for 1600-ton vessels from stiff-leg chute tower.

Cranes. Modern Shipyard Cranes, Claude M. Toplis. Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 408-412, 4 figs. Comparison of crane systems; double cantilever crane running on high gantry, overhead bridge traveling crane, jib crane running on high gantry and tower crane system.

Davey Plant at Lauzon, Can. The Davey Shipbuilding Plant at Lauzon. Mar. Eng. of Canada, vol. 9, no. 3, Mar. 1919, pp. 105-107, 6 figs. Installation for building wooden steamers, steel trawlers and large steel steamers.

Electrical Equipment. Electrical Equipment of a Modern Shipyard, A. Henderson. Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 400-407, 14 figs. Central station containing four 450-kw. Westinghouse rotary converters, which convert the 3300-volt, 3-phase, 50-cycle supply to 240 volts continuous current for distribution through out works.

Ford Method Ford Methods in Ship Manufacture—V. Fred E. Rogers. Indus. Management, vol. 57, no. 5, May, 1919, pp. 367-372, 12 figs. Electric rivet heating and welding, flame cutting and boring propeller-shaft bearings.

Ford Shipbuilding Plant, River Rouge, Mich. Am. Architect, vol. 115, no. 2259, Apr. 9, 1919, pp. 526-529, 9 figs. Operation in assembled shop. Boats are assembled on a line of trucks moving on standard-gage railroad tracks.

Framing, Millar System. SS. "Clan MacWilliam." Shipbuilding & Shipping Rec., vol. 13, no. 13, Mar. 27, 1919, pp. 375-376, 3 figs. Construction on Millar's patent system of framing. Deadweight 10,250 tons, on 26 ft. 10½ in. draft.

German Shipbuilding. German Shipbuilding and the Revolution. Shipbuilding & Shipping Rec., vol. 13, no. 13, Mar. 27, 1919, pp. 373-374. Competition with foreign yards deemed impossible.

Halifax Shipyards. Halifax Shipyards Embraces Old and New Industry. Mar. Eng. of Canada, vol. 9, no. 3, Mar. 1919, pp. 97-99, 3 figs. Plant equipped with graving dock and deep-water wharf, also marine railway.

Vickers, Canadian Plant. Canadian Vickers have Well-Equipped Plant. Mar. Eng. of Canada, vol. 9, no. 3, Mar. 1919, pp. 89-93, 5 figs. Growth of shipbuilding industry on banks of St. Lawrence.

Welding. Electric Welding as Applied to Ship Construction, H. Jasper Cox. Mech. Eng., vol. 41, no. 5, May 1919, pp. 439-444, 11 figs. Variables which affect efficiency of weld. Investigations to determine possibility of application of electric welding to shipbuilding. General scope of experiments included principally determination of modulus of elasticity and approximate elastic limit; ultimate strength and ultimate elongation; application of alternating stresses with (a) rotating specimens, (b) stationary test pieces. Paper presented before Soc. Naval Architects and Mar. Engrs.

Electric Welding Applied to Shipbuilding, J. H. Collie. Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 421-427, 22 figs. After reference to general systems of welding that are available, writer describes particular systems now mostly in use and then passes on to the question of testing electric welds.

Wooden Ships. Building Wooden Ships for French Government. Mar. Eng., of Canada, vol. 9, no. 3, Mar. 1919, pp. 94-96, 7 figs. General layout of Montreal plant.

MUNITIONS AND MILITARY ENGINEERING

Airdromes. American Combat Airdromes, Charles C. Loring. Architectural Rec., vol. 45, no. 4, Apr. 1919, pp. 311-324, 18 figs. Plans show characteristic irregular grouping necessary to render plants less vulnerable as targets.

BATTLESHIPS. Some Ideas About the Effects of Increasing the Size of Battleships, E. J. King. U. S. Naval Inst. Proc., vol. 45, no. 193, Mar. 1919, pp. 387-406. Argument for increasing size is based on claim that battleships of increased size can carry more fighting power, are protected for more effective resistance, have higher speed under all conditions, greater radius of action and greater cruising life.

H. M. Battle Cruisers "Repulse" and "Renown." Engineering, vol. 107, no. 2780, Apr. 11, 1919, pp. 461-464, 14 figs. High-speed cruisers armed with big guns propelled with low-pressure turbines.

CAMPS. The Army's Utilization of Camp Wastes, F. C. Bamman. Mun. Jl. & Public Works, vol. 46, no. 17, Apr. 26, 1919, pp. 304-308, 2 figs. Results of changing from incineration to utilization. (To be concluded.)

CRUISERS. New Light Cruisers and Flotilla Leaders. Engineer, vol. 127, no. 3300, Mar. 28, 1919, pp. 308-309, 3 figs. Dimensions of H. M. "Sentinel," "Blanche," "Bristol," "Nottingham," "Arethusa," and "Centaur."

GUN MOUNTS. Making Naval Gun Mounts—III, Franklin D. Jones. Machy, (N. Y.), vol. 25, no. 8, Apr. 1919, pp. 745-749, 14 figs. Fixtures for broaching, milling and drilling operations, and testing methods. (Concluded.)

GUN, PHOTOGRAPHIC. The Photographic Gun, Edgar H. Felix. Aerial Age, vol. 9, no. 4, Apr. 7, 1919, pp. 198-199, 13 figs. Mechanism of gun camera showing Geneva movement and shutter mechanism, which automatically continues to take photos as long as trigger is depressed.

GUN SIGHTS. Making Gun Sights for Anti-Aircraft Guns, Fred H. Colvin. Am. Mach., vol. 50, no. 15, Apr. 10, 1919, pp. 681-684, 10 figs. Mechanism consists primarily of a yoke attached to the recoil cyclinder which allows sight to be swung up and down on gun by means of curved rack governed by worm actuated pinion in a case.

GUNS. Making the U. S. 75-Millimeter Field Gun—II. Erik Oberg. Machy. (N Y.,) vol. 25, no. 8, Apr. 1919, pp. 716-721, 27 figs. Methods developed by Wisconsin Gun Co., Milwaukee, Wis.

America's Great Effort in Ordnance—II, Sci. Am., vol. 120, no. 17, Apr. 26, 1919, pp. 432-433 and 444 and 446, 9 figs. Features of proving ground for testing army ordnance at Aberdeen, Md.

MACHINERY, ARMY'S STOCKS. The Army's Foreign Stock of Machinery, John B. Woods. Am. Machy., vol. 50, no. 17, Apr. 24, 1919, pp. 775-777, 3 figs. Possibilities of disposing of millions of dollars worth of American machinery now in France and Belgium.

MINE PROTECTION. The Protection of Ships Against Mines—II. Engineer, vol. 127, no. 3300, Mar. 28, 1919, pp. 293-295, 5 figs. Arrangements for towing projector-type paravanes on war ships and mercantile vessels.

MINES. Floating Mines in the North Atlantic and Arctic Oceans. Sci. Am., vol. 120, no. 16, Apr. 19, 1919, pp. 394-395 and 416, 5 figs. Trend of ocean currents in relation to dangers to navigation from mines which have broken loose from their bearings. Paper read before the Académie des Sciences.

MOTOR-TRANSPORT SALVAGE PARK. M. T. C. Salvage Park in France — I & II, W. F. Bradley. Automotive Industries, vol. 40, nos. 16 & 17, Apr. 17 and 24, 1919, pp. 860-863 and 902-905, 19 figs. Reconstruction plant erected by Motor Transport Corps of U. S. army 120 miles behind front.

NAVAL CONSTRUCTION. Naval Construction During the War, Eustace Tennyson d'Eyncourt. Engineering, vol. 107, no. 2780, Apr. 11, 1919, pp. 482-400, 20 figs. Sketch and general summary of work carried out by British Admiralty. Paper read before Instn. Naval Architects.

NAVY, U. S. Our Newest Navy, David Potter, U. S. Naval Inst. Proc., vol. 45, no. 192, Feb. 1919, pp. 201-222. How its cost is being determined.

PROJECTORS. Projectors—British and German, Byron C. Goss. Nat. Service & Internat. Military Digest, vol. 5, no. 5, May 1919, pp. 276-280, 4 figs. Feature of design and construction.

RAILROAD TRANSPORTATION. Modern Armie and Modern Transport. Ry. Gaz., vol. 30, no. 14, Apr. 4, 1919, pp. 601-602. Work of North-Eastern Railway Co. during the war.

ROADS. Military Roads as Constructed and Projected by the Construction Division, War Department, U. S. A., in 1918, Daniel B. Goodsell. Mun. & County Eng., vol. 56, no. 4, Apr. 1919, pp. 140-142, 10 figs. Typical cross-sections of cement concrete and bituminous pavements?

SUBMARINE DETECTORS. The Wonderful Submarine Detector, Brewster S. Beach. Am. Mar. Eng., vol. 14, no. 4, Apr. 1919, pp. 8-14. Effort made by American scientists to perfect instrument for locating submarines while in a submerged condition.

Listening Devices in U-Boat War. Telephony, vol. 76, no. 15, Apr. 12, 1919, pp. 23 and 26-27. Development of submarine detector by research laboratory experts of General Electric Co.

SUPPLY BASES. Yard Tracks for Brooklyn Army Supply Base. Ry. Rev., vol. 64, no. 17, Apr. 26, 1919, pp. 609-611, 1 fig. Terminal arrangements and water-front development.

AERONAUTICS

AIRCRAFT

AIRSHIP DEVELOPMENTS. The Case for the Airship, Ladislas d'Orcy, Jl. So. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 303-307, 10 figs. Progress made since 1914.

The Development of Airship Construction, C. I. R. Campbell. Engineering, vol. 107, no. 2780, Apr. 11, 1919, pp. 469-472, 3 figs. General particulars of non-rigid, semi-rigid and rigid airships. Paper read before Instn. Naval Architects.

BALLOONING. Free Ballooning, a Notable Factor in the Royal Air Force, Lance Rushbrooke. Flight, vol. 11, no. 13, Mar. 27, 1919, pp. 394-396, 7 figs. Use of free balloons in reconnaissance, transmission of messages, photography and other military purposes.

COMMERCIAL USE. The Commercial Use of Airships. Nature, vol. 103, no. 2575, Mar. 6, 1919, pp. 4-5. Discusses possibilities of use of airships in immediate future, and compares between large airplane and rigid airship.

DESIGN. Lighter-than-Air Craft, T. R. Cave-Browne-Cave. Flight, vol. 11, no. 13, Mar. 27, 1919, pp. 410-416, 1 fig. Matters which influence lift and behavior of airship. Paper read before Roy. Aeronautical Soc.

Aerial Greyhounds of To-Morrow. Sci. Am., vol. 120, no. 16, Apr. 19, 1919, pp. 400-401 and 418, 3 figs. Constructural features of airships for future transatlantic service.

HELIUM. The Use of Helium for Aircraft Purposes. Nature, vol. 102, no. 2573, Feb. 20, 1919, pp. 487-488. On increasing buoyancy of airship by heating gas electrically or otherwise.

TRANSPORT SERVICE. The Posssibilities of Airship Transport Service. Flight, vol. 11, no. 8, Feb. 20, 1919, pp. 230-232, 1 fig. Estimated cost of running Atlantic airship service, London-New York; financial and working arrangements and Government subsidy; general specifications of a proposed airship for transport service. (Continuation of serial.)

APPLICATIONS

BUENOS AIRES-PERNAMBUCO SERVICE. The Buenos Aires-Pernambuco Aerial Service (El servicio aéro Buenos Aires-Pernambuco). La Ingenieria, vol. 23, no. 6, Mar. 16, 1919, pp. 389-398, 5 figs. Project contemplates making total distance of 2700 miles in 38¼ hr. actual flying time. Handley Page, Rolls-Royce and Sunbeam machines will be used.

LANDINGS, MARKING. The Future of the Airplanes in Business, C. B. Merrick. Jl. Electricity, vol. 42, no. 7, pp. 309-310, 3 figs. Marking landing places and guide posts by electricity.

REGULATIONS. Regulations for Air Navigation. Automotive Industries, vol. 40, no. 15, Apr. 10, 1919, pp. 782-785. Project of Int. Convention regarding air navigation.

DESIGN

LANDING. Commercial Feature of Airplanes from an Engineer's Standpoint, G. H. Day. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 290-292. Sees as most important development of future that which will enable aeroplanes to land in small field, this to be obtained without too great a sacrifice of high speed.

TYPES, CHARACTERISTIC. Airplane and Seaplane Engineering, H. C. Richardson. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 273-285, 12 figs. Characteristics of types devolved and discussion of factors affecting their performance.

DYNAMICS

CURVILINEAR FLIGHT. The Aeroplane in Curvilinear Flight. Aeronautical Jl., vol. 23, no. 97, Jan. 1919, pp. 23-24. Expressions for determining approximately the relation between B and other quantities. From Schweiz. Aero Club Bul. nos. 8 and 9.

STRESSES IN LANDING GEAR. A Theoretical Investigation into the Stresses Arising in the Landing Gear of an Aeroplane, H. H. Thomas. Flight, vol. 11, no. 15, Apr. 10, 1919, pp. 483-484. In relation to probability of machine landing automatically.

TESTS ON MODELS. From Model to Full Scale in Aeronautics, H. Levy. Aeronautics, vol. 16, no. 284, Mar. 27, 1919, pp. 248-352. Technical analysis of following problem: Flying machine or part of one is in motion through the air with a given speed in the region of normal speed of flight; is there a corresponding experiment on a model from which the forces originated on the full scale may be deduced?

ENGINES

A. B. C. The British A. B. C. Aero Engines. Aerial Age, vol. 9, no. 7, Apr. 28, 1919, p. 335, 4 figs. Outstanding feature of these models is copper coating on cooling fins.

BASSE-SELVE. The 270 H. P. Basse-Selve Aero-Engine. Engineer, vol. 127, no. 3298, Mar. 14, 1919, pp. 246-248, 11 figs. also Aerial Age, vol. 9, no. 5, Apr. 14, 1919, pp. 246-248, 253-255 and 262, 26 figs. Report on design based on examination of engine taken from remains of a German Rumpler two-seater biplane shot down and destroyed in France on May 31, 1918.

BRITISH. Current Types of British Aero Engines. Aeronautics, vol. 16, no. 284, Mar. 27, 1919, pp. 329-342, 20 figs. Siddeley-Deasy (Puma) Napier-Lion, Mercury, Lucifer, Hercules, Jupiter, Hnat I, Dragon Fly, "Manitou" Sunbeam-Coatalen, Maori IV, B.R.I. and B.R.2 types.

CRANKSHAFTS. The Design of Aeroplane Engines—XXI, John Wallace. Aeronautics, vol. 16, no 282, Mar. 12, 1919, pp. 272-276, 7 figs. Points on crankshaft design; polar curve of crankpin load.

DUSENBERG. The World's Largest Airplane Engine. Gas Engine, vol. 21, no. 5, May 1919, pp. 162-164, 10 figs. Dusenberg 850-hp. 1575-lb. engine.

HALL-SCOTT. Hall-Scott Type L-6a Aero Engine. Aerial Age, vol. 9, no. 7, Apr. 28, 1919, pp. 346-347, 5 figs. Characteristics of six-cylinder, 495-lb., 200-hp. engine.

King-Bugatti. King-Bugatti 16-Cylinder Aero Engine. Automotive Industries, vol. 40, no. 17, Apr. 24, 1919, pp. 906-910, 7 figs. Consists of two 8-cyl. all-in-line engines, mounted on common crankcase and geared to common propeller shaft. Designed to permit 37-mm. cannon to shoot through hollow propeller shaft. (To be continued.)

Mercedes. 200 H.P. Compression Mercedes Engine. Flight, vol. 11, no. 8, Feb. 20, 1919, pp. 233-236, 9 figs. Report on running performance. Issued by Technical Dept. (Aircraft Production) Ministry of Munitions.

Napier Lion. The Napier Lion Aeromotor. Flight, vol. 11, no. 13, Mar. 27, 1919, pp. 397-402, 12 figs. Twelve-cylinder 450 hp. engine with record of 30,500-ft. altitude.

Siddeley. The Siddeley Aero Engines—"Puma" and "Tiger." Flight, vol. 11, no. 14, Apr. 3, 1919, pp. 429-433, 4 figs. Puma engine has 6 vertical cylinders, 145 mm. bore by 190 mm. stroke; valves are in cylinder heads and are worked by overhead camshaft; Tiger engine has two lines of 6 cylinders inclined at an angle of 60 deg.; valves are worked by two overhead camshafts. These engines were intended for use in aeroplanes making long-distance journeys into Germany.

Supercharging. Maintaining Constant Pressure Before the Carburetors of Aero Engines Regardless of the Altitude, Leslie V. Spencer. Aerial Age, vol. 9, nos. 5 and 7, Apr. 14 and 28, 1919, pp. 244-246 and 264, and pp. 336-337 and 356, 10 figs. Arrangment of Sherbondy turbo-compression as laid out for Liberty 12-cyl. engine. (To be continued.)

MODELS

Slotted Armature. Localization of the Transformation of Energy in a Slotted Armature (Localizacion de la transformacion de la energia en un inducido dentado), Konrad Simons. Boletin de la Associacion Aegentina de Electro Técnicos, vol. 4, no. 11, Nov. 1918, pp. 874-876, 1 fig. Model to demonstrate that forces of magnetic field actuate more on teeth than on conductors.

Motors. Elementary Aeronautics and Model Notes, John F. McMahon. Aerial Age, vol. 9, no. 4, Apr. 7, 1919, p. 213. Motorcycle driven aeroplane.

Elementary Aeronautics and Model Notes, John F. McMahon. Aerial Age, vol. 9, no. 5, Apr. 14, 1919, p. 259, 2 figs. Ford motor rebuilt for aeroplane work.

PLANES

Armstrong-Whitworth. The Armstrong-Whitworth Machines. Flight, vol. 11, no. 14, Apr. 3, 1919, pp. 438, 21 figs. History, development and characteristics of the various types.

Caproni. The Caproni E-3, Night Bomber. Aviation, vol. 6, no. 6, Apr. 15, 1919, pp. 322-325, 3 figs. Outline drawings.

The Caproni Triplane. Aerial Age, vol. 9, no. 5, Apr. 14, 1919, pp. 242-243, 5 figs. Specifications of type CA-4 triple-motored Caproni triplane.

Georges Levy. The Georges Levy Type R Flying Boat. Aerial Age, vol. 9, no. 6, Apr. 21, 1919, pp. 286-288, 3 figs. Directions for rigging and mounting as applied by Georges Levy Co.

Grahame-White. An Interesting Grahame-White Sporting model. Flight, vol. 11, no. 15, Apr. 10, 1919, pp. 468-473, 19 figs. Span is only 20 ft. and overall length 16 ft. 6 in. Machine, however, is said to be capable of making 102 m.p.h. at low altitudes and 93 m.p.h. at 10,000 ft. It is fitted with 80-hp. le Rhone engine.

Navy. F-5-L Navy Flying Boat—IV, S. T. Williams. Automotive Industries, vol. 40, no. 15, Apr. 10, 1919, pp. 809-811, 2 figs. Flying controls and methods of hook-up; weight and percentage of weight of every component.

The Navy HS-IL and 2L Flying Boats, Aerial Age, vol. 9, no. 7, Apr. 28, 1919, pp. 338-340 and 357, 6 figs. General dimensions and data.

TESTING

Sand Testing. Sand Testing of Aeroplanes, Albert S. Heinrich. Aerial Age, vol. 9, no. 4, Apr 7, 1919, pp. 200-202, 10 figs. Test of tail surfaces. (Continued.)

TRANSATLANTIC FLIGHT

British Machines. The Transatlantic Race. Flight, vol. 11, no. 15, Apr. 10, 1919, pp. 476-480, 5 figs. British machines intended to be used for flight.

VARIA

Flying Sickness. Flying Sickness, Martin Flack, Sci. Am. Supp, vol. 87, no. 2260, Apr. 26, 1919, p. 262. Discussion of its cause and means of combating it.

Oxygen Use. Oxygen and the Transatlantic Flight, T. S. Rippon. Flight, vol. 11, no. 13, Mar. 27, 1919, p. 403, 3 figs. Graphs showing normal pulse of aviator during flight without oxygen and when oxygen was used.

Physical Qualities of Aviators. Medical Aspects of Aviation, L. E. Stamm. Aeronautical Jl., vol. 23, no. 97, Jan. 1919, pp. 3-17. Survey of necessary physical qualities to meet special conditions of stress and strain in the air, and of the mental qualities required for aviation.

Visibility of Aeroplanes. The Visibility of Airplanes, M. Luckiesh. Jl. Franklin Inst., vol. 187, no. 4, Apr. 1919, pp. 409-457, 16 figs. Relative brightness of inland water viewed perpendicularly in terms of brightness of zenith blue sky; variation of brightness of zenith sky with altitude of measurements, on a very hazy but cloudless day; reflection factors of various substances; relation between size of image of 50-ft. object and altitude or distance; curves showing brightness of various objects from different angles of observation. (Concluded.)

Wind Charts. Wind Charts for Air Navigation (Les cartes des vents à l'usage des aéronautics), J. Rouch and L. Gain. Revue Générale des Sciences, vol. 30, no. 6, Mar. 30, 1919, pp. 168-171, 5 figs. How knowledge of wind currents may be used for shortening aerial trips in a manner similar to that in which ocean currents are taken advantage of in maritime voyages.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

Electromotive Force of Metals. Electromotive Force of Metals (Force électromotrice des métaux), J. A. Montpellier. Industrie Electrique, vol. 28, no. 642, Mar. 25, 1919, pp. 103-104. Ionic phenomena in thermocouples and table of relative potentials of metallic elements.

Importance. Electrochemistry in its Human Relations, F. J. Tone. Chem. & Metallurgical Eng., vol. 20, no. 8, Apr. 15, 1919, pp. 413-415. Electrochemistry can contribute to human progress and raise standard of living by providing cheap fertilizer for increased crop yields, improve sanitation and produce new materials of construction.

Nelson Cell. The Nelson Electrolytic Chlorin Cell, C. F. Carrier, Jr. General Meeting Am. Electrochemical Soc., Apr. 3-5, 1919, paper no. 16, pp. 221-231, 3 figs. History, development, construction and operation of the Nelson cell, including particularly the life of its different parts, ampere efficiency and energy efficiency with which it works.

Sodium Permanganate. An Electrolytic Process for the Production of Sodium Permanganate from Ferromanganese, Robert E. Wilson and W. Grenville Horsch. General Meeting Am. Electrochemical Soc., Apr. 3-5, 1919, paper no. 15, pp. 207-220, 1 fig. Ferromanganese anodes were used in diaphragm cell in soldium carbonate solution, with production of an 8 to 12 per cent solution of sodium permanganate in anode compartment.

ELECTROPHYSICS

Conservation of Electricity. Conservation of Electricity and the Electronic Theory (La conservation de l'électricité et la théorie électronique), L. Décombe. Revue Générale de l'Electricité, vol. 5, no. 12, Mar. 22, 1919, pp. 443-444. Admitting the electric constitution of matter, various experimental researches are presented in support of theory establishing conservation of electrical moment in a dielectric by assimilation of atoms to doublets of variable moment. Paper before la Société française de Physique.

Dielectric Phenomena. Dielectric Phenomena in Dielectric Substances (in Japanese), K. Kamibayashi. Denki Gakkwai Zasshi, no. 368, Mar. 10, 1919.

Electronic Emission. The Emission of Electricity from Incandescent Bodies (l'émission d'électricité par les corps incandescents), A. Boutaric. Revue Générale des Sciences, vol. 30, no. 6, Mar. 30, 1919, pp. 171-183, 6 figs. Survey of experimental research by various investigators, notably O. W. Richardson. Theories offered in explanation electronic emission. First article.

ELECTRODEPOSITION

Copper Plating on Iron. Electro-Plating on Iron from Copper Sulphate Solution, Oliver P. Watts. Brass World, vol. 15, no. 4, Apr. 1919, pp. 108-111. Shows that certain solutions of lead and antimony may be substituted for the arsenic dip, previous to direct-current plating of copper on iron from copper sulphate. Paper read before Am. Electrochem. Soc.

Plating Room Chemicals. Plating Room Chemicals, A. Schleimer. Brass World, vol. 15, no. 4, Apr. 1919, pp. 127-129. Appearance and properties of borax, charcoal, cobalt, copper acetate, copper sulphate, copper carbonate, corrosive sublimate, liver of sulphur, nickel salts, magnesium sulphate, lead acetate, caustic potash, sodium carbonate and cyanide.

FURNACES

Crucibles. Morgan's Patent Electrically Heated Crucibles. Electrical Review, vol. 84, no. 2157, Mar. 28, 1919, pp. 342-344, 4 figs. Designed to prevent volatilization of non-ferrous alloys which takes place when arc is used on account of excessive heat.

Rennerfelt. Types of Electric Furnaces—I; the Rennerfelt, W. F. Sutherland. Can. Machy., vol. 21, no. 14, Apr. 3, 1919, pp. 328-330, 7 figs. Operating characteristics; tilting mechanism and control and wiring diagram of furnace.

Developments in the Rennerfelt Furnace, H. A. de Fries and Jonas Hertenius. Eng. & Indus. Management, vol. 1, no. 8, Apr. 3, 1919, pp. 238-239, 1 fig. Side electrodes tilt ant shape of shell is round in new design.

Resistance Type. Electric Furnaces of the Resistance Type Used in the Production of Essential War Materials, T. F. Baily. General Meeting, Am. Electrochemical Soc., Apr. 3-5, 1919, paper no. 19, pp 257-260, 1 fig. Heat-treating equipment intended for automatical and continuous hardening and tempering of cast-steel anchor chains. Heating is by an electrical resistor granular carbon confined in carborundum fire sand walls, machinery being controlled by pyrometers which allow of hardening and tempering at definite temperatures.

Steel Foundry. The Electric Foundry: Its Introduction into Foundry Practice, W. E. Moore. General Meeting Am. Electrochemical Soc., Apr. 3-5, 1919, paper no. 12, pp. 181-186. Comparison of electric furnace in steel foundry work with open-hearth furnace and small bessemer converter. Writer concludes that it is superior to both, in regard to cheapness of raw material, conservation of alloying metals, waste of lining, temperature obtainable, control of chemical composition and quality of steel produced.

Vom Baur. The Vom Baur Electric Steel Furnace. Iron Age, vol. 103, no. 17, Apr. 24, 1919, pp. 1071-1073, 2 figs. Electrode holders are so constructed that by means of fillers either graphite or carbon electrodes can be used. Tilting mechanism allows furnace to tilt backward 7 deg. so that slag can be taken off at this door instead of from the spout.

GENERATING STATIONS

AUTOMATIC GENERATING PLANTS. Automatic Induction Generator Plants, E. A. Quinn. Jl. Electricity, vol. 42, no. 8, Apr. 15, 1919, pp. 342-344, 7 figs. Description of two small power plants which make use of water normally used in larger plants of a light and power corporation under heads which existed in the flow line but had hitherto not been utilized. Plants are said to be operated without attendants.

BUS AND SWITCHES. Modern Bus and Switch Structures, C. D. Gray and M. M. Samuels. Elec. World, vol. 73, nos. 16 & 17, Apr. 19 & 26, 1919, pp. 788-792 and 831-833, 16. figs Masonry, material, compartment doors and general arrangement. Types of circuit breakers and support of buses used with large generating units.

CANADA. Central Electric Power Station Statistics, Can. Engr., vol. 36, no. 6, Feb. 6, 1919, pp. 203-205. Data gathered by Dominion Water Power Branch and Bureau of Statistics.

Electric Generation in Canada. Can. Eng., vol. 36, no. 9, Feb. 27, 1919, pp. 255-256. Table of control electric generating plants in Canada, showing capacity, ownership and prime movers.

The Present Electric Outlook in Canada, A. S. L. Barnes. Electrical Review, vol. 84, no. 2158, Apr. 4, 1919, pp. 389-390. Figures indicating total amount of power capable of developing and amount of power already developed. (Continuation of serial.)

CONDENSER, STATIC. Economic Use of Static Condenser—I & II, Waldo V. Lyon. Elec. World, vol. 73, nos. 15 & 16, Apr. 12 & 19, 1919, pp. 724-726 and 776-778, 6 figs. Increasing capacity of a generating plant by using static condensers to correct power factor; feasibility of putting less generating equipment in new plant by using condensers. Problems of power-factor correction by static condensers are analyzed for purposes of improving voltage regulation and reducing copper losses.

PROHIBITION. Effect of Prohibition on Lighting Revenue. Elec. World, vol. 73, no. 15, Apr. 12, pp. 736-739. Conditions following prohibition as reported by 75 central stations.

SMETHWICK. Electricity Supply at Smethwick. Electrical Review, vol. 84, no. 2158, Apr. 4, 1919, pp. 368-371, 5 figs. Capacity of plant which was 12,475 kw. before the war has been increased to total of 36,326 kw. by installation of B. T. H. turbo-generators.

SO. PHILADELPHIA WORKS. Power System of South Philadelphia Works, Graham Bright. Elec. Jl., vol. 16, no. 4, Apr. 1919, pp. 126-131, 15 figs. Showing lighting arresters, disconnecting switches, etc.

THEFT OF CURRENT. Detection and Remedy of Current Theft from Central Stations. Thomas Robson Hay. Elec. Rev., vol. 74, no. 15, Apr. 12, 1919, pp. 588-589. Methods employed by Duquesne Light Co. of Pittsburgh.

GENERATORS AND MOTORS

ALTERNATORS. Free Oscillations of Alternators in a Constant-Voltage System (Oscillations libres des alternateurs sur réseau à tension constante), André Blondel. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 9, Mar. 3, 1919, pp. 439-444. Values of K and e which make $\triangle$ a minimum, determined by taking advantage of the fact that changes in rI during oscillations are negligible by comparison to vector $(u + rI)$ when I is constant.

ASYNCHRONOUS MACHINES. Theory of Elliptic-Field Asnychronous Machines (Sur la théorie des machines asynchrones à champ elliptique), W. Genkin. Revue Générale de l'Electricité, vol. 5, no. 15, Apr. 12, 1919, pp. 539-548, 15 figs. General equations derived from Fynn's theory. Equivalent circuit worked out for revolving-field motor, single-phase motor, phase converter and induction meter.

Application of the Diagram of Asynchronous Motors (Applications du diagramme des moteurs asynchrones), L. Lagron. Revue Générale de l'Electricité, vol. 5, no. 14, Apr. 5, 1919, pp. 507-510, 4 figs. How to use writer's diagram published in R. G. E., vol. 4, Dec. 7, 1918, p. 861, to modifying connection of coils, conststructing characteristic curves and the starting of motor.

HEATING. Maximum Power of Electrical Machines Limited by Permissible Heating of Parts (Erude analytique des conditions dans lesquelles, pour un échauffement déterminé, le puissance de certaines catégories de machines électriques est maximum), H. Lajus. Revue Générale de l'Electricité, vol. 5, no. 13, Mar. 29, 1919, pp. 467-471, 1 fig. A d. c. generator or an alternator operating in constant cos (I) theoretically assumed to be heated to the permissible limit can develop maximum power, according to the writer's investigations when frequence is maximum and the sum of hysteresis and Foucault losses equals the Joule losses.

HIGH-FREQUENCY GENERATORS. A High-Frequency Generator for Airplane Wireless Telegraph Sets, A. Nyman. Elec. Jl., vol. 16, no. 4, Apr. 1919, pp. 140-145, 16 figs. Scheme developed by Signal Corps for U. S. Army; requirements were lightness, compactness and reliability.

LUBRICATION. Lubrication of Electric Generators and Motors, Reginald Trantschold. Elec. Rev., vol. 74, no. 16, March 19, 1919, pp. 629-630. Influence of type of apparatus upon choice of lubricant.

RAILWAY MOTORS. Manufacturers' Tests of Railway Motors, J. S. Dean. Elec. Ry. Jl. vol. 53, no. 16, Apr. 19, 1919, pp. 777-778, 9 figs. Chart presenting various detail parts with materials used in their manufacture. (First article of series.)

RHEOSTATS. Starting Rheostats for Shunt Motors. Terrell Croft. Power House, vol. 13, no. 4, Apr. 5, 1919, pp. 90-91, 4 figs. Calculation of size of resistance to be placed in series with armature to prevent excessive current.

SINGLE-PHASE GENERATORS. Armature Reaction and Wave Form of Single-Phase Generator (in Japanese), G. Shimizu. Denki Gakkwai Zasshi, no. 368, Mar. 10, 1919.

SWITCH-GEAR, STARTING AND CONTROLLING. Starting and Controlling Switchgear for Shipyard Machinery, A. P. Pyne. Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 413-420, 21 figs. Review of working conditions of various motors to be encountered in a shipyard and suggestions in regard to selecting starting and controlling apparatus.

SYNCHRONOUS MOTORS. Synchronous Motor Characteristics—I, Theo Schou. Elec. World, vol. 73, no. 17, Apr. 26, 1919, pp. 828-830, 6 figs. Heyland diagram for induction motor is applied to sycnhronous motors with squirrel-cage windings in order to investigate starting and pull-in torques. Comparison of brass and copper for rotor bars.

IGNITION APPARATUS

CONTACT BREAKERS, SPLITDORF. The New Splitdorf Magneto. Aerial Age, vol. 9, no. 6, Apr. 21, 1919, p. 304, 2 figs. Details of contact breaker.

GENERATORS, MOTOR-CAR. Regulation of Automotive Generators, W. A. Dick. Elec. Jl., vol. 16, no. 4, Apr. 1919, pp. 148-151, 11 figs. Regulation characteristics of generators used for lighting and other purposes on automobiles and kindred machines. Only those types that have been developed and put into commercial use are dealt with.

MAGNETOS, ALUMINUM IN. British-Made Magnetos. Elecn., vol. 82, no. 13, Mar. 28, 1919, pp. 348-349, 6 figs. Uses of aluminum in their manufacture. (Concluded.)

MAGNETOS, EXPERIMENTS. Experiments on the High-Tension Magneto—I, Norman Campbell. London, Edinburgh and Dublin Phil. Mag., vol. 37, no. 219, Mar. 1919, pp. 284-301, 6 figs. Work conducted at Nat. Physical Laboratory under direction of Advisory Committee for Aeronautics. Results were kept confidential during time of war.

LIGHTING AND LAMP MANUFACTURE

DESIGN. Chart to Facilitate the Design of Lighting System. Elec. World, vol. 72 no. 16, Apr. 19, 1919, pp. 778-779, 1 fig. Curves are based on illuminating intensity 3 ft. above floor; portion of diagram determining size of lamps necessary to produce intensified illumination; a depreciation of 30 per cent in light intensity due to dirt in reflector of lamp or deterioration of filament is assumed. From Indus. Lighting Code of Indus. Commission of Wisconsin.

LABORATORIES. Some Special Problems in the Lighting of Laboratories and Technical Institutions. Illuminating Engr., vol. 12, no. 1, Jan. 1919, pp. 13-16. Concerning lighting of blackboards and chemical, electrical and physical laboratories.

OFFICE LIGHTING. Modern Practice in Office Lighting, A. Wise. Illuminating Engr., vol. 12, no. 2, Feb. 1919, pp. 27-39, 17 figs. Choice of methods for lighting and how these can be applied to various types of offices; importance of periodical cleansing of lamps and lighting units; illumination required for various classes of work; typical examples of installations.

SEARCHLIGHTS. The Searchlight Projector as Used in the Mercantile Marine, R. C. Harris. Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 444-449, 15 figs. Types of lamps, mirrors and lenses and also methods of remote control, both mechanical and electrical.

SNELLENS TYPES. Report on Standard Illumination of Snellens Types Used in Testing the Vision of Candidates for Public Service. Illuminating Engr., vol. 12, no. 1, Jan. 1919, pp. 5-7, 2 figs. Report issued by Council of British Ophthalmologists. From British Jl. of Ophthalmology.

STREET LIGHTING. Simple Lamp-Record System for Street Lighting Circuits, T. D. McDowell. Elec. Rev., vol. 74, no. 17, Apr. 26, 1919, pp. 668-669, 3 figs. Card records for noting type and history of lamps in use on large systems for street, boulevard or park lighting.

MEASUREMENTS AND TESTS

FAULT LOCALIZING. Fault Localizing: A Few Hints, H. Bujama. Electrical Review, vol. 84, no. 2160, Apr. 18, 1919, pp. 432-433, 5 figs. Double-slide wire bridge for use in connection with Murray loop and Varley loop tests.

FUSES. Short-Circuit Tests of Cartridge Fuses at the New York Office. Laboratories' Data, Underwriters' Laboratories, Nat. Board of Fire Underwriters, no. 1, Feb. 1919, pp. 16-19, 2 figs. Fuses were placed in cutout base, covered with thin layer of dry absorbent cotton and enclosed by strongly made protective cage;circuit breaker is now set so that it will not open automatically, but only by the cord, was then closed and finally circuit was closed by switch at back of test frame.

Results of Factory Inspection of Standard Cartridge Enclosed Fuses. Laboratories' Data, Underwriters' Laboratories, Nat. Board of Fire Underwriters no. 1, Feb. 1919, pp. 20-22, 1 fig. Graphs drawn from results of quarterly inspections.

GALVANOMETERS, DIFFERENTIAL. Zero Error in Differential Galvanometers (Uber ein Differentialgalvanometer nebs einer Untersuchung iiber Nullpunktsfehler bei Drehspulengalvanometern), Helmer Backström, Zeitschrift fur Instrumentenkunde, vol. 38, nos. 11 and 12, Nov. and Dec. 1918, pp. 173-179 and 189-195, 8 figs. Magnitude of after effect on zero position as affected by length of time during which deflection is maintained, damping of movement, and variations of current. Bibliography on moving-coil galvanometers covering period 1880-1916.

GROUND AND SHORT-CIRCUIT DETECTION. Phase and Fault Testing by Means of Lamp Signals, Frank Gillooley. Elec. Rev., vol. 74, no. 16, Mar. 1919, pp. 617-619, 4 figs. Methods of using lamps in testing for grounds. short circuits and continuity of underground cables; methods of checking up phases and identification.

HYDROGEN OVERVOLTAGE, MEASUREMENT OF. Hydrogen Overvoltage, Duncan A. MacInnes and Leon Adler Jl. Am. Chem. Soc., vol. 41, no. 2, Feb. 1919, pp. 194-207, 5 figs. Apparatus and method of measurement. It is concluded that hydrogen overvoltage is due primarily to a layer of supersaturated dissolved hydrogen in the electrolyte surrounding an electrode.

INSULATOR TESTING. Pacific Coast Practice in Insulator Testing. Jl. Electricity, vol. 42, no. 8, Apr. 15, 1919, pp. 345-347. Report of Insulator Committee of convention of Pac. Coast Section N. E. L. A.

Peak Potential, Measurement of. Note on the Measurement of the Peak Potential of an Alternating Source. Clifford C. Paterson and Norman Campbell. London, Edinburgh, and Dublin Phil. Mag., vol. 37, no. 219, Mar. 1919, pp. 301-303, 1 fig. Conditions which are considered necessary for accuracy to measuring peak potential by means of a thermionic valve.

Temperature Body, Measurement. Some Notes on Electrical Methods of Measuring Body Temperatures, Robert S. Whipple. Electrical Review, vol. 84, no. 2158, Apr. 4, 1919, pp. 392-393, 5 figs. Adaptation of thermoelectric couples for measuring body temperatures; results of experiments. Paper read before Roy. Soc. of Medicine & Instn. of Elec. Engrs.

Temperature Determination by Weighing. Weighing High Temperatures in an Electric Balance, J. M. Bird. Sci. Am., vol. 120, no. 17, Apr. 26, 1919, pp. 430-431, 442 & 444, 5 figs. Curves for transformation points of two different steels, showing in each case the heating curve and the cooling curve. System of pyrometry based on use of thermocouples for controling heat treating furnaces in steel mills.

Timing. Accurate Timing in Electrical Tests, F. A. Kartack. Elec. World, vol. 73, no. 14, Apr. 5, 1919, pp. 672-675, 9 figs. Tuning-fork timing device found very satisfactory in practice, consists essentially of heavy iron base casting in head block of which are mounted two steel fork legs actuated by magnet; adjustment for rate of vigration is obtained by counterweights. Design was put into operation at Bar Standards Laboratory.

Voltage Test Equipment. A Voltage Test Equipment. Laboratories' Data, Underwriters' Laboratories, Nat. Board of Fire Underwriters, no. 1, Feb. 1919, pp. 26-28, 1 fig. Outfit consists of transformer, the terminals of which are enclosed in glass case large enough to cover the device or sample under test.

Voltmeter, Electrostatic, Ayrton-Mather. New Measuring Instruments (Quelques nouveaux instruments de mesure), A. Tobler and K. Tobild. Journal Télégraphique, vol. 43, no. 3, Mar. 25, 1919, pp. 33-36, 7 figs. Ayrton-Mather electrostatic voltmeter as perfected by R. W. Paul. (To be continued.)

POWER APPLICATIONS

Cooking. Electric Cooking in Hotels, Clubs and Restaurants, C. O. Hard. Nat. Elec. Light Assn. Bul., vol. 6, no. 4, Apr. 1919, pp. 206-208, 3 figs. Section range with connected load of 30 kw.; 30-in. broiler connected load and other electrical features.

Mill Drive. Electrically Driven Plate Mills, G. E. Stoltz. Engrs.' Club of Philadelphia, vol. 36-1, no. 170, Jan. 1919, pp. 7-13, 10 figs. Considerations in selection of size and type of motor, control and flywheel, based on examination of performances of existing mills.

Electric Equipment in Blooming Mill of Steel Company of Canada, Hamilton. Elec. News, vol. 28, no. 8, Apr. 15, 1919, pp. 24-25, 2 figs. Generator set consists of 1800-hp., 2200-volt 3-phase wound rotor induction motor, a 50-ton flywheel and two 1200-kw., 600-volt d. c. generators all mounted on a common shaft.

Mine Service. Selection of the Electrical System. Voltage and Frequency for Mine Service, Terrell Croft. Coal Age, vol. 15, no. 15, Apr. 10, 1919, pp. 658-659. Believes that 500 volts is not an advisable tension to use at a coal mine, and advocates adhering to 250 volts as a standard.

TELEGRAPHY AND TELEPHONY RADIO

Detector, Radio-Frequency Oscillations. A Magnetic Detector of Radio Frequency Oscillations. Wireless Age, vol. 6, no. 8, May 1919, pp. 11-12, 4 figs. Based upon reputed principle that super-position of a high-frequency current upon iron core already excited by low-frequency current reduces hysteresis loop of low-frequency current.

Modulator, Mercury Vapor, Langmuir's. Langmuir's Mercury Vapor Modulator for Wireless Telephony. Wireless Age, vol. 6, no. 8, May 1919, pp. 15-16, 6 figs. Method of controlling output of radio frequency alternator at speech frequencies for radio telephony. Device comprises a glass or quartz envelope containing a body of mercury (constituting the cathode) and main anodes which may be made of graphite, tungsten, molybdenum or other highly refractory material.

Musical Radio-Sending. Notes on a Problem of Musical Radio-sending (in Japaneese), T. Minohara. Denki Gakkwai Zassihi, no. 368, Mar. 10, 1919.

Progress Since 1914. Wireless telegraphy and telephony, J. A. Fleming. Times Eng. Supp., vol. 15, no. 533, Mar. 1919, pp. 97-98. Progress since 1914.

Receivers, Bridge and Barrage. Simultaneous Sending and Receiving, E. F. W. Alexanderson. Wireless Age, vol. 6, no. 8, May 1919, pp. 23-26, 5 figs. Fundamental characteristics of the "bridge receiver" and the "Barrage receiver." Paper read before Inst. Radio Engrs.

Regulations. Wireless Telegraphy and the Safety of Transoceanic Navigation (La télégraphie sans fil et la sécurité de la navigation maritime). Journal Télégraphique, vol. 43, no. 3, Mar. 25, 1919, pp. 36-38. Regulations of International Conference held at London on Nov. 12, 1913. (Concluded).

Vacuum Tube. Negative Resistance Vacuum Tube as an Amplifier and a Beat Receiver. Wireless Age, vol. 6, no. 8, May 1919, pp. 12-13, 2 figs. Scheme using heterodyne principle to secure increased amplification and selectivity in receiving.

TELEGRAPHY AND TELEPHONY, WIRE

European Telephone Practice. European Telephone Practice, Fred W. Scholz. Telephone Engr., vol. 21, no. 4, Apr. 1919, pp. 159-163, 2 figs. Adaptation of telephone exchanges to telephone trafic. From Telegraphen-Versuchsamt. (To be continued.)

Telephone Receiver, Theory. Electromagnetic Theory of the Telephone Receiver with Special Reference to Motional Impedance, A. E. Kennelly and H. Nukiyama. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 4, Apr. 1919, pp. 491-539, 32 figs. Theory, which is stated under definite limitations, takes into account the m.m.f. produced by vibrations of diaphragm in permanent magnetic field; thus motional power is shown to be derived partly from testing alternating current and partly from changes in power of magnetic circuit.

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

Instrument Voltage Transformers. Instrument Voltage Transformers, W. R. Woodward. Power, vol. 49, no. 15, Apr. 15, 1919, pp. 562-564, 11 figs. Westinghouse types.

Rectifiers. Transformation of Direct into Alternating Current, and Vice Versa, without a Commutator (Sur un système de transformaton de courant continu en courant alternatif, et vice versa sans commutateur divisé), O. Li Gotti. Revue Générale de l'Electricité, vol. 5, no. 13, Mar. 29, 1919, pp. 471-484, 10 figs. Louis Magnini patented in 1905 (see Industrie Electrique, May 25, 1905, p. 217) an apparatus for rectifying an alternating current by the periodic alteration of the inductance coils mounted in two groups. In present article writer makes general study of possible transforming devices operating on induction phenomena.

Transformer Practice. Essentials of Transformer Practice — XXI, E. G. Reed, Elec. Jl., vol. 16, no. 4, Apr. 1919, pp. 145-147, 7 figs. Voltage transformations with autotransformers.

TRANSMISSION, DISTRIBUTION, CONTROL

Control. The Control of Large Amounts of Power—III, E. B. Wedmere. Power House, vol. 13, no. 4, Apr. 5, 1919, pp. 97-101, 12 figs. Current-limiting by use of busbar reactance; heating and stresses due to heavy currents; combinations of machines requiring maximum transfer capacity; influence of power factor of machine on output of engine. Paper read before Inst. Elec. Engrs., England.

Cutout Bases. Effect of Cutout Base Design upon Plug Fuse Performance. Laboratories' Data, Underwriters' Laboratories, Nat. Board of Fire Underwriters, no. 1, Feb. 1919, pp. 23-25, 1 fig. Effect differences in cross-section have upon heating and consequently upon performance of plug fuses used in cutout bases.

Distribution, Flexibility. Flexible Distribution for Industrial Plants, L. F. Leurey. Elec. World, vol. 73, no. 17, Apr. 26, 1919, pp. 835-838, 7 figs. Design for meeting changing demands for power. Safety and low operating costs are said to be secured by employment of bus-bar feeders of uniform size.

Interconnection. Emergency Interchange of Power, G. R. Kenny. Jl. Electricity, vol. 42, no. 8, Apr. 15, 1919, pp. 347-349, 1 fig. Interconnection of two 60-cycle with one 50-cycle system. Paper presented by Eng. Committee for Pac. Coast Section N. E. L. A. convention.

Polyphase-Motor Protection. Protecting Polyphase Induction Motors from Single-Phase Operation, B. W. Jones. Power, vol. 49, no. 16, Apr. 22, 1919, pp. 604-606, 3 figs. Comparison of different means generally employed to prevent polyphase induction motors from operating single-phase and also form overheating.

Relays. Alternating-Current Plunger-Type Relays, Victor H. Todd. Power, vol. 49, no. 17, Apr. 29, 1919, pp. 636-639, 14 figs. Schematic diagram and characteristics of overload relay which obtains time limit by means of air bellows.

Relay Protective Systems, G. E. Armstrong. Jl. Electricity, vol. 42, no. 8, Apr. 15, 1919, pp. 349-353, 1 fig. Methods used on system of Southern Cal. Edison Co. From Eng. Report for spring convention of Pac. Coast Section N. E. L. A.

Synchronous Alternators. Stability of Synchronous Alternators in Constant-Potential System (Conditions de stabilité de la marche synchronique des alternateurs accouplés sur réseau à tension constante), A. Blondel. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 12, Mar. 24, 1919, pp. 587-593. Equation not taking into account oscillations induced in circuits of inductors is modified so as to include effect of these oscillations, and conditions necessary and sufficient for stability are obtained by application of Hurwitz' determinant.

Substation. Columbus Railway, Light & Power Co.'s Canal Street Substation, E. W. Clark. Elec. Rev., vol. 74, no. 17, Apr. 26, 1919, pp. 670-671, 6 figs. Switching arrangements and provision for voltage changeover.

Transformer Station, High-Tension. Transmission of Electrical Energy from Bourges to the American Arsenal at Beauvoir (Transmission d'énergie électrique de Bourges à l'Arsenal Americain de Beauvoir), Michel Berthon. Revue Générale de l'Electricité, vol. 5, no. 12, Mar. 22, 1919, pp. 445-449, 3 figs. High-tension (30,000 volts) transforming station presented as example of rapidly established economic installation.

WIRING

City Hall Wiring. The Electrical Installation in San Francisco's City Hall. Elec. Rev., vol. 74, no. 17, Apr. 26, 1919, pp. 661-667, 7 figs. Features of conduit and wiring system for light, power, communication and signalling.

STORAGE BATTERIES

Barium Sulphate Action. Function of Barium Sulphate in Lead Accumulators (Sulla funzione del solfato di bario hegli accumuratori a plombo), O. Scarpa. Elettrotecnica, vol. 6, no. 9, Mar. 25, 1919, pp. 176-179, 3 figs. Experimental research believed to have demonstrated that barium sulpnate acts as negative catalyzer to transformation of lead.

Charging Plant. New Haven Installs Model Charging Plant, Ry. Elec. Engr., vol. 10, no. 4, Apr. 1919, pp. 105-106, 9 figs. Plant is equipped for charging, cleaning and repairing both lead and alkaline batteries and equipment and both 30 and 60-volt systems are taken care of.

Lead Acid Batteries. Characteristics of Starting and Lighting Batteries of the Lead Acid Type, O. W. A. Oetting. Elec. Jl., vol. 10, no. 4, Apr. 1919, pp. 134-139, 15 figs. Considerations in selecting size of starting battery.

Trickling Charge. The "Trickling Charge" as Applied to Lead-Acid Storage Batteries of the Naval Service, Lucius C. Dunn. C. S. Naval Inst. Proc. vol. 45, no. 195, Mar. 1919, pp. 339-343, 2 figs. Methods of applying to a charged storage battery a current just large enough to counteract local action and thus maintain it in a charged condition.

VARIA

Insulation Mica. What Are Safe Operating Temperatures for Mica Insulation? H. D. Stephens. Elec. Jl., vol. 16, no. 4, Apr. 1919, pp. 131-135, 2 figs. Results of tests on twelve 60-cycle turbo-generators ranging in size from 5000 to 20,000 kva.

Insulation, Moulded. Designing Moulded Insulation, W. H. Kempton. Elec. Jl., vol. 16, no. 4, Apr. 1919, pp. 152-157, 19 figs. Suggestions to designers.

Lightning. Lightning-Rod Specifications Required by Italian War Ministry (Conditions à réaliser dans l'installation des paratonnerres, d'arpès le Ministère de la Guerre Italien). Génie Civil, vol. 14, no. 12, Mar. 22, 1919, pp. 236-237. On the uses of Meisens and other systems and provisions for nature and quality of metal in Cables.

Lightning and Its Effects, D. J. McCarthy. Ry. Elec. Engr., vol. 10, no. 4, Apr. 1919, pp. 123-125, 6 figs. Characteristics of discharges as revealed from a study made with a fixed and revolving camera.

METALLURGY

ALUMINUM

Micrography. The Micrography of Aluminum and its Alloys, D. Hanson and S. L. Archbutt. Engineering, vol. 107, no. 2779, Apr. 4, 1919, pp. 450-453, 13 figs. Different microstructural constituents met with in aluminum alloys. and methods by which these may be etched for microscopic examination. Paper read before Inst. of Metals.

Metallography. The Metallography of Aluminum—I & II, Robert J. Anderson. Metal Industry, vol. 14, nos. 12 & 13, Mar. 21 & 28, 1919, pp. 223-228 and 245-247, 20 figs. Discussion of amorphous theory and plastic deformation with remarks on grain growth phenomena; microstructure of various forms of aluminum; annealing and recrystallization of aluminum which has had plastic deformation; polishing and etching of aluminum microsections preparatory to microscopic examination.

COPPER AND NICKEL

Nickel Refining. Some Features of Nickel Refinery. Can. Manufacturer, vol. 39, no. 4, Apr. 1919, pp. 21-24, 8 figs. Features of Int. Nickel Co. of Canada refinery. Plant was erected at cost of $5,000,000.

FERROUS ALLOYS

Chromium-Nickel Steel. Critical Points, L. A. Danse. Proc. Steel Treating Research Soc., vol. 2, no. 3, 1919, pp. 32-38. Discussion of mechanical and thermal treatment of chromium-nickel steel, particularly as used in aircraft production.

FLOTATION

Flotation Experiments. A Device for Flotation Experiments, Will H. Coghill. Min. & Sci. Press, vol. 118, no. 15, Apr. 12, 1919, pp. 495-496, 1 fig. Device consists of two pyrex flasks, one of 250 cc. and the other of 500 cc., fitting in same rubber nipple; to prepare a test, smaller flask is filled with mixture of ore and water of desired consistency and emptied into larger one; flotation reagents are added and test is accomplished by hand agitation.

FURNACES

Air-Volume Regulation. Air-Volume Regulation in Smelting and Refining Furnaces, C. H. Smoot. Eng. & Min. Jl., vol. 107, no. 15, Apr. 12, 1919, pp. 654-656, 3 figs. Type of constant-volume regulator developed by Rateau-Battu-Smoot Eng. Corp.

Gas Heating. Heating of Metallurgical Furnaces (Le chauffage des fours métallurgiques), Louis Lecocq. Chimie & Industrie, vol. 2, no. 3, Mar. 1, 1919, pp. 260-270. Figures indicating advantage of utilizing gas from coke furnaces.

Greene Arc Furnace. The Greene Rolling Cylinder Arc Furnace. Iron Age, vol. 103, no. 16, April 17, 1919, pp. 1005-1007, 3 figs. Principal features are tilting arrangement by use of hydraulic cylinder connected to back of furnace shell and removable roof.

Pulverized Coal. Pulverized Coal in Canadian Steel Plant, C. F. Herington Iron Age, vol. 103, no. 17, Apr. 24, 1919, pp. 1065-1069, 7 figs. Air distributing system supplies powdered fuel for boilers and furnaces at Canadian branch of Armstrong Whitworth Co.

IRON AND STEEL

Gray Iron. Improving the Quality of Gray Iron by the Electric Furnace, George, K. Elliott. General Meeting Am. Electrochemical Soc., Apr. 3-5, 1919, paper no. 11, pp. 173-179. Proposes to use a basic-lined arc electric furnace for refining and superheating gray iron. Cupola is said to be strong on heating and melting, but weak in superheating, carbon regulation waste of alloying metals, and impossibility of refining; consequently, duplex process, using electric furnace in tandem with cupola, is believed will correct and supplement deficiencies of cupola.

Hot Deformation. Hot Deformation and the Quality of Steel, Georges Charpy · Iron vol. 103, no. 17, Apr. 24, 1919, pp. 1079-1881, 3 figs. Experiments determining effect on tensile strength and impact values; gun and hard basic steel weree used. Paper presented before Iron & Steel Inst., London.

Liquid Steel. Paper on "The Solid and Liquid States of Steel," Cosmo Johns. Jl. West of Scotland Iron & Steel Inst., vol. 26, part 3, 1918-1919, pp. 36-41. Properties of an optically clean surface of liquid steel and its similarity to that of a polished metallic surface with a vitreous film. Preservation of surface of liquid steel is attributed to presence of iron-vapor atmosphere.

Malleable Iron. Malleable Iron, What it is, and How it is Made, F. H. Bell. Can. Foundryman, vol. 10, no. 4, Apr. 1919, pp. 85-88, 7 figs. Organization in operation of foundry works.

Manganese. Manganese Alloys in Open-Hearth Steel Practice, Samuel L. Hoyt. Sci. Am. Supp., vol. 87, no. 2261, May 3, 1919, pp. 282-283. Conditions in open-hearth practice that affect conservation of manganese, both during the working of the heat and in making final additions; metallurgical conditions for use of manganese in the form of low-grade or special alloys; effect on finished steel both as to quality and condition of various methods and processes.

Ore Smelting. A New Method for the Smelting of Iron Ores, J. W. Moffat. Can. Machy., vol. 21, no. 14, Apr. 3, 1919, pp. 325-327. Duplex process for making of steel from ores not suitable for blast furnace.

Phosphorus in Steel. The Determination of Phosphorus in Vanadium Steels, Ferro-Vanadium, Non-Vanadium Steels and Pig Iron, Chas. Morris Johnson. Chemical News, vol. 118, no. 3073, Mar. 7, 1919, pp. 113-115. Method for steel containing vanadium up to 2.6 per cent; table showing effect of increasing amount of nitric acid on phosphorus recovery.

Tempering Velocity, Critical. Influence of Various Factors on the Critical Velocity of Tempering of the Carbon Steels (Influence de divers facteurs sur la vitesse critique de trempes des aciers au carbone), I. M. Portevin. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 7, Feb. 17, 1919, pp. 346-348. Duration of temper was determined in the experimental work as the time in seconds for cooling of metal from 700 to 200 deg. cent.

Toronto Electric Steel Plant. World's Largest Electric Steel Plant in Toronto, Goergo T. Clark and Frederick Phillips. Can. Engr., vol. 36, no. 13, Mar. 27, 1919, pp. 327-331, 10 figs. Plant occupies 127,65 acres, and 5000 lin. ft. of concrete docks, accommodating vessels of 24 ft. draft. It was built for manufacture of 6-in. and 9.2-in. forgings from raw material.

NON-FERROUS ALLOYS

Aluminum Alloys. Alloys of Aluminum with Rare or Special Alloys, Jean Escard. Metal Industry, vol. 13, no. 20, Nov. 15, 1918, pp. 333-335. Constitution, properties and preparation of aluminum and manganese, aluminum and chromium, aluminum and tungsten aluminum and vanadium, and aluminum and titanium alloys.

Aluminum Bronzes. Study and Graphical Representation of the Properties of Aluminum Bronzes (L'étude et la représentation graphique des propriétés des bronzes d'aluminum), R. de Fleury. Genie Civil, vol. 74, no. 13, Mar. 29, 1919, pp. 254-256, 9 figs. Triangular diagrams of resistance to rupture and ultimate elongation of bars.

Brass. Notes on Alloys Used in Brass Rolling Mills, A. J. Franklin. Metal Industry, vol. 14, no. 12, Mar. 28, 1919, pp. 241-244, 3 figs. Effect of impurities, casting difficulties, hints on annealing and composition of some of the alloys used in sheet-rolling mill.

Decomposition. Decomposition of Metals—II, A. I. Krynitzky. Chem. & Metallurgical Eng., vol. 20, no. 8, Apr. 15, 1919, pp. 421-424, 6 figs. Application of theory to commercial problem of manufacturing durable alloys containing tin and aluminum, with outline of recommended melting, drawing and annealing practice for certain munitions.

Metallography. Metallography Applied to Nonferrous Metals—II, Ernest J. Davis. Foundry, vol. 47, no. 5, Apr. 15, 1919, pp. 215-218, 15 figs. Predicting microstructure of series of alloys by equilibrium diagram.

OCCLUDED GASES

Occlusion. Occlusion of Gases by Metals (L'occlusion des gaz par les métaux), A. Delesne. Revue Générale des Sciences, vol. 30, no. 1, Jan. 15, 1919, pp. 17-19. Synopsis of discussion at conference of Faraday Soc., London.

VARIA

Etching Solutions. Etching Solutions and their Uses, Ernest G. Jarvis and McNab and Harlin Mfg. Co. Metal Indus., vol. 17, no. 4, Apr. 1919, pp. 170-171. Preparation and uses of seventeen different solutions.

Manganese-Silver Problem. The Manganese-Silver Problem—I, Harry J. Wolf. Colorado School of Mines Mag., vol. 9, no. 4, Apr. 1919, pp. 73-77. Metallurgical experiments performed to determine reason for insolubility in cyanide of silver in certain ores where it is accompanied by manganese oxides.

CIVIL ENGINEERING

BRIDGES

Concrete Overhead Arch Bridges. Four Concrete Overhead Arch Bridges on Toronto-Hamilton Highway. Contract Rec., vol. 33, no. 14, Apr. 2, 1919, pp. 301-306, 6 figs. Governing factor in design of bridges has been long clearances by using parabolic overhead arch ribs braced together by horizontal bracing members.

Canada's Longest Reinforced Concrete Trusses. Can. Engr., vol. 36, no. 14, Apr. 3, 1919, pp. 345-348, 6 figs. Bridges carrying Toronto-Hamilton highway across Etobicoke river and Bronte creek. Each is 119 ft. clear span, with 20-ft. roadway and 16-ft. overhead clearance.

Canadian Reinforced Concrete Arch Bridges, Frank Barber. Can. Engr., vol. 36, no. 11, Mar. 13, 1919, pp. 289-293, 6 figs. Historical review and lists of open spandrel and earth-filled arches with clear span of over 100 ft. or total bridge length of over 200 ft.

Concrete-Pile Trestle Construction. Concrete Pile Trestle Construction, Albert M. Wolf. Eng. World, vol. 14, no. 8, Apr. 15, 1919, pp. 25-27, 6 figs. Economy of concrete pile process is argued by the fact that piles and slabs can be cast in central yard, and then transported to site and erected with comparatively small portable plants in the form of combined derrick and piledriver cars.

Construction. Railway Bridges in the Dutch Indies (Mededeelingen omtrent de verzwaring van den bovenbouw der bruggen in de lign Goendih-Soerabajader Nederlandsch-Indische Spoorweg-Maatschappij), E. C. U. Hartman. De Ingenieur, vol. 34, no. 9, Mar. 1, 1919, pp. 148-161, 35 figs. Dismantling of old bridges and erection of new with aid of portable auxiliary bridges placed under existing structures on temporary pile foundation.

The Construction of Culverts and Small Bridges, Charles D. Snead. American City, Town & County Edition, vol. 20, no. 4, Apr. 1919, pp. 323-326, 2 figs. Methods suggested at Kentucky Road School.

Failures. Are Our Highway Bridges Safe? Mun. Jl. & Public Works, vol. 46, no. 16, Apr. 19, 1919, pp. 276-279. Instances of failures of bridges. County highway officials quoted as saying that 30 per cent of bridges of the country are unsafe for heavy vehicles.

India. Adam's Bridge. Indian Eng., vol. 65, no. 1, Jan. 4, 1919, pp. 10-11, 1 fig. Project for connecting India and Ceylon by railway line.

Lift Bridges. Pretoria Avenue Lift Bridge, Ottawa, L. McLaren Hunter. Contract Record, vol. 33, no. 16. Apr. 16, 1919, pp. 355-356, 3 figs. Two 52½-ft. fixed spans and a central 95 ft. electrically operated direct lift span giving 30 ft. maximum clearance.

Relieving Arches. Relieving Arching in Subway Distribute Stress to Piers. Eng. News-Rec., vol. 82, no. 14, Apr. 3, 1919, pp. 667-669, 7 figs. Feature of design in three-span subway carrying street is said to be arched sidewalk spans seated on haunches of roadway span in order to insure desired distribution of stress.

Strengthening Bridges. Strengthening Bridges for Truck Traffic. Contract Rec., vol. 33, no. 14, Apr. 2, 1919, pp. 318-319, also Good Roads, vol. 17, no. 14, Apr. 5, 1919, pp. 149-151. Report of Committee of Am. Road Builders' Assn. on methods of reconstruction to carry heavy loads.

BUILDING AND CONSTRUCTION

Architectural Practice. Post-War Committee on Architectural Practice. Jl. Am. Inst. Architects, vol. 7, no. 4, Apr. 1919, pp. 174-176. Committee on Education evolved present system of education by measured results as expressed in terms of architects service to client, community and nation; and in degree of honorable livelihood made possible to practitioner by such education.

The Making Habitable of Old Dwellings in Town and Country, M. H. Ballie-Scott. Jl. Roy. Inst. British Architects, vol. 26, no. 4, Feb. 1919, pp. 73-79 and (discussion) pp. 80-81, 1 fig. Contrasts artistic tendencies in olden architectural constructions with modern practice of plain building.

Esthetics of Metallic Constructions (Considérations sur l'esthétique des constructions métalliques), M. Resal, Annales des Ponts et Chaussées, partie technique, vol. 47, no. 6, Nov.-Dec. 1918, pp. 253-272. Architectural development in steel construction, specially bridges, is expected to follow what is established as a general law of artistic development, according to which statical structures are constructed long after a material is first employed in building.

How Can the Electrical Industry Assist the Architect? J. O. Case. Jl. Electricity, vol. 42, no. 8, Apr. 15, 1919, pp. 370-374. Commercial Committee of Pac. Coast Section N. E. L. A. recommends that electrical manufacturers assist architects in specification work.

Chimney, Demolition. Demolishing Tall Brick Chimney, Ralph B. Chandler. Can. Engr., vol. 36, no. 16, Apr. 17, 1919, pp. 383-384, 3 figs. Plans and elevations of chimney, showing preparations for demolition with dynamite.

Coal Bins An Example of Coal Bin Reconstruction, Wm. Joshua Barney. Coal Trade Jl., vol. 50, no. 17, Apr. 23, 1919, pp. 448-451, 7 figs. Reinforced concrete structure built to enlarge capacity. Bins continued in operation while structure was being erected.

Concreting Plant. Efficient Concreting Plant Am. Contractor, vol. 40, no. 17, Apr. 26, 1919, p. 30, 1 fig. Mechanical dumping and distribution in construction of Hotel Fort des Moines the erection of which was demanded by the Government to be urgently terminated.

Dome, Reinforced-Concrete. The Reinforced Concrete Dome at Hippodrome, Copenhagen. Eng. & Contracting, vol. 51, no. 18, Apr. 30, 1919, p. 445, 2 figs. Notes on methods of construction.

Earthquakes. Effect on Structures of Recent Porto Rico Earthquakes, M. L. Vicente and C. F. Joslin. Eng. News-Rec., vol. 82, no. 17. Apr. 24, 1919, pp. 806-808, 5 figs. Investigations are represented as indicating that wood frame proves safest for buildings, with well-built reinforced concrete next, and articulated construction last.

Floor, Girderless. Notes on the Test of a Girderless Floor, Peter Gillespie and T. D. Mylrea. Jl. Eng. Inst. of Canada, vol. 2, no. 4, Apr. 1919, pp. 300-317, 22 figs. Tests conducted on flit slabs in Toronto factory by City Architect's Dept. in conjunction with Dept. of Applied Mechanics, University of Toronto.

Foundations. Mathematical Study of Foundations on an Elastic Soil (Etude mathématique des foundations sur terrain élastique), Keiichi Hayashi. Memoirs of the Coll. of Eng. Kyushu Imp. University, Fukuoka, Japan, vol. 1, no. 4, 1919, pp. 225-267, 18 figs. Three cases are considered; mass is loaded symmetrically with uniformly distributed weight; when there are central elevations; symmetrical loading with two concentric weights.

Flues, Chimney. Notes on Chimney Flues, Henry N. Dix. Am. Architect, vol. 115, no. 2259, Apr. 9, 1919, pp. 530-534, 6 figs. Causes of poor draft.

Houses. Philippine Island Concrete House. Concrete, vol. 14, no. 4, Apr. 1919, pp. 146-149, 14 figs. House is of concrete and steel, the only wood in the structure being used in framing for kitchen roof, window and door frames, for doors and windows, stiar rail cap, dumb-waiter box and shelving in closets.

Recommendations for Inexpensive Houses. Contract Rec., vol. 33, no. 14. Apr. 2, 1919, pp. 308-311. Recommendations of Ontario Housing Committee.

House-Building Machinery. Labor-saving Machinery Used in Building Houses, Samuel H. Lea. Eng. News-Rec., vol. 82, no. 16, Apr. 17, 1919, pp. 753-755, 8 figs. Tractors for dragging plows and hauling concrete cars from central mixing plant to all parts of extended job.

Masonry. Studying the Defects in Masonry Structures. Ry. Maintenance Engr., vol. 15, no. 5, May 1919, pp. 167-168, 2 figs. On defects resulting from instability, disintegration and weathering.

Roofs, Brick-Arch. Thin Tied Flat Brick Arch Roofs, E. W. Stoney. Indian Eng., vol. 65, no. 6, Feb. 8, 1919, pp. 80-81, 16 figs. Experiments to determine strength of various tied arch ribs of 10 to 30 ft. span, 2 ft. 3 in. wide, having rise of one-eighth span.

Schools. Standardization of Plans for Schools, Clarence E. Dobbin. Contract Rec., vol. 33, no. 15, Apr. 9, 1919, pp. 339-340. Points out that uniform practice in preparation of designs reduces office work and produces economies in cost without sacrificing architecture.

Construction and Equipment of Portable School Buildings—II, John Howatt and Samuel R. Lewis. Heat. & Vent. Mag., vol. 16, no. 4, Apr. 1919, pp. 34-39, 7 figs. Double-ceiled construction with paper between.

Skylight. New Type Skylight Saves Maintenance Expense. Contract Rec., vol. 33, no. 17, Apr. 23, 1919, pp. 392-393, 2 figs. Construction designed to make provision for expansion and contraction. Used at Windsor Station, Montreal, Can. Pacific Ry.

Sprinklers. Sprinkler Devices for Building Protection, F. S. Broadfoot. Contract Record, vol. 33, no. 16, Apr. 16, 1919, pp. 363-365. Advises frequent inspection or central station control.

Stairways. The Double Stairway, its Design and Construction. Am. Architect, vol. 115, no. 2260, Apr. 16, 1919, pp. 557-561, 16 figs. Schematic arrangements, dimensions and types of details.

Storage Tanks. Storage Tanks of Reinforced Concrete for Ammoniacal Liquors, F. W. Frerichs. Concrete, vol. 14, no. 4, Apr. 1919, pp. 151-154, 3 figs Tanks were made from cement concrete consisting of one part cement, two parts sand and four parts gravel. Accounting is given of tests to which tanks were subjected with view of ascertaining permeability of concrete by water and ammoniacal liquors.

The Admiralty Oil Fuel Reservoir at Rosyth. Petroleum Times, vol. 1, no. 12, Mar. 29, 1919, pp. 245-246, 3 figs. Reservoir is built of concrete on a rock foundation. Oil is pumped in or out by means of cast-iron oil mains.

Superintendence. Systematic Building Superintendence, Charles F. Dingman. Concrete, vol. 14, no. 4, Apr. 1919, pp. 159-162, 4 figs. Scheduling details of building construction; Flynt Company's "Standard practice instructions" superintendents. (Concluded.)

CEMENT AND CONCRETE

Beams. A Simple Method for Designing Concrete Beams Reinforced for Compression. Arthur Raymond. Eng. & Contracting, vol. 51, no. 17, Apr. 23, 1919, p. 401, 2 figs. Simplifications introduced in general theory by approximating on safe side of formulæ.

Blasting Concrete. Blasting Concrete. S. R. Russell. Du Pont Mag., vol. 10, no. 5, May 1919, pp. 8-10, 5 figs. Suggestions in regard to drilling of holes and locating blasting cap. It is claimed that explosives can be used for breaking concrete with great economy of time and money and with absolute safety.

Concrete Mixtures. Saturation of Concrete Reduces Strength and Elasticity, M. B. Haggard. Cement and Eng. News, vol. 31, no. 4, April 1919, pp. 23-25, 6 figs. Compression tests made in experimental laboratory of Univ. of Minnesota.

The Design of Concrete Mixtures. Eng. & Contracting, vol. 51, no. 17, Apr. 23, 1919, pp. 421-426, 5 figs. Interrelation of consistency. size and grading of aggregates, and the proportion of cement. Experimental research at Structural Material Research Laboratory, Lewis Inst. Chicago.

How to Design Concrete Mixtures, D. A. Abrams. Eng. News-Rec., vol. 82, no. 16, Apr. 17, 1919, pp. 758-763, 7 figs. Theory developed from tests; main principles of theory are: With given concrete materials and conditions of tests the quantity of water used determines strength of concrete so long as mix is of workable plasticity; measurement of aggregate grading on a sieve is of greatest importance in proportioning a mixture.

Depositing in Water. Depositing Concrete in water. Contract Record, vol. 33, no. 16, Apr. 16, 1919, pp. 374-375. Report of sub-committee of Committee on Masonry of Am. Ry. Eng. Assn., presenting its opinion on best practice to be followed.

Design. Use Minimum Steel for Economy in Concrete Design, Albert M. Wolf. Concrete, vol. 14, no. 4, Apr. 1919, pp. 139-142. 2 figs. Tables giving sizes, percentages of steel and cost per foot of height for various columns.

Electrolysis. Electrolysis and Concrete—II. Railway Engineer, vol. 40, no. 471, Apr. 1919, pp. 67-69, 2 figs. Tests made at Mass. Inst. of Technology. Points investigated were : Action of stray currents on unstressed embedded steel: rate of corrosion of steel under stress; and, effect of setting cement on paint films. (Continuation of serial.)

PRESERVATION, CONCRETE. The Preservation of Concrete Structures, Maxmilian Toch. Chem. Engr., vol. 27, no. 3, Mar. 1919, pp. 69-71. Methods in use for protecting concrete against errosion, chemical action, disintegration and decomposition. Address delivered before Am. Inst. Chem. Engrs.

SOLUBILITY OF PORTLAND CEMENT. Solubility of Portland Cement and Its Relation to Theories of Hydration, J. C. Witt and F. D. Reyes. Eng. World, vol. 14, no. 7, Apr. 1, 1919, pp. 39-41. Investigation to determine what constituents of cement will go into solution and the proportion of the total amount of each present in the sample.

DAMS. *See Earthwork. Rock, Excavation, etc.*

EARTHWORK, ROCK, EXCAVATION, ETC.

COFFERDAM. Notes on the Design of a Single-Wall Cofferdam, F. R. Sweeny, Eng. News-Rec., vol. 82, no. 15, Apr. 10, 1919, pp. 708-711, 3 figs. Theoretic and economic considerations in developing size and location of timber wales and braces and steel sheeting.

DAMS. Recent Development of Marin Water District, H. M. Bowers. Jl. Electricity, vol. 42, no. 7, pp. 316-318, 4 figs. Dam making use of siphon type of spillway.

Swift Rapids Dam and Ship Lift Lock. Contract Rec., vol. 33, no. 15, Apr. 9, 1919, pp. 330-333, 7 figs. Generating plant supplies current to Orillia, Ont., lock; plant is part of Trent Valley system.

Construction Methods Used at Drummondville, James Dick. Can. Engr., vol. 36. no. 17, Apr. 24, 1919, pp. 397-400, 7 figs. Damming of river and erection of power house to develop 19,000 h.p.

EXCAVATOR, TUNNELING. The Tunnelling Excavator. Iron & Coal Trades Rev., vol. 98, no. 2667, Apr. 11, 1919, p. 440, 1 fig. It is reported that under actual working conditions this patented machine has cut a tunnel 7 ft. 2 in. in diameter at average rate of 60 ft. in 24 hours.

SUBWAY. Solving Construction Problems in Canal Street Subway, A. J. Mayell. Eng. News-Rec., vol. 82, no. 14, Apr. 3, 1919, pp. 650-652, 4 figs. Pit and drift methods used in construction work under old subway in New York city..

TRENCH DIGGING. Municipal Work in Detroit. Fire & Water Eng , vol. 65, no. 18, Apr. 30, 1919, pp. 977-979, 3 figs. Trench digging and pipe laying by Water Dept. of city.

HARBORS

COPENHAGEN. Extension of Copenhagen Harbor (Forskelligt Jernbetonarbejde i og ved Kobenharns Havn). Teknish Tidscrift, vol. 42, no. 51, Dec. 18, 1918, pp. 6-7, 4 figs. Municipal electric power station adjoining harbor. Buildings and elevated railway for discharging coal to boiler house are of reinforced concrete. Part of quay wall consists of grooved reinforced-concrete piles and reinforced slabs.

DOCK GATES. Reinforced Concrete Dock Gates. Engineer, vol. 127, no. 3299, Mar. 21, 1919, pp. 289-290, 3 figs. Gates are constructed as stress line for uniform water pressure and are circular in shape; they have to stand a water pressure of 14 ft.

MONTREAL. Suggested Harbour Improvements for Greater Montreal, E. S. M. Lovelace. Jl. Eng. Inst. of Canada, vol. 2, no. 4, Apr. 1919, pp. 318-327, 3 figs. To remedy strong current from canal basin to foot of island opposite Varennes; to provide sufficient depth at low water for larger ocean-going vessels; to prevent danger of floods during spring and fall.

SOERABAJA, JAVA. New Harbor Works at Soerabaja, Java (Technische lessen en vraagstukken op het gebied van den Indischen havenbouw), Wouter Cool. De Ingenieur, vol. 34, no. 8, Feb. 22, 1919, pp. 121-141, 35 figs. Building of vertical reinforced-concrete quay walls on large caissons 22 ft. wide with 12 in. thick walls. Bases floated into position and sunk by being filled with concrete in bags.

TIMBER, IMPREGNATED. Impregnated Timber for Harbors (Impraegnering af Havnetommer), A. Collstrop and Edv. Bülow. Ingeniören, vol. 28, no. 11, Feb. 5, 1919, pp. 69-74, 17 figs. Results obtained in Denmark by impregnating pine and beach with tar oil.

VANCOUVER. Improvement of Vancouver Harbor. Contract Rec., vol. 33, no. 17, Apr. 23, 1919, pp. 381-386. Recommendations for development of port.

MATERIALS OF CONSTRUCTION

CLAY. Experiments with Clay in its Relation to Piles, Alfred S. E. Ackerman. Surveyor, vol. 55, no. 1417, Mar. 14, 1919, pp. 213-224 and also Soc. Engrs., Jl. & Trans., vol. 10, no. 2, 1919, pp. 37-80 and (discussion), pp. 80-107. 17 figs. Results of 95 experiments, some extending over period of 40 hours each. Object was to determine relationship between horizontal pressure and depth at any given point in clay. Among other conclusions writer establishes that corrugating as well as tapering piles increases their resistance.

TILE. Strength of Hollow Building Tile. Eng. & Contracting, vol. 51, no. 17, Apr. 23, 1919, pp. 411-413, 6 figs. Tests conducted by Bureau of Standards. From Technologic Paper no. 120.

RECLAMATION AND IRRIGATION

DRAINAGE WORK. Moore Park Drainage System, Toronto, W. G. Cameron. Can. Engr., vol. 36, no. 9, Feb. 27, 1919, pp 251-255, 7 figs. Storm-water outlet; district drained comprises area of 233.5 acres.

Drainage Works on Railway Lands, G. A. McCubbin. Can. Engr., vol. 36, no. 11, Mar. 13, 1919, pp. 295-298. Dominion laws in respect to drainage and examples of their application. Paper read at Annual Meeting of Assn. of Ontario Land Surveyors.

ROADS AND PAVEMENTS

ACCOUNTING. County Highway Books and Bookkeeping, Gordon F. Daggett. American City, Town & County Edition, vol. 20, no. 4, Apr. 1919, pp. 327-330, 3 figs. Forms for county highway departments.

BRICK PAVEMENTS. Present Status of Brick Pavements Constructed with Sand Cushions, Cement Mortar Beds and Green Concrete Foundations, W. M. Acheson. Good Roads, vol. 17, no. 14, Apr. 5, 1919, pp. 147-149, also Contract Record, vol. 33, no. 16, Apr. 16, 1919, pp. 370-371. Comparison of old and new methods of constructing brick pavements with reference to strength and durability.

CHICAGO BOULEVARDS. The Michigan Avenue Improvement is the Most Important Addition to Chicago's Boulevard System, Hugh E. Young. Eng. World, vol. 14, no. 8, Apr. 15, 1919, pp. 15-24, 7 figs. Construction of work to remedy congestion in traffic which will involve expenditure of $7,700,000.

CONCRETE ROADS. Machine Finishing Concrete Roads, E. G. Carr. Mun. & County Eng., vol. 56, no. 4, Apr. 1919, pp. 132-134, 5 figs. Benefit of using machine by reason of compactness resulting from action in concrete mass.

DRAINS. Segment Blocks have Advantages on Larger-Size Drains, D. L. Yarnell. Eng. News-Rec., vol. 82, no. 14, Apr. 3, 1919, pp. 663-664. Report prepared under direction of Bur. Public Roads and Rural Eng. Advantages of lightness, ease of handling and small breakage.

FINANCING. Methods of Financing Highway Improvements for States, Counties and Towns. Good Roads, vol. 17, no. 17, Apr. 26, 1919, pp. 177-179. Committee report presented at Convention of Am. Road Builders' Assn.

GRADE SEPARATION. General Problems and Aspects of Grade Separation. Eng. & Contracting, vol. 51, no. 16, Apr. 16, 1919 pp. 381-384. Report issued by Div. of Grade Separation and Bridges of city of Detroit. It comprises partly an account of progress and partly a study of general and special problems with which city is confronted as it looks forward to an extensive program of construction.

GUARANTEES. Pavement Guarantees. Can. Engr., vol. 36, no. 13, Mar. 27, 1919, pp. 337-339. Report of Committee on "Economic Status of Guarantees of Pavements on Roads and Streets," presented Feb. 28, at the Annual Convention of Am. Road Builders' Assn.

INDIAN ROADS. Metalling Roads in the Punjab, Khan Bahadur M. Abdul Ahad. Indian Eng., vol. 65, no. 9, Mar. 1, 1919, pp. 124-125, 1 fig. Substitutes introduced by Punjab road engineers are: Sarai-Kala limestone, stone boulders, shingle and shale and overburnt brickbats.

MACADAM. Considerations Affecting Designs of Heavy Traffic Highways in Ontario, W. A. McLean. Mun. & County Eng., vol. 56, no. 4, Apr. 1919, pp. 157-158. Table indicating required thickness of macadam road crust to transmit at an angle of 30 deg. from the vertical safe bearing pressure to subgrade of various soils. From annual report of Ontario Dept. of Highways.

NATIONAL ROADS. National Roads, E. A. Kingsley. Mun. Jl. & Public Works, vol. 46, no. 16, Apr. 19, 1919, pp. 293-294. Argument in their favor based on success of Nat. Administration of French Roads.

OIL HEATING PLANT. Road-Oil Heating Plant of Los Angeles County, E. Earl Glass. Eng. News-Rec., vol. 82, no. 15, Apr. 10, 1919, pp. 729-730, 3 figs. Built plant from old equipment in stock. Installation is said to save county $20 per 1,000-gal. tank.

RELOCATIONS. Highway Relocations, Gordon F. Daggett. Wisconsin Engr., vol. 23, no. 7, Apr. 1919, pp. 235-243. In relation to securing a more economical road as regards construction and maintenance features.

SCARIFIER. A New Road Scarifier. Engineer, vol. 127, no. 3298 Mar. 14, 1919, p. 254, 4 figs. A quick-lift toggle action is fitted to frame carrying tines which permits carrying tines to full depth on both sides of an obstruction.

SNOW REMOVAL. Efficient Methods of Snow Removal from Highways Outside of Urban Districts. Good Roads, vol. 17, no. 17, Apr. 26, 1919, pp. 180 & 187. Committee report presented at Convention of Am. Road Builders' Assn.

TRUCK TRANSPORTATION. Hard Surface Roads and the Auto Truck, H. W. Eldridge. Cement & Eng. News, vol. 31, no. 4, Apr. 1919, pp. 28-29, 1 fig. Transportation of war supplies from point of production in interior states to points of shipping on Atlantic Coast.

Bituminous Surfaces under Truck Traffic, Prevost Hubbard. Contract Rec., vol. 33, no. 14, Apr. 2, 1919, pp. 314-315. Firm foundation essential to resist action of heavy motor trucks.

WATERFRONT PAVING. Improvement of the Embarcadero in San Francisco, California, Charles W. Geiger. Good Roads, vol. 17, no. 16, Apr. 19, 1919, pp. 167-168, 3 figs. Bituminous-concrete and basalt-block pavement employed for light and heavy vehicles on waterfront thoroughfare.

WOOD-BLOCK PAVEMENTS. Some Specific Suggestions on the Design and Construction on Modern Wood Block Pavements, E. A. Fisher. Mun. & County Eng., vol. 56, no. 4, Apr. 1919, pp. 129-130, 4 figs. Laying block on pitch cushion applied to smooth concrete base and filling in the remainder with sand.

SANITARY ENGINEERING

NEW ORLEANS SYSTEM. Unique Feature of Unified Operation of Water, Sewerage and Drainage Facilities at New Orleans, La., George G. Earl. Mun. & County Eng., vol. 56, no. 4, Apr. 1919, pp. 121-129, 3 figs. Developments which are said to have reduced death rate of city about one-third.

REFUSE COLLECTION. Efficiency in City Scavenging, Mun. Jl. & Public Works, vol. 46, no. 17, Apr. 26, 1919, pp. 309-311, 3 figs. Suggestions for planning a system of refuse collection.

Refuse Disposal. Refuse Disposal in London. Mun. Jl. & Public Works, vol. 46, no. 15, Apr. 12, 1919, pp. 263-264. Borough of 120,000 population reported to have screened its refuse, recovered paper and other salable materials and used a clay pit for dumping.

Sewage Disposal. Design Features of Sewage Disposal Plant at Industrial Housing Development of the Alan Wood Iron and Steel Co., at Swedeland, Pa., George L. Robinson. Mun. & County Eng., vol. 56, no. 4, Apr. 1919, pp. 135-136, 1 fig. Sections of sliding tanks.

Sewage Disposal in North Dakota, Elwyn F. Chandler. Quarterly Jl. of the Univ. of North Dakota, vol. 9, no. 3, Apr. 1919, pp. 220-230. Lists for North Dakota and the Red River Valley those towns that are on the banks of rivers and that already have (or will shortly have) sewerage systems, and formulate conclusions concerning the population that each may reach before its sewer outfall will transform the stream into a possible nuisance.

Regulating Chlorine Doses. Mun. Jl. & Public Works, vol. 46, no. 15, April 12, 1919, pp. 264-265. Conclusions from experiments by Maryland Health Dept. Five-minute absorption test recommended.

The Disposal of Sewage by Treatment with Acid, Edgar S. Dorr and Robert Spurr Weston. Boston Soc. Civil Engrs., vol. 6, no. 4, Apr. 1919, pp. 145-166 and (discussion) pp. 166-175. Concludes from results of various experiments and studies that the Miles process will produce a well disinfected effluent from which 90 per cent of the settleable solids have been removed.

Sewage Disposal by Dilution, Including Chlorination of Sewage Effluent and Treatment of Sludge, W. C. Easdale. Surveyor, vol. 55, nos. 1418 and 1419, Mar. 21 and 28, 1919, pp. 227-229 and 224-246, 2 figs. also Eng. & Contracting, vol. 51, no. 18, Apr. 30, 1919, pp. 456-459, 2 figs. Concerning removal of maximum percentage of solids in suspension; maintenance of sewage in fresh condition while passing through tanks; treatment of sludge in such a manner as to facilitate its disposal without causing fouling of tank effluent.

Sewage, Measuring Devices for. Sewage System for Essex Border Cities. Contract Record, vol. 33, no. 16, Apr. 16, 1919, pp. 358-362, 3 figs. Regulating chambers and measuring devices.

Sewage Pumping. Milwaukee Sewage Pumping Station, T. Chalkely Hatton. Fire & Water Eng., vol. 65, no. 17, Apr. 23, 1919, p. 938, 3 figs. Automatically controlled system for disposing of maximum combined daily flow of 231,000,000 gal.

Sewage Screening. Grit Chamber and Fine Screens for Part of New York Sewage, Charles E. Gregory. Eng. News-Rec., vol. 82, no. 14, Apr. 3, 1919, pp. 672-674, 5 figs. Screens of revolving-disk type. Plant serves an area of 345 acres of which about 17 per cent is built up with apartment houses.

Sewers. Equipment and Methods Employed in Building Sewers in San Francisco, Cal., H. W. Shimer. Mun. & County Eng., vol. 56, no. 4, Apr. 1919, pp. 136-140, 18 figs. Disposal scheme adopted is to discharge sewerage only at points were there are strong tidal current.

Storm Sewer Extension at Toronto Harbour, George T. Clark. Can. Engr., vol. 36, no. 6, Feb. 6, 1919, pp. 193-195, 4 figs. Drainage problems arising from waterfront improvements and how they are being solved.

Town Planning. Town Planning in Canada, James White, Can. Engr., vol. 36, no. 6, Feb. 6, 1919, pp. 199-200. Outline of work of Commission of Conservation in relation to housing and land problems.

SURVEYING

Azimuth Line. Drawing the Azimuth Line (Tracciamento della retta d'azimut), E. Modena. Revista Maritima, vol. 52, no. 2, Feb. 1919, pp. 169-173, 1 fig. Method is similar to St. Hilaire's for altitude line.

Geometric Leveling. Geometric Leveling by the Method of Dr. Wilhelm Seibt (Nivelacion geométrica par el metodo del Dr. Wilhelm Seibt), Tomas Gonzàlez Roura. La Ingenieria, vol. 23, no. 6, Mar. 16, 1919, pp. 379-388. Probable error of an isolated observation. (Continuation of serial).

Transit. Variations of the Optical Axis of a Transit (Sur l'étude des perturbations de l'axe optique d'une lunette méridienne en direction), Maurice Hamy. Comptes Rendus des Séances de l'Académie des Sciences, vol. 168, nos. 9 and 10, Mar. 3 and 10, 1919, pp. 429-435 and 484-489, 4 figs. Adjustment of telescope by means of collimator placed in line of axis of rotation and two double-reflection prisms placed near ends of collimator and telescope which permit illuminated opening of collimator to be viewed through eyepiece of telescope. Formulæ for corrections. Determination of coefficients entering in equations given in first part of article (Comptes rendus, vol. 168, Feb. 24, 1919).

WATER SUPPLY

Dry Feeding. The Dry Feeding of Chemicals Used in Water Purification, F. B. Leopold. Mun. & County Eng., vol. 56, no. 4, Apr. 1919, pp. 134-135, 1 fig. Main feature of dry-feed apparatus is cast-iron housing, into which is fitted a drum wheel carrying material forward through an adjustable orifice.

Earthquake Protection. San Francisco's High-Pressure Water Supply, Charles W. Geiger. Eng. World, vol. 14, no. 8, Apr. 15, 1919, pp. 29-32, 6 figs. Safeguards to protect system from damage by earthquakes or accidents.

Factory Water Supply. What it Pays to Know About Factory Water Supply—II, Charles L. Hubbard. Factory, vol. 22, no. 4, Apr. 1919, pp. 689-692, 4 figs. Bringing water to the plant.

Filter Plant. Dundas Has New Filter Plant on Gravity Supply, E. H. Darling. Can. Engr., vol. 36, no. 16, Apr. 17, 1919, pp. 379-382, 6 figs. Concrete dam forms conservation reservoir. Plant has capacity of 700,000 imp. gal. a day.

Manzanares River. Embankment and Hygienic Treatment of the Manzanares River (Encauzamiento y saneamento del rio Manzanares), Edwardo Fungairino. Rivesta de Obras Publicas, vol. 67, no. 2268, Mar. 13, 1919, pp. 121-126, 10 figs. Reinforced-concrete structures being erected.

Montana. Treating Montana Waters, C. Herschel Koyl. Ry. Maintenance Engr., vol. 15, no. 5, May 1919, pp. 154-157, 2 figs. Results yielded by installation of Great Northern Railway for treating waters on 1100 miles of main lines.

Purification. Water Purification. Times Eng. Supp., vol. 15, no. 533, Mar. 1919, pp. 104-105. Methods and aims.

Softening. Lime Softening of Water and the Use of Sludge as an Aid, W. A. Sperry. Can. Engr., vol. 36, no. 16, Apr. 17, 1919, pp. 384-386 also Eng. & Contracting, vol. 51, no. 15, Apr. 9, 1919, pp. 364-365. Experience at Grand Rapids with changing seasons and illustrating the relations of time and temperature. Paper read before Illinois Section Am. Waterworks Assn.

Treating Water Reduces Boiler Troubles, C. Herschel Koyl. Ry. Age., vol. 66, no. 17, Apr. 25, 1919, pp. 1053-1056, 2 figs. Great Northern experiences with installation on 1100 miles of main lines.

Water Softening; Investigation; Features of Plant; and Special Problems of Large Installations, M. F. Stein. Eng. & Contracting, vol. 51, no. 15, Apr. 9, 1919, pp. 353-356, 5 figs. Results of investigation for softening Lake Erie water. A diagram shows ultimate composition of water after treatment with various amount of lime. Paper read before Illinois Section of Am. Waterworks Assn.

Under-Water Mains. Water Main Under Copenhagen Harbor (Vandledning under Havnen til Sundbyerne), Ingeniören, vol. 27, no. 101, Dec. 18, 1918, p. 634. Project for increasing water supply to suburb where rapid growth has made present supply insufficient.

Wells. Methods of Drilling and Test Results of Large Capacity Well. Eng. & Contracting, vol. 51, no. 15, Apr. 9, 1919, pp. 362-363, 3 figs. Data secured at University of Illinois Wells.

WATERWAYS

Flood Control. Flood Control Work in Washington, W. A. Scott. Eng. World, vol. 14, no. 7 Apr. 1, 1919, pp. 23-28, 12 figs. Project involving expenditure of $1,000,000.

Hell Gate Channel. Industrial Influence of Waterways, Harry Chapin Plummer. Indus. Management, vol. 57, no. 5, May 1919, pp. 353-358, 5 figs. How improvement of Hell Gate Channel and Harlem River will affect eastern manufacturers.

Rivers. Formation of Sinuosites in Water Courses (Recherches sur la formation des sinuosités des cours d'eau), C. Hoc. Génie Civil, vol. 74, no. 12, Mar. 22, 1919, pp. 233-234, 7 figs. Theory of meander of rivers developed from study of dynamic conditions of moving point in liquid, considered as subjected to system of elastic forces defined by ellipsoid of elasticity. (Concluded).

VARIA

Coast Defence Work. Civil Engineering in the War, G. K. Scott Moncrieff. Times Eng. Supp., vol. 15, no. 533, Mar. 1919, p. 100. Coast-defense work.

Memorials. Observations on Types of Memorials, A. L. Brockway. Am. Architect, vol. 115, no. 2259, Apr. 9, 1919, pp. 511-514. Remarks that the great monuments of the past are expressions of the ideas of the people who erected them; consequently, that it is not fitting for moderns to celebrate their victories by appropriating expressions of ancient nations.

MECHANICAL ENGINEERING

AIR MACHINERY

Compressed-Air Applications. Compressed Air in the Manufacture of Concrete Pipe, D. W. C. Grove. Compressed Air Mag., vol. 24, no. 4, Apr 1919, pp. 9104-9106, 1 fig. Filling and tamping forms with pneumatic rammer.

CORROSION

Chemistry of Corrosion, Non-Ferrous Metals. Fourth Report to the Corrosion Committee of the Institute of Metals, Guy D. Bengough. Iron & Coal Trades Rev., vol. 98, no. 2665, Mar. 28, 1919, pp. 388-389. Nature of actions that take place when zinc, copper, aluminum, 70:30 brass, etc. corrode in neutral or nearly neutral liquids; behavior of condenser tubes in similar liquids, and variations in behavior in different samples of tubes of the same composition. Also in Min. Jl., vol. 124, no. 4362, Mar. 29, 1919, pp. 190-191. Also abstracted in Engineer, vol. 127, no. 3300, Mar. 28, 1919, pp. 300-301.

Rustproofing. Rustproofing Steel. Machy. (N.Y.), vol. 25, no. 8, Apr. 1919, pp. 736-737, 2 figs. Methods used in plant of Hudson Motor Car Co., Detroit, Mich., for rustproofing passenger-car steel bodies preparatory to painting by means of deoxidine process.

Parker Rustproofing Process, Edward K. Hammond. Machy. (N.Y.), vol. 25, no. 9, May 1919, pp. 851-854, 4 figs. Method which is said to be applicable to machine surfaces without changing their shape or size.

Ships. Corrosion of Ships. Am. Mar. Engr., vol. 13, no. 9, Sept. 1918, pp. 8-9. Manner of protection against corrosion. From Liverpool Jl. of Commerce.

FORGING

Dies. Obtaining Maximum Service from Dies, James C. Cran. Am. Drop Forger, vol. 5, no. 4, Apr. 1919, pp. 172-173 and p. 185. Electric steel recommended.

See also Hammer and Dies below.

Engine Cylinders. Operations on the iberty Motor Cylinders—I, Fred H. Colvin. Am. Mach., vol. 50, no. 16, Apr. 17, 1919, pp. 757-758, 6 figs. Method of forging.

Hammer, Bement Steel. Forgings from Forty-Eight-Inch Ingots. Pac. Mar. Rev., vol. 16, no. 4, Apr. 1919, pp. 118-119, 2 figs. Double-arch Bement steam hammer said to be capable of delivering a blow of 150,000 lb.

Hammer and Dies. A Review of Hammer and Die Problems, R. C. Jennings. Am. Drop Forger, vol. 5, no. 4, Apr. 1919, pp. 180-182, 3 figs. Describes machine patented by writer and designed to use either American or English die blocks.

FOUNDRIES

Brass Foundry. Materials and Chemicals Used in Brass Foundry Practice—V. Charles Vickers. Brass World, vol. 15, no. 4, Apr. 1919, pp. 113-115, 2 figs. History, properties, appearance, physiological action and commercial use of substances commonly used in brass founding. Method for making phosphore-tin.

Crucibles. The Use and Abuse of Crucibles, A. C. Bowles. Min. & Sci. Press vol. 118, no. 15, Apr. 12, 1919, pp. 505-506, 3 figs. Alleges that principal cause of failure of crucibles is lack of proper annealing; states that a temperature of 250 deg. fahr. is required to dispel moisture absorbed from atmosphere.

Engine Castings. Inland Plant Sefs Record on Marine Engine Castings, D. M. Avey. Foundry, vol. 47, no. 5, Apr. 15, 1919, pp. 196-204, 23 figs. Rapid production of castings at plant of Hooven, Owen, Rentschler Co., builders of Corliss type engines; foundry said to have turned out heavy castings for a complete engine per day.

Malleable Castings. Malleable Plant to Revert to Destined Work. Foundry, vol. 47, no. 5, Apr. 15, 1919, pp. 221-224, 6 figs. General arrangement of Nat. Malleable Castings Co. foundry where cast-steel anchor chains are being manufactured. Plant was originally designed for production of malleable castings for automobile service and is being refitted to undertake this work.

Patterns. Patternmaking Methods—II, Joseph A. Shelly. Machy, (N.Y.), vol. 25, no. 8, Apr. 1919, pp. 722-726, 7 figs. Examples of pattern work and methods used in general pattern making practice.

Patterns and Moulds for Engine Cylinder Castings—I, Joseph Horner. Foundry Trade Jl., vol. 21, no. 206, Feb. 1919, pp. 90-94, 13 figs. Principles which control the various classes of work, by reason of the double practice of both patternshop and foundry.

Risers. Hot Water Practice in Relation to Risers—I, W. B. Gray. Metal Worker, vol. 91, no. 15, Apr. 11, 1919, pp. 455-456. Method of determining size.

Sand Blast. Application of the Sand-Blast to General Foundry Work, Parts 1 and 2, H. D. Gates. Pt. 1: Metal Trades, vol. 10, no. 4, Apr. 1919, pp. 172-175, 4 figs. Discusses general question of cleaning castings by sand blast and describes various types of hose machines. Pt. 2: Can. Foundryman, vol. 10, no. 4, Apr. 1919, pp. 90-94, 9 figs. Its applicability and advantages for general foundry work together with examples and data of what has actually been accomplished.

Standardization. Standardization of Foundry Practice, S. W. Wise. Foundry Trade Jl., vol. 21, no. 206, Feb. 1919, pp. 95-97. Record of operation of various cupolas and discussion of the possibility of standardizing cupola practice. Paper read before Newcastle Branch, British Foundrymen's Assn.

Steel Castings. Steel Castings from the Engineer's View-point, H. A. Neel, Proc. Steel Treating Research Soc., vol 2, no. 3, 1919, pp. 14-16 and 43-44 and (discussion) pp. 44-50. Developments in molding and metallurgical practice which have made possible to use steel castings in operations formerly undertaken with forgings.

Manufacture of Steel Castings by Various Processes, David D. MacGuffie. Foundry Trade Jl., vol. 21, no. 206, Feb. 1919, pp. 85-89, 3 figs. Remarks on the crucible, Tropenas, Stock oil-fired converter, and electric-furnace processes. paper read before British Foundrymen's Assn.

FUELS AND FIRING

Ash. Fusibility of Ash from Coals Found in the Interior Province, W. A. Selvig, W. C. Ratliff and A. C. Fieldner. Coal Age, vol. 15, no. 16, Apr. 17, 1919, pp. 698-703. Table of softening temperatures of coal ash from coals of interior province obtained at Fuels Chemical Laboratory tests conducted by Bur. of Mines.

Coal, Lignite. Lignite Coals and Their Utilization, C. C. O'Harra. Pahasapa Quarterly, vol. 8, no. 2, Feb. 1919, pp. 15-35, 18 figs. Extent and estimated reserve of coal deposits of the world; developments in industrial recoveries of coal bye-products.

Combustion Experiments with North Dakota Lignite, Henry Kreisinger, C. E. Augustine and W. C. Harpster. Dept. of Interior, Bur. of Mines, tech. paper 207, 44 pp., 13 figs. Tests were made by burning lignite—both as it comes from mine and as corbonized residue from gas retorts—at various rates in experimental furnaces and by studying process of combustion.

Coal, Pulverized. Pulverized Coal and Its Bearing on the Fuel Situation, H. G. Barnhurst. Manufacturers Rec., vol. 75, no. 16, Apr. 17, 1919, pp. 107-108. Table giving cost of preparing coal in plants of various capacities.

The Use of Pulverized California Coal, Chas. H. Delany. Jl. Electricity, vol. 42, no. 8, Apr. 15, 1919, pp. 357-359. Its substitution for fuel oil is discussed from standpoint of initial costs and comparative operating expense. Paper prepared for Spring Convention of Pac. Coast Section N. E. L. A. by Eng. Committee.

Pulverized Coal as the Reconstruction Fuel for all Industrial Heating Operations, C. F. Herrington. Iron & Steel of Can., vol. 2, no. 4, Apr. 1919, pp. 77-83, 4 figs. Equivalent prices of powdered coal and other fuel. Details of powdered-coal plant.

Coal, Southwestern. Burning Coals of the Southwest, W. M. Park. Power, vol. 49, no. 15, Apr. 15, 1919, pp. 574-575, 4 figs. Large furnace volumes, liberal grate area and unusual quantities of refractory material in the ignition arch and bridge wall, are advocated.

Coal, Storage. Storage of Coal and Spontaneous Combustion. Ry. & Locomotive Eng., vol. 32, no. 4, Apr. 1919, pp. 99-100. Analysis of causes and approved methods of suppression.

Coal, Western. Western Coal, R. D. MacLaurin. Can. Chem. Jl., vol. 3, no. 4, Apr. 1919, pp. 124-125. Means taken by Government officials to stimulate development of these resources. (Concluding article.)

Draft. The Securing of Economy in the Burning of Fuel, J. F. Patton. Power House, vol. 13, no. 4, Apr. 5, 1919, pp. 94-95, 3 figs. Influence of draft on burning of coal; use of draft gages; importance of eliminating air leaks.

Firing. Utilization of Fuels in Industrial Furnaces (L'utilisation des combustibles dans les foyers industriels), Roger Hartmann. Société Industrielle de l'Est, Bul. 145, Feb. 1919, pp. 3-21,3 figs. Theoretical study of economical combustion based on chemical phenomena of ignition; means suggested by the governments of England, America and France for efficient utilization of fuels.

Flue-Gas Analysis. Combustion and Flue Gas Analysis. Dept. of the Interior, Bur. of Mines, tech. paper 219, 12 pp., 6 figs. Recommends use of measuring instruments. Reprint of Eng. Bul. no. 4, prepared by U. S. Fuel Administration.

Fuel Conservation. National Saving of Fuel and Power, Arthur V. White. Can. Engr., vol. 36, no. 11, Mar. 13, 1919, pp. 299-303. Activities of Canadian Committee of Conservation.

Gas, Blast-Furnace. Fuel Economy (Economies de combustible dans une aciérie moderne). Métallurgie, vol. 51, no. 14, Apr. 2, 1919, pp. 777-778. Utilization of gases from blast furnaces. (Concluded.)

Grates. Recent Improvements in Sintering Equipment and Practice. Eng. & Min. Jl., vol. 107, no. 17, Apr. 26, 1919, pp. 744-745, 3 figs. Device intended to prevent grates from getting dirty. Designed for use with the straight-slot type of grate.

Oil Firing. Saving the Waste in the Chimney—V, Robert Sibley and Chas. H. Delany. Jl. Electricity, vol. 42, no. 7, Apr. 1, 1919, pp. 318-320, 7 figs. Operating test of steam power plant operated by fuel oil in San Francisco.

Peat. The Utilisation of Peat for Power Generation—I & II, John B. C. Kershaw. Engineer, vol. 127, nos. 3298 & 3299, Mar. 14 and 21, 1919, pp. 239-240 and 265-267. 11 figs. Processes for carbonizing followed at various plants in France, Sweden and Germany.

FURNACES

Davis Furnace for Baking Electrodes. Davis Furnace for Baking Electrodes (Four Davis à cuire les électrodes). Revue Générale de l'Electricité, vol. 5, no. 12, Mar. 22, 1919, p. 458. Installed at Hecla works of Diamond Foundry, Luton, England, where, it is said, 30,000 tons of electric steel are produced per year at average consumption of 11 lbs. of electrode per ton of steel.

Gas Furnaces. Heating Gas Furnaces, O. L. Kowalke. Gas Rec., vol. 15, no. 7, Apr. 9, 1919, pp. 231-234, 6 figs. Tests to determine maximum temperature which can be obtained in a given furnace, using three types of mixers with regulated and unregulated air supply, by burning carbureted water gas in bunsen flame and also under adapted surface combustion conditions. Paper before Wis. Gas Assn

Gas Furnaces as Re-Heaters of Iron Piles, etc Iron & Coal Trades Rev., vol. 98, no. 2664, Mar. 21, 1919, p. 254. Function gas furnace has to perform in smelting steel and in reheating iron.

Heat-Treating Furnaces. Heating Furnaces and Annealing Furnaces—III, W. Trinks. Am. Drop Forger, vol. 5, no. 4, Apr. 1919, pp. 174-180, 8 figs. Method of computing fuel consumption from losses.

The Design of Heating Furnaces from a Practical Standpoint, George J. Hagan. Proc. Engs. Soc. Western Pa., vol. 35, no. 1, Feb. 1919, pp. 31-47 and (discussion) pp. 48-57, 5 figs. On design and method of construction, with reference to furnaces used in sheet and tin-plate industry and to a continuous rotary furnace for wash and heat.

Melting Furnaces. Metallurgical Furnaces. Adolph Bregman. Metal Indus., vol. 17, no. 4, Apr. 1919, pp. 159-162, 7 figs. Conditions that govern size, shape and type of metal-melting furnaces.

GAGES

Hoke Precision Gages. Manufacture of Hoke Precision Gages at the Bureau of Standards, H. L. van Keuren. Am. Machinist, vol. 50, no. 14, Apr. 3, 1919, pp. 625-630, 6 figs. Gage blocks are being produced at the Bureau with an accuracy limit of a few millionths of an inch. Apparatus used in testing flatness and parallelism to one millionth of an inch. Development of process for their commercial manufacture has taken place within period of 6 months. Special reference is made to light-weight interference method for determining accuracy.

Johanssen Tolerances. Johanssen System of Tolerances. Machinery, vol. 13, no. 339, Mar. 27, 1919, pp. 718-719, 1 fig. On Swedish system based on diameter of hole.

Measurement of Gages. The Measurement of Gauges—I & II, E. A. Forward. Engineer, vol. 127, nos. 3300 & 3299, Mar. 21 and 28, 1919, pp. 282-283 and 294-295, 24 figs. Methods used for measuring three classes of gages: (1) plate or form gages the profiles of which are combinations of straight lines and curves; (2) conical plugs, rings and disks, combinations of cones with cylinders and planes, and castellation gages; (3) position gages.

Plug Gages, Angular. Angular Plug-Gage Making, Hugo Pusep. Am. Machinist, vol. 50, no. 14, Apr. 3, 1919, pp. 635-640, 15 figs. Lays emphasis on elimination of errors in preliminary operation, in order to prevent their accumulation and the appearance of serious defects which will be difficult to eliminate in later operations.

GAS ENGINEERING

Distributing Systems. Increasing Capacity of Low-Pressure Mains by Admitting Gas at More Than One Point, A. C. Howard. Am. Gas. Eng. Jl., vol. 110, no. 16, Apr. 19, 1919, pp. 329-331. Using an artificial gas distributing system for natural gas. From Gas & Elec. News.

Flow of Gas. Flow of Gases Under Heavy Pressure (Sur l'écoulement des gaz à très fortes pressions), A. Rateau Comptes rendus des Séances de l'Académie des Sciences, vol. 168, no. 7, Feb. 17, 1919, pp. 330-335. Changes in gas equation to make it applicable to the flow of gases in guns.

Lighting. The Group and Duct System of Lighting Gas World, vol. 70, no. 1810, Mar. 29, 1919, pp. 237-239, 3 figs. Also in Gas Jl., vol. 146, no. 2916, Apr. 1, 1919, pp. 30-32, 3 figs. System is designed to utilize one injector for supplying any number of burners, in place of each individual burner having gas injector and air intake. There are three separate sets of types—one suplying high pressure gas, one carrying air to an injector for mixing with the gas, and one supplying mixture of gas and air from injector to burners.

Mantles, Gas. Influence of Quality of Gas on the Efficiency of the Gas Mantle, Pts. 2 and 3, R. S. McBride, W. A. Dunkley, E. C. Crittenden and A. H. Taylor, Gas World, vol. 70, nos. 1805 and 1810, Feb. 22 and Mar. 29, 1919, pp. 128-130 and 233-236, 10 figs. Pt. 2: Graphs showing effect of gas-pressure variations upon efficiency, gas consumption and candle-power of various lamps. Pt. 3: Lean water gas reported to have shown qualities for mantle lighting superior to those of rich water gas in proportion to total heating values. Section 1 appears in Gas World for Feb. 8.

Production, Gas. Distribution of Light, Heat, and Motive Power by Gas, Dugald Clerk. Gas Journal, vol. 145, no. 2915, Mar. 25, 1919, pp. 637-640 and (discussion) pp. 640-642; also Gas World, vol. 70, no. 1809, Mar. 22, 1919, pp. 210-212. Efficiency of gas production compared with efficiency of electricity generation. Claim to electric superiority over gas in coal economy considered as unjustified. Thermal efficiency of carbonizing gas coal in horizontal retorts. Paper read before Roy. Soc. of Arts.

Purification, Oil Gas. Liquid Purification of Gas, O. B. Evans. Gas Rec., vol. 15, no. 7, Apr. 9, 1919, pp. 215-216. Concluded from tests of Atlantic Refining Co. that cold liquid purification of oil gas may result in a loss of 25 per cent in candle power. Paper before Am. Gas Assn.

Principles of Gas Purification and Purifier Design, F. W. Steere. Gas Age, vol. 43, no. 7, Apr. 1, 1919, pp. 361-363, 2 figs. Review of methods and suggestions regarding improvements in apparatus employed in removing sulphur from gas. (Concluded.)

Water Gas. Gas Machine Factors Involved in the Manufacture of Carburcted Water Gas. Am. Gas Eng. Jl., vol. 110, no. 15, Apr. 12, 1919, pp. 312-316 and 320-324. Fundamentals upon which process is dependent and suggestions toward locating cause of variations in results.

HANDLING OF MATERIALS

Car Dumper. The Biggest Car Dumper in the World. Sci. Am., vol. 120, no. 15, Apr. 12, 1919, pp. 363 and 382, 4 figs. Virginian Ry. installation designed to handle two 60-ton cars simultaneously; cars are tipped sidewise.

Ship Loading. Radical Departure in Loading Ocean Freighters. Ry. Age, vol. 66, no. 16, Apr. 18, 1919, pp. 981-984, 7 figs. Reported that Erie R.R. utilizes existing equipment in handling 50 locomotives direct from pier to ship.

HEAT-TREATING

Brass. Effects of Heat when Annealing Alloys, H. C. H. Carpenter and L. Traverner. Am. Drop Forger, vol. 5, no. 4, Apr. 1919, pp. 193-196, 2 figs. Chart showing ultimate stress after heating various metals, also time required to cause drop of three points in scleroscope hardness in a brass strip. Paper presented before Inst. Metals, London.

Bronze. Results of Heat-Treating Bronze Castings, George F. Comstock. Foundry, vol. 47, no. 5, Apr. 15, 1919, pp. 189-194, 18 figs. Effects of annealing bronze-alloy castings studied with the aid of photomicrographs of test sections.

Case-Hardening. The Application of Heat in Case-Hardening, Theodore G. Selleck. Jl. Am. Steel Treaters Soc., vol. 1, no. 3, Dec. 1918, pp. 87-98, 11 figs. Value of laboratory reports of analysis and specifications under which material was shipped from manufacturer, as a source of information for determining nature and quality of material to be treated.

Case-Hardening of Carbon Steels (Mécanisme de la trempe des aciers au carbone), Pierre Chevenard. Revue de Métallurgie, vol. 16, no. 1, Jan-Feb. 1919, pp. 17-79, 36 figs. Results of micrographic analysis and tests have caused writer to establish that case-hardening results from transformation at low temperatures (150 to 300 deg. cent.) V-a of austenite; when hardening is complete, steel is made up almost exclusively of martensite. Thus the theory announced by Le Chatalier in 1895 appears to have been confirmed.

Notes on the Process of Case-Hardening, J. R. Handforth. Can. Machy., vol. 21, no. 12, Mar. 20, 1919, pp. 277-280, 10 figs. Photo-micrographs of structures produced by case-hardening. From Machine Tool Rev.

Improved Packing Methods for Carburizing, William H. Addis. Am. Mach., vol. 50, no. 15, Apr. 10, 1919, pp. 679-680, 3 figs. Two methods for spacing pieces.

Steel, Low-Carbon. Heat-Treatment of Low-Carbon Steel. W. M. Wilkie. Can. Machy., vol. 21, no. 17, Apr. 24, 1919, pp. 396-401, 12 figs. Characteristic structures found in steel, their formation by heat treatment and effect each has in quality of steel. Paper read before Toronto Section Am. Soc. Mech. Engrs.

Steel, Tool. Heat Treatment of Tool Steel, S. N. Brayshaw. Ironmonger, vol. 167, no. 2369, Apr. 12, 1919, Believes that precision can only be attained by makers and users of steel by carrying out heat treatments in liquids instead of in atmospheric furnaces. Paper read before Birmingham Metallurgical Soc.

HEATING AND VENTILATION

Hot-Water Heating. Designing Data as Applied to a Large Hot-Water Heating Plant, George E. Reed. Heat & Vent. Mag., vol. 16, no. 4, Apr. 1919, pp. 26-34, 13 figs. Western Practice illustrated in layout for Franklin High School, Portland, Ore. (Concluded.)

Industrial Heating. Saving Steam in Industrial Heating Systems. Dept. of the Interior, Bur. of Mines, tech. paper 221, 14 pp., 7 figs. Calls attention to faults of design and operation which lead to uneconomical use of live steam for heating and other purposes. Reprint of eng. Bul. no. 6, prepared by U. S. Fuel Administration.

Steam Flow. Simplifying Calculations for Flow of Steam in Pipes, Heat. & Vent. Mag., vol. 16, no. 4, Apr. 1919, pp. 19-26. 3 figs. Curves based on generally accepted formulæ.

Tunnel, Simplon. The Ventilation Plant of the Simplon Tunnels (Die Ventilationsanlage des Simplon-Tunnels), F. Rothpletz. Schwizerische Bauzeitung, vol. 73, nos. 1, 2, 5 and 7, Jan. 4, 11 and Feb. 1, 15, 1919, pp. 3-4, 14-16, 41-44 and 72, 20 figs. Instead of two fans, one at each entrance, 1913 project provided for one ventilation plant at Brig with two 11½ ft. fans with central suction openings 8.5 ft. in diameter. Arrangement of plant and details of operation of fans as worked out from study of barometric conditions and past experience are mentioned.

HOISTING AND CONVEYING

Conveyor, Cinder. New Type of Cinder Conveyor. Ry. Age, vol. 66, no. 16, Apr. 18, 1919, p. 1017, 1 fig. Conveyor discharges cinders through pipe line by action of steam jet.

Conveyors, Power Requirements of. Power Plant Management; Coal and Ash Handling—II, Robert June. Power House, vol. 13, no. 4, Apr. 5, 1919, pp. 87-89, 4 figs. Power required for various types of conveyors and conditions under which these are operated.

Conveyor, Scoop. A New Type of Conveyor that Reduces the Cost of Handling Coal, Coke, Ashes, Sand, Etc. Popular Engr., vol. 11, no. 4, Apr. 1919, pp. 22-23, 6 figs., also Cement & Eng. News, vol. 31, no. 4, Apr. 1919, pp. 42-44, 7 figs. Distinctive feature is scoop on feeding end, which can be pushed or completely buried into material to be conveyed. Conveyor is equipped with a 16-inch belt and driven by 2-hp. electric motor.

A New Portable Elevator. Coal Trade Jl., vol. 50, no. 16, Apr. 16, 1919, pp. 410-411, 5 figs. Elevator has scoop on feeding end, which can be pushed or completely buried into the material to be conveyed.

Cranes. Lifting Cranes in Shipbuilding Yards (Les appareils de levage dans les chantiers de constructions navales). Génie Civil, vol. 74, no. 14, Apr. 5, 1919, pp. 265-268, 8 figs. Their constructiln and location as affecting economical and rapid transportation of materials. Examples of installations in English yards.

Luffing Cranes. Eng. World, vol. 14, no. 7, Apr. 1, 1919, pp. 55-57, 1 fig. Description of Topils crane used in an English shipyard.

HYDRAULIC MACHINERY

Backwater. New Methods for the Solution of Backwater Problems, H. R. Leach. Eng. News Rec., vol. 82, no. 16, Apr. 17, 1919, pp. 768-770, 6 figs. Suggestions in regard to simplifying reduction of complications by using diagram with only one major variable.

Bernoulli's Formula. On Bernoulli's Formula (Sur la formule de Bernoulli), Emile Cotton. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 11, Mar. 17, 1919, pp. 547-549. Modification by taking into account actual conditions of motions of natural liquid in tube of finite section.

Conduit Protection. Devices for Regulating Automatically the Delivery of a Pressure Conduit (Appareils automatiques d'arrêt du débit des conduites forcées), N. de Schoulepnikow. Bulletin Technique de la Suisse Romande, vol. 45, no. 7, Apr. 5, 1919, pp. 57-59, 3 figs. Bourchayer-Viallet syphon.

Drops. Flow of Liquid Drops Through Cylindrical Pipes (Sur les lois de l'écoulement des liquides par gouttes dans des tubes cylindriques), L. Abonnenc. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 11, Mar. 17, 1919, pp. 556-557. Experimental confirmation of formula developed by Vaillant, in which time between consecutive drops in a parabolic function of weight of drop.

Flood Protection. Panels of Movable Weir Collapse Automatically. Eng. News-Rec., vol. 82, no. 17. Apr. 24, 1919, pp. 818-820, 5 figs. Details of automatic tripping control operated by float in chamber which is filled as flood rises.

Flow. On the Flow of Fluids (Sur l'écoulement des fluides), L. Lecornu, Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 10, Mar. 10, 1919, pp. 481-484. Velocity of fluid in a conduit of variable cross-section.

Ram, Hydraulic. The Hydraulic Ram. Fire & Water Eng., vol. 65, no. 16, Apr. 16, 1919, pp. 873-875, 2 figs. Principle of operation and discussion of its possibilities for small-town installations.

The Hydraulic Ram, W. S. H. Cleghorne. South African Jl. Industries, vol. 2, no. 2, Feb. 1919, pp. 135-142, 6 figs. Principles of action and conditions necessary for successful operation.

Turbines. Economical Operation of Water Turbines, F. H. Rogers. Elec. World, vol. 73, no. 14, Apr. 5, 1919, pp. 680-683, 7 figs. Value of principal losses that may occur and methods of locating their origin; inquiry into effect of losses on output.

Water Economy. Water Economy in Hydroelectric Plants, L. W. Wyss. Elec. World, vol. 73, no. 15, Apr. 12, 1919, pp. 727-728, 1 fig. Claims that output of plant is increased by allowing excess water to run off at night.

Water Hammer. Water Hammer in Conduits of Variable Diameter (Sur les coups de bélier dans les conduites de diamètre variable), G. Guillaumin. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 12, Mar. 24, 1919, pp. 605-608. Theory based on assumption that water travels at uniform speed.

INTERNAL-COMBUSTION ENGINES

ACETYLENE. Acetylene Motors, C. F. Keel. Acetylene & Welding Jl., vol. 16, no. 186, Mar. 1919, pp. 48-49. General summary of actual position in regard to developments accomplisbed during war in utilization of acetylene as a motor fuel. (To be continued.) Translated from paper published by Swiss Acetylene Assn.

BORE-STROKE RATIO. The Problem of Bore-Stroke Ratio, Georges Funck. Autocar, vol. 42, no. 1225, Apr. 12, 1919, pp. 528-532. 4 figs. Study of bore-stroke ratio as dependent on number of cylinders, their disposition and system of cooling, and for the purpose for wbicb engine is intended to be used.

COMPOUND GAS ENGINES. Expansion, Robert Miller. Motor Boat, vol. 16, no. 8, Apr. 25, 1919, pp. 21-24, 5 figs. Possible increase in efficiency of internal-combustion engine by increasing expansion, with reference to compound gas engine, with two jacketed high-pressure cylinders each discharging into a low-pressure unjacketed cylinder.

DESIGN. A Comparison of Airplane and Automobile Engines, Howard C. Marmon. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 237-239. Deals particularly with weight in cylinder construction, design of cranksbaft and crank-cases and economy in fuel and oil consumption.

DIESEL-ENGINE PISTONS, SEIZURE. Seizures of Diesel Engine Pistons, Edward Ingham. Electrical Review, vol. 84, no. 2160, Apr. 18, 1919, pp. 451-452. Seizures are attributed to overbeating of piston and resulting expansion of metal, consequently proper lubrication and cooling of piston are advised.

FUELS. More Efficient Utilization of Fuel, Cbarles F. Kettering. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 263-269, 10 figs. Distillation curves of various internal-combustion engine fuels; specific gravity fuels. Conclusions obtained from examination of causes which produce cylinder knocks.

An Interpretation of the Engine-Fuel Situation, Joseph E. Poque. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 247-252 and (discussion) pp. 252-255, 3 figs. Future of automotive industry is represented as depending on three factors: adaptability of "internal-combustion" engines to use of liquid fuel, supply of crude petroleum, and production of substitute fuel.

Fuel Economy of Automotive Engines, H. C. Dickinson. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 227-233, 6 figs. Properties of fuels which are subject to specification test are examined and trend of future development in utilization of new fuels of internal-combustion engines is discussed from viewpoint of expediency in adopting single fuel for all automotive engines.

GAS ENGINES, HIGH-POWER. High-Power Gas Engines, William Stead. Gas and Oil Power, vol. 14, no. 163, Apr. 3, 1919, pp. 93-96. Part large gas engine may play in state control scheme of electric power generation for power and light supply.

MOTORCYCLE. Tbe Engine of the Side Car Motorcycle—II. E. Cauldwell. Automotive Industries, vol. 40, no. 17, Apr. 24, 1919, pp. 911-913, 6 figs. Lift, velocity and acceleration curves for 3000 r. p. m. of crankshaft; lubrication features of 4-cyl. Henderson engine. Paper presented to Instn. Automobile Engrs.

OIL ENGINE. Tbe Oil Engine—Its Economic Position in tbe Marine Field, Theodore Lucas. Pac. Mar. Rev., vol. 16, no. 4, Apr. 1919, pp. 93-98, 3 figs. Advantage of liquid-fuel engines over steam engines is said to consist in reduction of cost and adding to useful carrying capacity of ship. Comparison of methods of mecbanical atomization with reference to arrangement of Lucas engine.

The Higb-Compression Oil Engine, W. G. Gernandt. Gas Engine. vol. 21, no. 5, May 1919, pp. 155-161, 3 figs. Comparison of various methods of injecting liquid fuel into combustion chamber of engine. Opinion is expressed that bigh-compression type of engine is suitable for burning of heavy fuel oils.

PRESSED-STEEL ENGINES. Pressed Steel Engines. Autocar, vol. 42, no. 1225, Apr. 12, 1919, pp. 537-538, 5 figs. Process for stamping from steel sbeets main parts and various details of engines.

RICARDO TANK ENGINES. Tbe 150 H. P. Ricardo Tank Engine, H. A. Hetberington. Automobile Engr., vol. 9, no. 125, Apr. 1919, pp. 116-120, 5 figs. Details of piston, valve and valve gear. (To be continued).

WISCONSIN ENGINES. Liberty Line of Wisconsin Engines. Automotive Industries, vol. 40, no. 15, Apr. 10, 1919, pp. 796-798, 4 figs. Principal characteristics include unit power plant design, aluminum crankcases, pressure lubrication and "all-steel" three-point support.

LUBRICATION

COMPRESSORS, AIR. Lubrication of Air Compressors, H. V. Conrad. Coal Age, vol. 15, no. 16, Apr. 17, 1919, pp. 704-706, 1 fig. Discusses rate of feed and carbon-cutting metbods and concludes with remarks on steam-engine lubrication.

JOURNAL BOXES. Lubrication and Care of Journal Boxes, M. J. O'Connor. Ry. Rev., vol. 64, no. 17, Apr. 26, 1919, pp. 620-621. Directions for preparing oil and waste for packing journal boxes; reclaiming oil packing removed form cars; of inspection of cars so tbat lubricating trouble may be kept down to a minimum.

LUBRICANTS. Lubricants for the Power Plant, Reginald Trautschold. Power Plant Eng., vol. 23, no. 8, Apr. 15, 1919, pp. 353-358, 3 figs. Qualities of a good oil; tests of grade of oil and grades for various uses.

Properties of Representative American Lubricating Oils for Use in Internal Combustion Engines. Aerial Age, vol. 9, no. 6, Apr. 21, 1919, p. 289. Table showing physical properties and percentage of distillation under 300 deg. cent. in vacuum.

MACHINE ELEMENTS AND DESIGN

BELTING. Fiber Belting (Zellstoff-Treibriemen), E. O. Rasser. Kunststoffe, vol. 8, no. 11, June 1, 1918, pp. 122-125. Describes various types such as woven paper belting, paper belting witb clotu filler, paper-yarn belting, knitted paper-yarn belting, plaited belting, paper-yarn belting witb wire filler, and tbe processes of their manufacture. Also type of joints and care of this type of belting.

GEARS. Gears for Tractor Construction, E. J. Forst. Automotive Industries, vol. 40, no. 17, Apr. 24, 1919, pp. 891-892. Importance of using bigh-grade steel on account of resulting compactness of transmission and greater facility of enclosing it.

Worm Gear Efficiency, C. H. Calkins. Automotive Industries, vol. 40, no. 15, Apr. 10, 1919, pp. 786-787, 2 figs. Baush company's worm-wheel testing stand for determining efficiency of worm-and-wbeel rear-axle drives.

Worms and Worm Gears, G. W. Carlson. Am. Mach. vol. 50, no. 17, Apr. 24, 1919, pp. 809-811. Application of this form of gearing is suggested for otber purposes tban automotive drives.

GEARS, MAGNETIC. Magnatic Gears (Engrenages magnetiques), Leopold Reverchon. Industrie Electrique, vol. 28, no. 643, Apr. 10, 1919, pp. 133-135, 4 figs. Escapement wheel rotated by alternative actions of a fixed magnet on one side and a magnet attached to an oscillating pendulum on the other upon magnetic needles placed in periphery of wheel symmetrically witb respect to its center.

JOINTS. The Design of Riveted Butt Joints, Alpbonse A. Adler. Mecb. Eng., vol. 41, no. 5, May 1919, pp. 433-436. Design equations derived from Schwedler's graphical method.

MACHINE SHOP

BABBITTING. Babbitting Higb-Speed Vertical Spindles, Stanley White. Wood-Worker, vol. 38, no. 2, Apr. 1919, pp. 42-43. Cautions against pouring metal before aligning spindle.

BORING, DUDGEON SYSTEM OF. Dudgeon System of Precision Boring. Macby. (N. Y.), vol. 25, no. 9, May 1919, pp. 803-805, 7 figs. Method of boring jigs and similar work by means of simple equipment and without depending upon accuracy of machine used for operating boring bar.

CRANKSHAFT MACHINING. Cranksbaft Macbining. Automobile Engr., vol. 9, no. 122, Jan. 1919, pp. 10-12, 11 figs. Equipment manufactured by Le Blond Co., Cincinnati.

CYLINDER MACHINING. Cylinder Boring and Reaming—I & II. Macbinery, vol. 13, nos. 338 & 339, Mar. 20 and 27, 1919, pp. 681-689 and 713-717, 26 figs. Classification of methods, their application to different kinds of work, and illustrations of actual operations. Description of tools, fixtures and machines used.

Cylinder Grinding—II, Franklin D. Jones. Machy. (N.Y.), vol. 25. no. 8, Apr. 1919, pp. 711-715, 11 figs. On advantages of finishing cylinder bores by grinding; machines used; practice in plants making automobile and airplace engines.

EQUIPMENT LAYOUT. Arrangement of Equipment in Sbops, James Forrest. Am. Mach., vol. 50, no. 15, Apr. 10, 1919, pp. 699-701. Straight-line and contract-sbop layout problems contrasted and cardboard models suggested.

JIGS AND TOOLS. Jig and Tool Design—II, G. H. Hey. Macbinery, vol. 13, no. 338, Mar. 20, 1919, pp. 704-708, 7 figs. Metbod of using drills and reamers in multi-spindle machine; standard wall bandles, knurled nuts and index plungers.

MICROSCOPE. The Microscope in the Tool-room, Jobn Scott. Macby. (N.Y.), vol. 25, no. 9, May 1919, pp. 799-802, 6 figs. Its application to precision work on master plates and for cutting screw threads.

MILLING. Continous Rotary Milling—I & II, Edward K. Hammond. Machy. (N.Y.), vol. 25, nos. 8 and 9, Apr. and May 1919, pp. 687-694 and 842-846, 24 figs. Types of milling machines tbat operate without interruption; work-holding fixtures and methods of setting up parts to be milled.

MOTORS. Planning Efficient Motor Drives and Connections, G. B. Howe. Wood-Worker, vol. 38, no. 2, Apr. 1919, pp. 34-35, 6 figs. Examples of individual motor drive arrangements in wood-working plants.

Metbods of Mounting Motors on Ceilings, Ralpb G. Bradsbaw. Can. Macby., vol. 21, no. 16, Apr. 17, 1919, pp. 373-375, 10 figs. Practice followed at various shops.

MACHINERY, METAL-WORKING

BORING HEADS. Tools for Boring Closed-Bottom Work. Macbinery, vol. 13, no. 339, Mar. 27, 1919, pp. 735-736, 6 figs. Types of blades used in boring heads and methods of grinding and setting the blades.

CHUCK, SPILLMAN AUTOMATIC. Spillman Automatic Cbuck (Maudrin à centrage automatique système H. Spillman). Génie Civil. vol. 74, no. 13, Mar. 29, 1919, pp. 251-254, 5 figs. Description of instrument; characteristic curves determined from measurements effected during actual performance.

CYLINDER-BORING MACHINE. Quadruplex Cylinder-Boring Machine. Engineering, vol. 107, no. 2779, Apr. 4, 1919, pp. 432-434, 7 figs. Model after French enclosed type.

Cylinder Boring and Beaming Fixtures, Franklin D. Jones. Machy. (N. Y.), vol. 25, no. 9, May 1919, pp. 822-825, 11 figs. Designs of fixtures for locating and holding automobile engine cylinder castings during the boring and reaming operations.

JIGS. Jigs, Tools, etc., for the Production of Standardized Parts, Herbert C. Armitage. Engineer. vol. 127, no. 3300, Mar. 28, 1919, pp. 309-310, 1 fig., also Iron & Coal Trades Rev., vol. 98, no. 2665, Mar. 28, 1919, pp. 378-379, 2 figs.; and Engineering, vol. 107, no. 2779, Apr. 4. 1919, pp. 434-437, 8 figs. Advantages derived by use of jigs and tools are claimed to be: interchangeability of work; cheapening of production; ability to use less skilled class of labor on manufacturing work. Effect of war conditions on engineering practice; curves sbowing relation between output and cost of components. Scheme for milling both ends of twenty connecting rods per hours.

LATHES. Italian Lathe for Gun Turning (Di un tornio Italiano per la lavoraxione di pezzi d'artiglieria). Augusto de Marchi. Industria, vol. 33, no. 5, Mar. 15, 1919, pp. 136-143, 26 figs. Description of lathe specially designed for accurate work. Reference is made to tolerances permitted in manufacture of artillery parts.

PLANERS. Cincinnati Open-Side Planing Machines. Am. Mach., vol. 50, no. 16, Apr. 17, 1919, pp. 725-728, 6 figs. Amoung the points of interest cited are power rapid traverse for rail heads, hox-type table, forced luhrication of the V's, patent "tu-speed" drive on 36-in. and 48-in. machines, quick-reverse aluminum pulleys and extra capacity table.

A Combination Machine Tool, Iron Age, vol. 103, no. 16, Apr. 17, 1919, pp. 1001-1003, 6 figs. Planner equipped with tool head and accessory parts designed for performing fundamental machining operations.

THREAD-CUTTING MACHINE. Thread-Cutting and Spindle-Boring Tools, J. H. Moore. Can. Machy., vol. 21, no. 16, Apr. 17, 1919, pp. 371-372, 4 figs. Description of standard lathe for precision thread cutting.

TOOLS, FORMING. Tools for Automatic Machines, H. E. Thomas. Machinery vol. 14, no. 340, Apr. 3, 1919, pp. 16-18, 13 figs. Types of forming tools; diagrams for determining diameter of forming tools. Read before Manchester Assn. of Engrs.

MACHINERY, SPECIAL

BALANCING MACHINES. Dynamic and Static Balancing. Machinery, vol. 14, no. 341, Apr. 10, 1919, pp. 40-44, 12 figs. Machines for balancing high-speed pulleys; aeroplane propeller static balancing machine; combination static balancing and drilling machine; "umbrella" type of balancing fixture. Second article.

CLUTCHES. Automatic Clutch Design, M. H. Sabine. Machinery, vol. 14, no. 340, Apr. 3, 1919, pp. 1-5, 7 figs. Designed for controlling power unit from distant position. Clutch is electro-mechanically operated.

DESIGNS. Developing Designs for Machinery and Tools. Machinery, vol. 13, no. 338, Mar. 20, 1919, pp. 690-791, 5 figs. Example of design evolution of two-wheel construction with traversing wheel slides.

DIVIDING MACHINES. Special Dividing Machines (Maguinas es peciales para granduar), J.V. Hunter. Ingenieria Internacional, vol. 1, no. 1, Apr. 1919, pp. 20-21, 8 figs. Type designed for circular division.

PORTABLE MACHINERY. The Use of Portable Machinery in Ship Construction, G. F. Mackay. Elecn., vol. 82, no. 15, Apr. 11, 1919, pp. 429-431, 9 figs. Features of electric caravan, winches, sawing machines, electric drills, and electric deck planers.

TOOL EQUIPMENT. Principles of Special Machine Design, F. E. Johnson. Machy (N. Y.), vol. 25, no. 9, May 1919, pp. 797-798. Concerning tool equipment of manufacturing machines.

THREAD-MILLING MACHINE. Continuous Thread Milling Machine of Unusual Design, Edward K. Hammond. Machy. (N. Y.), vol. 25, no. 8, Apr. 1919, pp. 727-729, 3 figs. Description of machine designed for use in turning and threading bars of large diameter and indeterminate lenght.

MACHINERY, WOODWORKING

PATTERN-TURNING MACHINE. Pattern Turning—I, Joseph A. Shely. Machy. (N. Y.), vol. 25, no. 9, May 1919, pp. 836-841 12 figs. Equipment required and methods used in turning.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

BRASS. Structural Characteristics of Rolled Sheet Brass, H. A. Eastick. Metal Indus., vol. 17, no. 4, Apr. 1919, pp. 176-178, 6 figs. Chart showing temperature at which recrystallization of alpha brass of different degrees of hardness commences.

BUILDING MATERIALS. Cheap Building Materials (Die Ausstellung "Sparsame Baustoffe" in der Austellungshalle am Zollogischen Garten). Zentralblatt der Bauverwaltung, vol. 38, nos. 102 and 103, Dec. 18 and 21, 1918, pp. 506-507 and 513-514, 6 figs. Describes exhibits shown at exhibition in Zoological Garden in Berlin, specially two types,— the "Vogt" concrete wall built of thin blocks of channel section interlocked and with certain interstices filled with cement grouting, and the "Ambi," built of thin concrete plates, with projecting ribs which interlock, the key being of cement grouting.

CAST IRON. Properties of Cast-Iron Test Bars, H. J. Young. Foundry Trade Jl., vol. 21, no. 207, Mar. 1919, pp. 157-160, 16 figs. Photomicrographs showing defects in test bars. Paper read before Newcastle Branch British Foundrymen's Assn.

GLUES. Compositions of Glues (Differentes composiciones de cola en la industria). Boletin de la Sociedad de Fomento Fabril, vol. 35, no. 12, Dec. 1918, pp. 834-840. Preparation of glues and allied productions for industrial purposes. (Concluded).

LEATHER. Physical Examination of Leather and Leather Substitutes (Zur physikalischen Prüfung von Leder und Ersatzstoffen für Leder), R. Lauffmann. Kunststoffe, vol. 8, no. 8, Apr. 2, 1918, pp. 85-87, 3 figs. Examination regarding wearing qualities, tearing resistance, elongation, water absorption capacity, water permeation capacity and water resistance, and specific gravity.

RESISTANCE OF MATERIALS. The Resistance of Materials—II, G. S. Chiles and R. G. Kelley. Ry. Mech. Engr., vol. 93, no. 4, Apr. 1919, pp. 181-184, 7 figs. Effect of sudden or abrupt changes in section on the distribution of unit stresses.

STEEL. Dynamic Resistance of Steel (Sur la résistance dynamique de l'acier), Louis Roy. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 6, Feb. 10, 1919, pp. 304-307. Account of theoretical study and experimental verifications with gun bullets.

On the Elasticity of Steel, Akimasa Ono. Memoirs of the Coll. of Eng. Kyushu Imp. University, Fukuoka, Japan, vol. 1, no. 4, 1919, pp. 269-332, 18 figs. Experimental research; effect of elastic hysteresis on indication of load; temperature effect on deformation and effect of mechanical and thermal treatments on the constancy of elastic properties.

WIRE ROPE. Investigation of Wire Rope, J. H. Griffith. Eng. & Min. Jl., vol. 107, no. 17, Apr. 26, 1919, pp. 737-738. Tests on wire ropes having diameter smaller than those of average mine hoisting ropes. Report by Bur. Standards, Pittsburgs.

MEASUREMENTS AND MEASURING APPARATUS

CALORIMETER. An Improved Form of Throttling Calorimeter, W. R. Woolrich. Power, vol. 49, no. 12, Apr. 1, 1919, pp. 495-496, 2 figs. Explains how instrument may be made self-contained by having necessary curves drawn on a metal plate fastened to barrel or calorimeter.

CLINOMETER. A Useful Instrument, H. L. Seymour. Can. Engr., vol. 36, no. 13, Mar. 27, 1919, pp. 335-337, 2 figs. Abney Hand level, pocket altimeter or clinometer and its uses in surveying engineering and architectural work.

COAL METERS. A Coal Meter for Boilers. Engineer, vol. 127, no. 3298, Mar. 14; 1919, p. 261, 2 figs. Lea recorder intended for boilers fitted with chain grates, similar in operation to the well-known V notch recorders and integrators for water measurements.

COLORIMETER. The Numerical Expression of Color Properties, Paul H. Geiger. Michigan Technic, vol. 32. no. 1, Mar. 1919, pp. 36-40, 2 figs. Principle upon which Nutting colorimeter operates.

FLOW IN PIPES, FLUID. Electrical Measurement of Fluid Flow in Pipes, Jacob M. Spitzglass. Mech. Eng., vol. 41, no. 5, May 1919, pp. 429-432 and 487, 6 figs. Theory and development of device embodying ammeter and watt-hour meter in which the electric current flowing is proportional to the quality of fluid passing through pipe.

HARDNESS TESTS. Hardness Tests of Gun-Barrel Steel. William Kent Shepard. Am. Mach., vol. 50, no. 16, Apr. 17, 1919, pp. 739-742, 2 figs. Ultimate strength, yield point, Brinell and scleroscope hardness number. Percentage reduction in area and elongation in 2-in. Brinell diameter and scleroscope hardness number.

INDICATING INSTRUMENTS, RESIDENCE OF. The Concept of Resilience with Respect to Indicating Instruments, Frederick J. Schlink. Jl. Franklin Inst., vol. 187, no. 2, Feb. 1919, pp. 147-169, 2 figs. Deals particularly with instruments of index-and-scale and value-controlling types of class of non-integrating instruments, as distinguished from integrating instruments and those used for comparison purposes strictly.

MICROSCOPE. Usefulness of the Metallurgical Miscroscope to the Engineer, E. D. Fahlbarg Wisconsin Engr., vol. 23, no. 7, Apr. 1919, pp. 255-257, 4 figs. Examples of its uses in examination of carbon steel.

PYROMETERS. Standards of Temperature and Means for Checking Pyrometers. Jl. Am. Steel Treaters Soc., vol. 1, no. 3, Dec. 1919, pp. 99-110, 7 figs. A consideration of sources of error in thermocouple pyrometers leads writer to advise that in order to secure reliable measurements in plant turning out high-grade heat-treated product, following equipment should be available: Standard precision and double range potentiometers with accessories, one mounted and two unmounted platinum thermo-couples, checking furnace with control panel and extra standard cell.

SCALE CONVERSION. Conversion of Uneven into Even Scales (Die Umwandlung einer ungleichmäßigen Teilung in eine gleichmaßige), Hugo Krüb. Zeitschrift fur Instrumentenkunde, vol. 38, no. 12, Dec. 1918, pp. 195-200, 6 figs. Conversion effected by means of two equal bars hinged at one end and constrained to move at the other along a straight line reproducing both scales. When hinged end is moved along a curve, the shape of which depends on nature of uneven scale, the other ends point at corresponding values in the scales.

STEAM GENERATION. Determining Economy of Steam Generation, G. H. Sheasley. Power Plant Eng., vol. 23, no. 9, May 1, 1919, pp. 395-397. Methods of procedure and equipment required.

TEMPERATURES, LOW. The Meeasurement of Low Temperatures with Thermo-couples, Thomas Spooner. Jl. Franklin Inst., vol. 187, no. 4, Apr. 1919, pp. 509-511, 2 figs. Chromel-alumel thermocouple for measuring temperatures below 0 deg. cent.

THERMOMETER, MERCURY, TESTING. Simple Boiling Point Apparatus for Testing Mercury Thermometers at Temperatures over 100 deg. C. (Ein einfacher Siedepunktapparat zur Prufung von Quecksilberthermometern bei Temperaturen über 100 deg. C.), Gottfried Dimmer. Zeitschrift für Instrumentenkunde. vol. 38, no. 3, Mar. 1918, pp. 33-40, 2 figs. Describes tests with thermoelement and mercury thermometer and results. Substances used were aniline of 184.1 deg.; naphthaline at 218 deg.; benzophenone at 306 deg.; and sulphur at 444.6 deg.

TURBO-ALTERNATORS, EFFICIENCY. The Determination of Efficiency of the Turbo-Alternator, S. F. Barclay and S. P. Smith. Engineer, vol. 127, no. 3299, Mar. 21, 1919, pp. 290-291, 2 figs. Determination from measurements of the cooling air and by the "air-heating" method.

WATER LEVEL, DISTANT. Measuring Distant Water Levels, C. G. Brown. Electricity, vol. 33, no. 1482, Apr. 4, 1919, pp. 201-202, 3 figs. Instrument employ relay connected to selenoid resistance in which contract placed alongside is controlled by height of river by means of float. Suitable arrangement records motions of float at hydraulic station

WATER-WASTE TESTING. Devices for Water-Waste Surveys at Oak Park Illinois. Eng. News-Rec., vol. 82, no. 17, Apr. 24, 1919, pp. 829-831, 2 figs. Portable venturimeter to test pipe districts with pitometer inserted in house service.

MECHANICS

ARTICULATED RODS. The Articulated Rod, T. L. Sherman. Automobile Eng., vol. 9, no. 125, Apr. 1919, pp. 102-106, 16 figs. Formulæ for various mechanical quantities and inertia forces curves on articulated-rod system in which two cylinders are fixed in one plane at a certain angle.

BEAMS. Economical Sections of Simple Reinforced-Concrete Beams (Recherche des sections économiques des poutres simples en béton armé travaillant à la flexion), G. Guillaumin. Génie Civil, vol. 74, no. 13, Mar. 29, 1919, no. 249-251. Proposes simplification of calculation and formulæ which have appeared in Eng. News, Feb. & June 1907, and in Technique Moderne, Jan. 1910.

Distribution of Metal in Beams and Levers, Eugene Motchman. Scale Jl., vol. 5, no. 7, Apr. 10, 1919, pp. 13-14, 7 figs. Application of design and formulæ to beams used in scales.

ELASTIC STRESSES. Strains due to Temperature Gradients, with Special Reference to Optical Glass, Erskine D. Williamson. Jl. Wash. Acad. Sciences, vol. 9, no. 8, Apr. 19, 1919, pp. 209-217, 1 fig. General equations for elastic stresses produced by temperature differences in spheres, cylinders and slabs when the temperature distribution is symmetrical about the center axis or central plane, respectively. More specific equations are given for the case of temperature distribution due to uniform surface heating.

FRAMES. Analysis and Tests of Rigidly Connected Reinforced Concrete Frames, Mikishi Abe. University of Illinois Bul. no. 107, vol. 16, no. 8, Oct. 21, 1918, 106 pp., 59 figs. Formulæ for moments and other indeterminate quantities for several types of indeterminate structures. Formulæ have been derived by methods involving use of principle of least work, and their applicability and reliability were tested in frames designed according to them.

IRREGULARITY, COEFFICIENT OF. Coefficient of Irregularity of Steam Engines, Gas Engines and of Electric Generators Running in Parallel (coefficient d'irrégularité des machines à vapeur, moteurs à gaz et marche en parallèle de génératrices électriques), M. Barrusta. Industrie Electrique, vol. 28, no. 642, Mar. 25, 1919, pp. 104-109. Formulæ developed from assomption that fly-wheel possesses two motions, one uniform and one pendular; in the case of electric generators motion is considered as resulting from action of two couples and its regularity is expressed in terms of a parameter in the differential equation of motion.

PENDULUM. Note on the Motion of a Simple Pendulem after the String has Become Slack, W. B. Morton London, Edinburgh and Dublin Phil. Mag., vol. 37, no. 219, Mar. 1919, pp. 280-284, 1 fig. Finds from graphs constructed from theoretical considerations that ultimate motion approaches asymptotical to oscillation between ends of horizontal diameter.

SHAFTS, CRITICAL SPEED OF. Critical Speed in Tapered Shaft Design, Machinery, vol. 13, no. 338, Mar. 20, 1919, pp. 694-695, 1 fig. Diagram for determining critical speed of tapered shafts.

SHAFTS, WHIRLING SPEED OF. The Lateral Vibration of Loaded Shafts in the Neighbourhood of a Whirling Speed—the Effect of Want of Balance, H. H. Jeefcott. London, Edinburgh and Dublin Phil. Mag., vol. 37, no. 219, Mar. 1919, pp. 304-314, 4 figs. Discusses how want of balance causes so-called "whirling speeds" and to what extent it is practical to carry balancing.

SPRINGS. Thermodynamics of Springs (Zur Thermodynamik der Federn), H. Bock. Zeitschrift fur Instrumentenkunde, vol. 38, no. 7, July 1918, pp. 109-115, 3 figs. Method evolved after p-r diagram of Gast theory for presenting thermal processes; application of method to theory of springs makes it possible at least partly to calculate "elastic after effect" by means of entropy theorem.

A New Theory of Plate Springs—III, David Landau and Percy H. Parr. Jl. Franklin Inst., vol. 187, no. 2, Feb. 1919, pp. 199-213, 3 figs. On "nip" stresses and "life" of plates under varying stresses produced in metal when in use.

MOTOR-CAR ENGINEERING

ALUMINUM. The Why of Aluminum in Motor Cars, H. M. Taylor. Motor Age, vol. 35, no. 16, Apr. 17, 1919, pp. 7-9, 3 figs. Feature of 8-cyl. engine built almost entirely of aluminum; welding and machining aluminum parts.

BRAKE LEVERS. Determining Correct Location of Brake Levers, Walter C. Baker. Automotive Industries, vol. 40, no. 17, Apr. 24, 1919, pp. 914-917, 6 figs Attemps to show how braking action may be remedied by changing their loads and their location. Maintains that brakes are not to blame for pedal motion due to torque and spring action.

BENZOL. Benzole as a Motor Fuel, Eric W. Walford. Autocar, vol. 42, no. 1223, Mar. 29, 1919, pp. 439-441, 2 figs. Hints concerning its use, either by itself or mixed with petrol.

DESIGN. Progressive and Retrogressive Designing, Otto M. Burkhardt. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. Technical considerations on elimination of certain links and members in design of motor vehicle. Elimination of torque and radius rods is one of various examples considered.

Probable Effect on Automobiles of Experience with War Airplanes, O. E. Hunt. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 243-245. Holding improvements in airplane engines not suitable for cars, writer believes that the most important contribution which the airplane has made to the automobile is stimulus to thought of industry as a whole that has resulted from study of design and manufacturing problems.

ENGINES. Possible Effect of Aircraft Engine Development on Automobile Practice, Henry M. Crane. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 240-242. Writer does not expect any radical change in automobile design. but only a probable increase in number of "valve-in-the-head" engines.

EUROPEAN CARS. Post-War Cars Designed by Europe, W. F. Bradley. Motor Age, vol. 35, no. 15, Apr. 10, 1919, pp. 24-27, 11 figs. Comparison of types shown at Lyons fair with American models.

The Angus Sanderson Car. Automotive Industries, vol. 40, no. 17, Apr. 24, 1919, pp. 888-890, 6 figs. Embodies engine with slipper-type piston, counterbalanced crankshaft, integral cylinder block and top half of crankcase, and forced-feed lubrication.

Automotor Design and Construction of 1919. Auto, vol. 24, no. 15, Apr. 10, 1919, pp. 360-364, 8 figs. Mechanical arrangement of the 16 hp. Panhard.

A New British Quantity-Production Car. Automotive Industries, vol. 40, no. 15, Apr. 10, 1919, pp. 807-808, 4 figs. Austin 20 hp. open touring car.

A New Eight-Cylinder Piecard-Pictet. Autocar, vol. 42, no. 1223, Mar. 29, 1919, pp. 432-434, 7 figs. Franco Swiss high-powered car. Features are front-wheel brakes and single sleeve-valve V engine.

The 20-25 Hp. Six-Cylinder Straker. Autocar, vol. 42, no. 1223, Mar. 29, 1919, pp. 429-431, 5 figs. Car with engine having separate cylinders, aluminum pistons, and overhead valve-operating mechanism.

KEROSENE BURNING. Paraffin as Fuel, Harry R. Ricardo. Automobile Engr., vol. 9, no. 122, Jan. 1919, pp. 2-5, 5 figs. Principle of utilization; type of carburetor required; results of tests.

LUBRICATION. The Lubrication of Motor Cars, G. W. A. Brown. Automobile Engr., vol. 9, no. 125, Apr 1919, pp. 110-115, 34 figs. Suggests improvement in oiling of gear box, universal joints, live axle, steering gear and other components of chassis. Paper read before Instn. Automobile Engrs.

STATE REGULATION. Regulation of the Speed, Weight, Width and Height of Motor Trucks and Trailers, George Graham. Can. Engr., vol. 36, no. 6, Feb. 6, 1919, pp. 200-202. Plan of Am. Assn. of State Highway Officials for uniform truck laws.

STEAM CARS. The Clarkson Steam Chassis Type IX. Automobile Engr., vol. 9, no. 122, Jan. 1919, pp. 17-21, 12 figs. Four-cylinder taudem compound engine, with coke as fuel.

TEMPERATURE CONTROL. Controlling the Water Temperatures, Eric W. Walford. Autocar, vol. 42, no. 1224, Apr. 5, 1919, pp. 471-473, 5 figs. Methods for increasing thermal efficiency and ease of starting and for promoting vaporization of fuel, by reulating effective radiating surfaces.

TIRES, RUBBER-SUBSTITUTE. Substitute for Rubber Tires (Ersatz für Kautschukreifen), Jahr. Kunststoffe, vol. 8, nos. 14 & 15, Jul. 2, and Aug. 1, 1918, pp. 157-160 and 173-175, 26 figs. Substitutes used are principally leather, all kinds of woven materials, felt, paper, vegetable fibres, hair, bristles, etc. Various types of tires and methods of fastening them to rim are described.

Notes on Germau Mechanical Transport, G. F. Randall. Motor Traction, vol. 28, no. 736, Apr. 9, 1919, pp. 305-307, 5 figs. Tires substituted by device consisting of hardwood blocks let into rims of ordinary steel or artillery wheels and held in place by split steel bands bolted up on each side of blocks in such a way as to render the wooden tires easily removable.

TIRES, TRUCK. Pneumatic Tires on Trucks, B. B. Bachman. Jl. Soc. Automotive Engrs., vol. 4, no. 4, Apr. 1919, pp. 298-302. Advantages claimed for pneumatic tires are reduction in mechanical repairs increase in permissible speed, decrease in gasoline and oil consumption, less fatigue for men lessened depreciation of roads and greater tractive ability.

TRACTORS. Twin City 12-20 Kerosene Tractor, P. M. Heldt. Automotive Industries, vol. 40, no. 16, Apr. 17, 1919, pp. 836-839, 5 figs. Three-plow tractor with double intake and exhaust valves enclosed drive, pressure lubrication, thermostatic temperature control, backbone frame construction and front-spring suspension.

The Velie Biltwell Tractor, P. M. Heldt. Automotive Industries, vol. 40, no. 15, Apr. 10, 1919, pp. 799-804, 15 figs. Three-plow machine with kerosene-burning engine, 3-speed sliding-gear transmission and incloses bull-gear drive.

TRUCKS, 4-WHEEL DRIVE. Special Parts for Four-Wheel Drive Trucks, Harry C. Satterthwaite. Am. Mach., vol. 50, no. 15, Apr. 10, 1919, pp. 691-698. 21 figs. Operations on ball-and-socket joint placed on each end of front axle. truck is both steered and driven in front.

WAR EXPERIENCE. Touring Cars on War Service. Automobile Engr., vol. 9, no. 122, Jan. 1919, pp. 13-16, 3 figs. Notes on performance of lighter transport chassis.

Motor-Lorry Design. Times Eng. Supp., vol. 15, no. 533, Mar. 1919, p. 103. Lessons of war service.

PIPE

LAYOUT. A Problem in Piping Layout, James Leslie Lane. Boiler Maker, vol. 19, no. 4, Apr. 1919, p. 93, 1 fig. Mathematical computatio nof angles and lengths of lines.

PIPING. Piping and Pipe Fittings. Southern Engr., vol. 31, no. 2, Apr. 1919, pp. 36-50, 17 figs. Calculations, layout, sizes, bends, traps, and other arrangements of piping.

POWER GENERATION

CALIFORNIA. Water Power in California, Andrew H. Palmer. Sci. Am. Supp., vol. 87, no. 2260, Apr. 26, 1919, pp. 260-261 and 271, 4 figs. Factors on which it depends and the extent to which it might be utilized.

CANADA. The Present Electrical Outlook in Canada, A. S. L. Barnes. Electrical Review, vol. 84, no. 2159, Apr. 11, 1919, pp. 421-423. Councils furthering British electrical trade with Canada. (Concluded.)

COQUITLAM BUNTZEN. The Coquitlam Buntzen Hydro-Electric Plant, F. C. Perkins. Power House, vol. 12, no. 4, Apr. 5. 1919, pp. 83-86, 5 figs. Originally designed for 12,000 hp., plant has grown to 85,000 hp. Growth of project is described and capabilities of economically developing 750,000 hp. are examined.

EASTERN STATES. Hydro-Electric Development in Eastern States, D. H. Colcord. Power Plant Eng., vol. 23, no. 8, Apr. 15, 1919, pp. 362-364, 4 figs. Plants at Niagara Falls, Holtwood and Rochester.

GAS AND ELECTRICITY. Distribution of Heat, Light and Motive Power by Gas and Electricity, Dugald Clerk, Colliery Guardian, vol. 117, no. 3039, Mar. 28, 1919, pp. 713-714. Theoretical efficiency of estimated average performances of gas works and of electric undertakings of United Kingdom. Paper read before Roy. Soc. of Arts.

ILLINOIS. Independent Illinois Power System. Power Plant Eng., vol. 23, no. 9, May 1, 1919, pp. 391-393, 5 figs. Abbott Light & Power Co.'s 45 miles of line supplying lighting and power load of 400 kw. to ten towns.

INTERCONNECTION. Interconnection Reduces Steam Reserve Necessary, L. J. Moore. Elec. World, vol. 73, no. 17, Apr. 26, 1919, pp. 840-842, 4 figs. Results obtained by tying together power systems in Central California.

Muscle Shoals. Features of Muscle Shoal Station, Edward R. Welles and W. A. Shondy. Elec. World, vol. 73, no. 15, Apr. 12, 1919, pp. 729-732, 4 figs. Characteristics of power-plant, particularly boiler, furnace, stoker, condensers and auxiliaries.

Pittsburgh District. Power Production for Electrochemical Purposes, C. S. Cook. General Meeting Am. Electrochemical Soc., Apr. 3-5, 1919, paper no 10, pp. 167-171. Cost in Pittsburgh district, particularly when generated in large stations and when off-peak power is used for electrochemical and electrometallurgical purposes. Writer concludes that this kind of steam power can compete with water power in all except the most favorable cases for developing hydraulic power.

State Aid. State Aid for Water Power Development, Alfred M. Beale. Can. Engr., vol. 36, no. 13, Mar. 27, 1919, pp. 333-334. Complete ownership by Government is not considered essential, but it is suggested that Government furnish capital and control rates.

Swift Rapids Plant. Electric Power from Swift Rapids Plant. Elec. News, vol. 28, no. 7, Apr. 1, 1919, pp. 27-31, 9 figs. Combination generating plant and ship lift lock.

POWER PLANTS

Boiler Mountings. Boiler Mountings. Mar. Engr. & Naval Architect, vol. 41, no. 499, Apr. 1919, pp. 210-214, 5 figs. Blow-out apparatus. (Continued.) Paper read before Liverpool Eng. Soc.

Boiler Room. Saving Coal in the Blackstone Power Plant, W. A. Eberman. Power, vol. 49, no. 17, Apr. 29, 1919, pp. 632-634, 3 figs. Remodeling of boiler furnaces together with co-operation of operating force and intelligent use of instruments is said to have resulted in saving fuel amounting to 12 per cent.

Clinker Grinders. The Clinker Grinder in Modern Boiler Practice, Charles H. Bromley. Power, vol. 49, no. 16, Apr. 22, 1919, pp. 592, 598, 12 figs. Describes various grinders and gives their performance data as obtained in different installations.

Condensers. Surface Condensing Plant for Large Power Stations, R. J. Kaula. Electrical Review, vol. 84, no. 2160, Apr. 18, 1919, pp. 453-455 and (discussion) pp. 455-456, 2 figs. Graph showing lb. of free air at atmospheric pressure against plant capacity in 1000 lb. of steam per hour; arrangement of strainers and pumps on tidal river. Paper read before Instn. Elec. Engrs.

Economizers. Proportioning Fuel Economizers, A. B. Clark. Power, vol. 49, no. 16, Apr. 22, 1919, pp. 613-615, 5 figs. Data showing advantages of contraflow over parallel flow of water and gas.

Equipment. Modern Steam Power Station Equipment, Joseph G. Worker. Coal Indus., vol. 2, no. 4, Apr. 1919, pp. 157-163; 13 figs. Review of equipment installed in various power plants.

Governor. An Electrically-Operated Steam Engine Governor, G. T. Garwood. Model Engr. & Elecn., vol. 40, no. 936, Apr. 3, 1919, pp. 234-236, 2 figs. A throttle actuating solenoid is switched in and out by a centrifugal device similar to an ordinary shaft governor.

Oil Filters. Reducing Cost of Production by Saving Coal and Oil (Die Vermindering der Betriebskosten durch Ersparnisse an Kohlen und Oel), Otto Grumer. Kunststoffe, vol. 8, no. 8, Apr. 2, 1918, pp. 88-92, 10 figs. Recommends counter current preheaters as efficient in reducing coal consumption and repair work and suggests installation of oil filter for steam in order to prevent oil particles from getting into pipe system, thereby reducing efficiency of preheater.

Stand-By Operation. Converting Steam Plant to Stand-by Operation, L. M. Klauber, Jl. Electricity, vol. 42, no. 8, Apr. 15, 1919, pp. 353-357, 3 figs. Problems met in turbine and boiler rooms. From report of Eng. Committee for Spring Convention of Pac. Coast Section N.E.L.A.

Stokers. Influence of Chemistry upon Improvement in Stoker Design, Clyde H. McClure. Elec. Rev., vol. 74, no. 16, Mar. 19, 1919, pp. 620-621. States that from viewpoint of chemical engineer future improvement in mechanical stokers, specially for territory dependent upon Indiana and Illinois coal, lies in combination of chain-grate and underfeed types.

Turbines. United States Nitrate Plant No. 2, at Muscle Shoals, Charles H. Bromley. Power, vol. 49, nos. 13 and 15, Apr. 1 & 15, 1919, pp. 482-488 and 558-561, 14 figs. Description of triple cylinder, pure-reaction, parallel-flow turbine; 60,000-kw. unit has four condensers, each of 25,000 sq. ft. of Muntz-metal tube surface.

Turbo-Generators. Narragansett Company Installs 45,000-kw. Turbo-Generator, J. P. Rigsby. Power Plant Eng., vol. 23, no. 8, Apr. 15, 1919, pp. 349-353, 3 figs. Installation is of cross-compound double-unit type, consisting of a high- and a low-pressure unit, each connected through a flexible coupling to its own generator.

Valves and Fittings. Valves and Fittings in Marine Work, A. G. Christie. Shipping, vol. 7, no. 2, Apr. 12, 1919, pp. 19 and 22. Comments on marine practices from viewpoint of central station man. Paper presented before Baltimore Section, Am. Soc. Mech. Engrs.

Water Treatment. Principles of Boiler Water Treatment. Ry. Rev., vol. 64, no. 14, Apr. 5, 1919, pp. 547-549. Origin, effects and means of removing scale; processes and economies of water treatment.

Boiler Water Treatment. Dept. of the Interior. Bur. of Mines, tech. paper 218, 1919, 8 pp. How a reduction in heat losses may be effected through substitution of softened for hard boiler water. Reprint of Eng. bul. no. 3, prepared by U. S. Fuel Administration.

PRODUCER GAS

Gas-Producer Plant. Details of Operation of a Gas Producer Plant, J. S. McClimon. Gas Age, vol. 43, no. 8, Apr. 15, 1919, pp. 421-423, 4 figs. Recommendations to operators and superintendents.

PUMPS

Cost of Pumping. Cost of Pumping Through Pipe Lines, G. C. Habermeyer. Can. Engr., vol. 36, no. 17, Apr. 24, 1919, pp. 402-403. Table showing cost in dollars per mile per million U.S. gal. of pumping water at various rates through different sizes of cast-iron pipe lines.

Pumping Station Design. Design of New Electric-Drive Water-Pumping Station was Governed by Power Rate, Henry W. Taylor. Eng. News-Rec., vol. 82, no. 14, Apr. 3, 1919, pp. 653-655, 2 figs. Water consumption change in power, power rates and changes in design involved in development of pumping station of water works at Coboes, N. Y.

Pumping Station. Distribution. Vergennes Pumping Station, Henry W. Taylor. Fire & Water Eng., vol. 65, no. 18, Apr. 30, 1919, pp. 984-985, 4 figs. System of distribution.

Submersible Pumps. Submersible Salvage Pumps and Engines. Engineer, vol. 127, no. 3299, Mar. 21, 1919, pp. 274-275 & 278, 9 figs. Means adopted to permit ability of engines to withstand submergence in water are: Every part of mechanism is arranged inside trunk of crank-case and those parts which protrude are of robust construction; all openings, such as inlet and exhaust are provided with easily attached covers, which prevent water from getting into interior of engine.

REFRACTORIES

Zirconia. Zirconia: Its Utilisation as a Refractory Substance, an Opacifier, and an Abrasive, M. A. Granger. Chemical News, vol. 118, nos. 3073 and 3074, Mar. 7 and 14, 1919, pp. 115-118 and 121-123. Mar. 7: Chemical nature of zirconiferous minerals. Mar. 14: Experiments on extraction of zirconia by alkaline carbonate.

REFRIGERATION

Absorption System. Mechanical Refrigeration—III. Southern Engr., vol. 31, no. 2, Apr. 1919, pp. 54-57, 2 figs. Diagram of absorption system and direction diagram showing course of gas and aqua ammonia.

Ammonia Compression. Economical Ammonia Compression, A. G. Solomon. Power Plant Eng., vol. 23, no. 8, Apr. 15, 1919, pp. 370-373. Advises stopping of leaks and regulating pressures.

Compression Refrigerating Machine. The Compression Refrigerating Machine. Gardner T. Voorhees. Ice & Refrigeration, vol. 56, no. 4, Apr. 1919, pp. 257-259. Operation of water and steam cycle; general comparison of refrigerants. (Continuation of serial.)

The Ammonia Compression Refrigerating System—XXIX, W. S. Doan. Refrig. World, vol. 54, no. 4, Apr. 1919, pp. 32-34, 4 figs. Methods of purging permanent gases from condenser without losing a great amount of ammonia. (Concluding article.)

Refrigeration by Steam Compression (Eutwicklungsformen des Dampf-Kälteprozesses), P. Ostertag. Schweizerische Bauzeitung, vol. 73, no. 4, Jan. 25, 1919, pp. 33-35, 8 figs. Schemes of plant operating on this principle, with reference to plant exhibited by Sulzer Bros. at Berne exposition in 1914.

Fruit, Cold Storage for. Cold Stores for Fruit in Denmark (Forsgskleanlæg paa Statens Havebrugs-Forsgsstation ved Blangsted), Erik Holten. Ingeniören, vol. 28, no. 14, Feb. 15, 1919, pp. 89-91, 4 figs. Installation of horizontal double-acting CO_2 machine.

Ice Plants. Deterioration of Ice Plants, Fred Ophuls. Ice & Refrigeration, vol. 56, no. 4, Apr. 1919, pp. 201-202. Advisability of making repairs of any defect as soon as same is discovered.

Competition and Co-operation among Ice Manufacturers T. Robert Appel. Ice & Refrigeration, vol. 56, no. 4, Apr. 1919, pp. 202-205. Co-operation as a remedy for eliminating competition.

RESEARCH

Bureau of Mines, Pittsburgh Station. The New Pittsburgh Station of the Bureau of Mines, Pts. 1 and 2, George W. Harris. Coal Age, vol. 15, nos. 16 and 17, Apr. 17 and 24, 1919, pp. 707-711 and 749-751, 6 figs. Apr. 17: Consists of central administration building and two wings, one containing the chemical laboratories and the other the mechanical laboratory. Apr. 24: During war, station was devoted to assisting in war work. It is now being organized to operate on a peace basis. (To be continued.)

Government Bureau, Heating and Ventilation. Heating and Ventilation a National Issue, Werner Nygren. Domestic Eng., vol. 87, no. 2, Apr. 12, 1919, pp. 47-49 and 86. Advocates Government research bureau.

Laboratory Organization. The Functions of a Research Laboratory, Saul Dushman. Can. Chem. Jl., vol. 3, no. 4, Apr. 1919, pp. 118-121. Internal organizations and results of research laboratory of General Electric Co.

Laboratory Research and Mill Practice. Relations of Laboratory Research to Mill Practice. Metal Indus., vol. 17, no. 4, Apr. 1919, pp. 174-176, 7 figs. Value of metallurgical research and chemical analyses. Illustrated by examples in which the defects in structure were determined by these processes. From Scovil Bul.

The Relationship between the Laboratory and the Workshop, W. R. Barclay, Engineering, vol. 107, no. 2779, Apr. 4, 1919, pp. 456-457. In reference to principles of operation and objects of accomplishment both in laboratory and in workshop. Paper read before Inst. of Metals.

The Scope of the Works Laboratory, Frederick C. A. H. Lantsberry. Engineering, vol. 107, no. 2779, Apr 4, 1919, pp. 437-438. Particular reference is made to service given by research laboratory in metallurgical and chemical works. Paper read before Inst. of Metals.

Municipal Testing Laboratory. The Organization of a Standard Municipal Testing Laboratory, J. O. Preston. Cornell Civil Engr., vol. 27, no. 2, Mar. 1919, pp. 50-65, 1 fig. Reasons for establishing it and fundamentals of design.

ORGANIZATION. The Government and the Organization of Scientific Research—I & II, Frank Heath. Chemical News, vol. 118, nos. 3074 & 3075, Mar. 12 and 21, 1919, pp. 127-129 and 134-137. Policy advocated by Advisory Council is encouraging research workers, organizing research by industries and establishing national research. Paper read before Roy. Soc. of Arts.

STANDARDS AND STANDARDIZATION

CHEMICAL STANDARDS. Chemical Standards in Relation to the Iron and Steel Trades, H. W. Brearley. Jl. Soc. Chem. Indus., vol. 38, no. 6, Mar. 31, 1919, pp. 97R-98R. Claims that advent of regular microscopic examination and what are called metallographic methods has caused a steady decline in the value of chemi-ical analysis as a means of determining specifications for high-class steel material. Comments on Chem. Standards in issue of Feb. 15, p. 15T.

INDUSTRIAL STANDARDS. Engineering and Industrial Standardization. C. A. Adams. Proc. Am. Inst. Elec. Engrs., vol. 38 no. 4, Apr. 1919, pp. 549-559. Machinery proposed by Am. Engrs. Standards Committee to create and regulate industrial standards.

STANDARDIZED PARTS PRODUCTION. The Production of Standardized Parts—I, Herbert C. Armitage. Machinery, vol. 14, no. 341, Apr. 10, 1919, pp. 55-57, 2 figs. Jigs, tools and special machines; formulæ of output to pay for tools. Paper read before Instn. Mech. Engrs.

TURBO-GENERATORS. Standardization of Turbo-Generators (Normalisation des groupes électrogènes à turbines à vapeur). Revue Générale de l'Electricité, vol. 5, nos. 14 and 15, Apr. 5 and 12, 1919, pp. 517-527 and 551-556, 4 figs. Specifications prepared by technical committee of the Chambre Syndicale des Constructeurs de Gros Matériel électrique. Apr. 5: Concerning turbine and coupling. Apr. 12: Relating to electrical part.

STEAM ENGINEERING

BOILER HEADS. Areas of Segments of Boiler Heads, C. H. Berry. Power, vol. 49, no. 17, Apr. 29, 1919, pp. 644-645, 4 figs. Charts based on formulæ quoted in paragraphs 214 and 217 of Am. Soc. Mech. Engrs. boiler code, edition of 1918.

BOILER, HUDSON. The Hudson Patent Cylindrical and Water Tube Boiler. Colliery Guardian, vol. 117, nos. 30-40, Apr. 4. 1919, p. 777, 4 figs. Large water-holding capacity and steam reserve of Lancashire type, combined with quick steaming properties and positive circulation of water-tube type, has been aimed at in design.

CROSS-COMPOUND ENGINES. Checking Up Alignment, George H. Wallace. Power Plant Eng., vol. 23, no. 8, Apr. 15, 1919, pp. 367-368. Procedure in case of cross-compound engine.

SAFETY VALVES. Some Important Points on Boiler Heating Surface, G. J. Wells. Mar. Eng. of Canada, vol. 9, no. 3, Mar. 1919, pp. 120-121 and 70. Report of committee giving regulations for determining size of safety valve of ordinary type required on each boiler. Paper read before Inst. Mar. Engrs.

TURBINES. Some Aspects in Steam Turbine Design. Steamship, vol. 30, no. 358, Apr. 1919, pp. 229-232. Progress of steam turbine as commercial proposition, particularly as applied to marine propulsion. Paper read before Assn. Eng. & Shipbuilding Draftsmen.

THERMODYNAMICS

GASOLINE VAPOR. Physical Properties of Gasoline Vapor (Proprietés physiques de la vapeur de pétrole), Jean Rey. Comptes rendus des séances de l'Académie des Sciences, vol. 167, no. 10, Mar. 10, 1919, pp. 509-513. Deduced from the entropic diagram presented in Comptes rendus, vol. 166, 1918, p. 387.

HEAT FLOW. The Transmission of Heat Through Heavy Building Materials, Eng. & Contracting, vol. 51, no. 18, Apr. 30, 1919, pp. 442-443. Experiments carried out by Dept. of Heating and Ventilating Eng. of University of London.

MECHANICAL EQUIVALENT OF HEAT. Sadi Carnot's Determination of the Mechanical Equivalent of Heat (La détermination de l'équivalent mécanique de la chaleur par Sadi Carnot), L. Décombe. Revue Générale de l'Electricité, vol. 5, no. 12, Mar. 22, 1919, pp. 442, 443. Expressions used by Carnot in his Reflexions on the Motive Power of Fire are quoted to prove that he was the first to establish the two thermodynamic laws. Paper before l'Académie des Sciences, Feb. 3, 1919. (See Comptes rendus, vol. 168, pp. 268-271.)

How Carnot Calculated the Mechanical Equivalent of Heat. An unpublished Document (Comment Carnot a calculé l'équivalent mécanique de la chaleur. Un document inédit), C. Raveau. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 11, Mar. 17, 1919, pp. 549-552. Quotes from Notes Inédites de Sadi Carnot expression writer used in connection with experiments on work done in isothermal expansion of a given volume of gas.

RADIATION. Note on the Coefficient of Total Radiation of a Uniformly Heated Enclosure, W. W. Coblentz. Jl. Wash. Acad. Sci., vol. 9, no. 7, Apr. 4, 1919, pp. 185-187. Experimental verification of writer's previous conclusion in regard to value of Stefan-Boltzmann constant of radiation.

SPECIFIC HEATS OF AQUEOUS SOLUTIONS. The Specific Heat of Aqueous Solutions, with Special Reference to Sodium and Potassium Chlorides, W. R. Bousefield and C. Elspeth Bousfield, Phil. Trans. Roy. Soc. London, Ser. A, vol. 218, no. 562, Feb. 25, 1919, pp. 119-156, 7 figs. Experimental study of contruction of water when a solute is dissolved in it with reference to specified heat of solution. A cylindrical Dewar vessel immersed in water bath as the calorimeter, and a "mercury resistance thermometer" as the electric heater.

WELDING

ACETYLENE WELDING. Oxy-Acetylene Welding in the Railroad Shops, F. Hazeldine. Can. Machy., vol. 21, no. 14, Apr. 3, 1919, pp. 334-335. Facts regarding use of oxy-acetylene welding and cutting torch in railroad shop. Paper read before Instn. Mech. Engrs.

Oxy-Acetylene and the Safety First Movement, A. Cressy Morrison. Jl. Acetylene Welding, vol. 2, no. 11, May 1919, pp. 543-549. Safety in relation to manufacture and transportation of materials and apparatus used in connection with art of welding and cutting. Address delivered before Western Pa. Division of Nat. Safety Council.

The Oxy-Acetylene Torch in the Railway and Locomotive Engineering Field, J. F. Springer. Jl. Acetylene Welding, vol. 2, no. 11, May 1919, pp. 570-576. Principles of gas welding methods and survey of various applications in welding of sheet metal.

Oxy-Acetylene Welding, J. H. Davies. Acetylene & Welding Jl., vol. 16, no. 186, Mar. 1919, pp. 46-47. Experiments in welding of steels for the purpose of determining conditions for securing good results. Paper read before Instn. Mech. Engrs.

Oxy-Acetylene Welding An Important Factor in Poison Gas Manufacture. Jl. Acetylene Welding, vol. 2, no. 11, May 1919, pp. 556 and 558. Work of Chem. Warfare Service.

Welding by the Oxy-Acetylene Method—II, J. F. Springer. Automotive Eng., vol. 4, no. 4, Apr. 1919, pp. 181-183, 3 figs. Details of apparatus used and reasons for the use of each part. Suggestions in regard to adjusting flame. (To be continued.)

ALUMINUM. Improvements in the Autogeneous Welding of Aluminum or Its Alloys. Acetylene & Welding Jl., vol. 16, no. 186, Mar. 1919, p. 60. Object of invention is to obtain a flux having melting point desired with use of no other salts than those of the halogen group.

BLOWPIPES. Improvements in Blowpipes. Acetylene & Welding Jl., vol. 16, no. 186. Mar. 1919, p. 59, 2 figs. Invention relates to welding blow-pipe of the type having an attachment in the form of a tube adapted so as to be readily attached to the blowpipe.

CAST-IRON WELDING. Hard Spots in Cast Iron Welding, S. W. Miller. Welding Engr., vol. 4, no. 4, Apr. 1919, pp. 19-24, 23 figs. Examination of various structures containing different percentages of carbon in the light of accepted metallurgical phenomena taking place in heat treatment, forms basis of suggesting cause of formation of hard spots and proposing remedy for avoiding same.

ELECTRIC WELDING. Electric Arc Welding, F. A. Anderson. Mech. Eng., vol. 41, no. 5, May 1919, pp. 452-454, 8 figs. Its application to expanding pipe into flange, with reference to special instance in which weld was tested in various ways. Paper read before San Francisco Section Am. Sec. Mech. Engrs.

The Application of Electric Welding to Steel Shipbuilding, H. A. Hornor. Proc. Engrs. Soc. Western Pa., vol. 34, no. 10, Jan. 1919, pp. 641-670 and (discussion) pp. 671-676, 35 figs. Survey of extent of employment of electric welding in U. S. Set of Standard symbols and nomenclature prepared by Electric Welding Branch, United States Shipping Board Emergency Fleet Corporation.

Electric Welding: Its Theory Practice, Application and Economics, H. S. Marquand. Elecn., vol. 82, nos. 13 and 14, Mar. 28 and Apr. 4, 1919, pp. 350-352 and 377-379, 7 figs. Mar. 28: Properties of metals considered from welding point of view. Apr. 4: Thomson process of resistance welding; requirements of plants and application of method to chain welding, tire welding and wire welding, electro-percussive method.

Electric Welding and Welding Appliances—V, VI & VII. Engineer, vol. 127, nos. 3298, 3299 and 3300, Mar. 14, 21 & 28, 1919, pp. 241-243, 267-268 and 296-299, 18 figs. Quasi-arc coated-metal-electrode process.

Electric Arc Welding Principles, E. Wanamaker and H. R. Pennington. Ry. Elec. Engr., vol. 10, no. 4, Apr. 1919, pp. 107-110, 1 fig. Practice concerning metals used, their application and electrical characteristics. (Continuation of serial.)

Electric Welding and its Applications, Walter Leonard Lorkin. Jl. Roy. Soc. Arts, vol. 67, no. 3463, Apr. 4, 1919, pp. 304-314 and (discussion) pp. 315-317, 3 figs. Endeavors to show that process is simple, that it can be carried out with ordinary labor and that welds are efficient and effected at small cost.

Fusion in Arc Welding, O. H. Eschholz. Power, vol. 49, no. 12, Apr. 1, 1919, pp. 504-506, 19 figs. Effect of arc length, welding procedure, electrode material, arc current and electrode diameter upon such characteristics as penetration and overlap.

Notes on Electric Arc Welding. Eng. & Min. Jl., vol. 107, no. 17, Apr. 26, 1919, p. 743, 4 figs. Practice in construction of transformer tanks at Pittsfield works of General Electric Co.

Some Recent Applications of Arc Welding, Frank C. Perkins. Can. Machy., vol. 21, no. 12, Mar. 20, 1919, pp. 281-283, 8 figs. Explanation of process and of methods in use; illustrations of work done by aid of arc welder.

Suggestive Applications of Electric Arc Welding. Am. Blacksmith, vol. 18, no. 7, Apr. 1919, p. 177, 9 figs. Welding of locomotive back flue sheet, flanged head and similar operations.

ELECTRIC WELDING MACHINES. Winfield Electric Welding Machines. Can. Machy., vol. 21, no. 15, Apr. 10, 1919, pp. 353-354, 3 figs. Motor-driven spot welder.

EMERGENCY REPAIRS. Trials of an Army Welder in France, Jefferson A. Snyder. Jl. Acetylene Welding, vol. 2, no. 11, May 1919, pp. 566-570. Emergency repairs conducted under handicap of insufficient equipment.

EXPANSION AND CONTRACTION. Making Expansion Outwit Contraction, David Baxter. Jl. Acetylene Welding, vol. 2, no. 11, May 1919, pp. 558-566, 4 figs. Welding 400-lb. gasoline engine flywheel. Fractures consisted of two cracked spokes and a crack full length of the hub; cracks in spokes were near juncture of spokes and hub.

GAS-WELDING APPARATUS. Some Welding Shop Ideas, David Baxter. Am. Blacksmith, vol. 18, no. 7, Apr. 1919, pp. 159-162, 5 figs. Construction details of compound heater gas burner and ladle and preheating torch.

LOCOMOTIVE-CYLINDER WELDING. Welding a Locomotive Cylinder. Welding Engr., vol. 4, no. 4, Apr. 1919, pp. 34-40, 6 figs. Break was caused by cylinder bushing being loose in cylinder and turning around so that cylinder cock hole was plugged up, and piston coming forward pushed out whole front of cylinder including valve-chamber front.

PLASTIC ARC. The Plastic-Arc System of Welding, J. O. Smith. Motorship, vol. 4 no. 5, May 1919, pp. 36-37, 15 figs. Technical discussion of methods employed

PREHEATING. Discussion of the Merits of Both Charcoal and Gas Preheating, Fred J Maeurer. Welding Engr., vol. 4, no. 4, Apr. 1919, pp. 25-27, 8 figs. Recommends use of charcoal in preheating castings where expansion and contraction must be taken into consideration.

STEEL, MILD. Welding Mild Steel, H. M. Hobart. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 4, Apr. 1919, pp. 561-609, 19 figs. Investigations undertaken by Welding Research Sub-Committee of Welding Committee of Emergency Fleet Corporation. General object was to extend use of welding in construction of merchant ships.

THERMITE WELDING. Repairing a Broken Crankshaft by Thermite, W. F. Sutherland Can. Machy., vol. 21, no. 17, Apr. 24, 1919, pp. 404-405, 3 figs. Repair job on a 10-in. upsetting press crank done at Metal & Thermite plant, Toronto.

WELDED MATERIALS, TESTS OF. Tests of Welded Materials, Paul C. Tris, Maurice Kapetensky. Proc. Steel Treating Research Soc., vol. 2, no. 3, 1919, pp. 18-24 and 50, 16 figs. The Metallurgical Laboratory where welded parts of Liberty Engine are tested is operated in three divisions, the chemical, the physical and metallographic laboratories. The experimental data secured in these divisions and the interpretation given to micrographs are exposed.

WELDERS, TRAINING. Training a Welder. Jl. Acetylene Welding, vol. 2, no. 11, May 1919, pp. 550, 552 and 556, 1 fig. On training by apprenticeship. (To be continued.)

WELDING AND CUTTING. Modern Welding and Cutting, pts. VII, VIII and IX, Ethan Viall. Am. Mach., vol. 50, nos. 14, 15 and 16, Apr. 3, 10 and 17, 1919, pp. 641-645, 675-679 and 733-737, 20 figs. Apr. 3, Thermit welding of cast iron and other parts. Apr. 10: History and uses of the gas torch. Apr. 17: Oxygen and hydrogen by the electrolytic method.

WOOD

SEASONING. Practical Rules for the Seasoning of Wood, Harold S. Betts. Ry. Maintenance Engr., vol. 15, no. 5, May 1919, pp. 169-170, 2 figs. Suggestions in regard to uniform drying of timber with minimum exposure to decay.

STATISTICS OF PRODUCTION. Production of Lumber, Lath, and Shingles in 1917, Franklin H. Smith and Albert H. Pierson. U. S. Dept. of Agriculture, bul. no. 768, Apr. 5, 1919, 44 pp. Collection and compilation of statistics. Estimated total lumber production was 36,000,000,000 board feet.

VARIA

BRITISH INDUSTRY DURING WAR. Some Developments in British Industry During the War. Nature, vol. 102, no. 2574, Feb. 27, 1919, pp. 506-508. How British industry surpassed German industry.

COLOR OF WATER. The Color of Water, Wilder D. Bancroft. Jl. Franklin Inst., vol. 187, no. 4, Apr. 1919, pp. 459-485. Analysis of theories proposed by various physicists and investigators. (Concluded.)

ENGINEER AS CITIZEN. The Engineer as a Citizen. Mech. Eng., vol. 41, no. 5, May 1919, pp. 448-450 and (discussion) pp. 450-451 & 496. Symposium on civic responsibility and relation to legislation, to administration, public opinion and production and distribution. Held at Meeting of Engineers of Metropolitan District.

How Shall Proper Recognition of the Engineering Profession be Obtained? W. W. K. Sparrow. Eng. & Contracting, vol. 51, no. 16, Apr. 16, 1919, pp. 387-388. Lack of recognition illustrated by such instances as reported by a Governor of a lawyer as State Highway Engineer. Organization, licensing and broader education believed to be prime requisites for obtaining recognition. Address before R. R. Conference, Chicago.

The Functions of the Engineer: His Education and Training, W. A. J. O'Meara. Jl. Instn. Elec. Engrs., vol. 57, no. 280, Mar. 1919, pp. 225-239 and (discussion) pp. 239-257, 1 fig. Points out that in engineering problems there are six separable and independent aspects, viz., financial, commercial, technical, custodianship, bookkeeping and administrative. On this basis modifications are recommended in the present scheme of education of engineering students.

ENGINEERS, LICENSING. Standard Bill for Licensing of Engineers. Can. Engr., vol. 36, no. 9, Feb. 27, 1919, pp. 257-258 and 263. Draft copy of bill prepared by Am. Assn. of Engrs.

MODEL MAKING. The War Work of Basset-Lowke, Limited— I & II. Model Engr. & Elecn., vol. 40, nos. 934 & 935, Mar. 20 & 27, 1919, pp. 194-200 and 210-215, 21 figs. Models and model making. Making of screw gages.

OPTICAL INSTRUMENTS. Trigonometric Computation Formulæ for Meridian Rays, P. V. Wells, Jl. Wash. Acad. Sci., vol. 9, no. 7, Apr. 4, 1919, pp. 181-184, 1 fig. Formulæ used in design of optical instruments.

PHOTOGRAPHY. Modern Application of Photography, Alfred B. Hitchins. Jl. Franklin Inst., vol. 187, no. 2, Feb. 1919, pp. 129-146, 13 figs. Developments of photography during war, specially aerial, will now permit, in opinion of writer, simplifications and extensions in scientific, commercial and political fields.

MECHANICAL PROCESSES

BELT SHIFTER. Manufacturing a Safety Belt Shifter, Robert Mawson. Am. Mach., vol. 50, no. 16, Apr. 17, 1919, pp. 743-745, 9 figs. Shifting mechanism consists of three rollers, one straight and two tapered; belt is pushed by means of straight roller, and owing to the shape of taper rollers the tendency is for the belt to slide onto the pulley as the shifter slides away.

BENDING, COLD. The Bending and Forming of Brass Rod and Tubes, P. W. Blair. Metal Indus., vol 17, no. 4, Apr. 1919, pp. 172-173, 5 figs. Machines for cold bending.

BOILERS. How to Design and Lay Out a Boiler—VI, William C. Strott. Boiler Maker, vol. 19, no. 4, Apr. 1919, pp. 103-106, 2 figs. Why the longitudinal seam must be stronger than the cirumferential seam; formulas for finding strength of boiler shell.

BRASS RODS. The Manufacture of Brass Rods—I & II, H. Mawson. Metal Industry, vol. 14, nos. 11 & 12, Mar. 14 & 21, 1919, pp. 203-207 and 229-232. 14 figs. Account of processes with reference to specification of Am. Soc. for Testing of Materials. Paper read before Liverpool Eng. Soc.

CARBURETORS. Organization of a Carburetor Plant—I, Fred. H. Korff. Machy. (N. Y.), vol. 25, no. 9, May 1919, pp. 847-850. Functions of different departments and their relation to product.

CHAINS, Cast-Steel. Cast-Steel Anchor Chain, A. E. Crockett. Proc. Engrs. Soc. Western Pa., vol. 35, no. 1, Feb. 1919, pp. 1-25 and (discussion) pp. 26-30, 24 figs. Investigation and trials which finally led to adoption of present method of manufacturing cast-steel anchor chain, and account of dynamic tension tests of cast chains.

CHUCK, UNIVERSAL. Universal Chuck Manufacture. Machinery, vol. 14, no. 341, Apr. 10, 1919, pp. 33-39, 21 figs. Methods employed by A. A. Jones & Shipman, Leicester.

CRUSHERS, STONE. Detroit United Railway Builds Large Stone Crusher Plant. Elec. Ry. Jl., vol. 53, no. 15, Apr. 12, 1919, pp. 726-727, 5 figs. Crushers taken from abandoned quarry used to equip plant of 500 cu. yd. pe rday capacity in salvaging waste materials for ballasting.

EARTHENWARE. Earthenware (Fabricacion de articulos de arcilla o barro). Boletin de la Sociedad de Fomento Fabril, vol. 35, no. 12, Dec. 1918, pp. 825-829, 5 figs. Processes followed and machinery used in manufacture of earthenware.

ENGINES, MARINE. Manufacture of Marine Engines at the Joshua Hendy Iron Works, H. S. Rexworthy. Metal Trades, vol. 10, no. 4, Apr. 1919, pp. 153-157, 10 figs. It is stated that engines weighing 100 tons and developing 2800 h.p. are being delivered at the rate of one every 30 days.

EXTRUSION OF METALS. The Present and Future of the Extrusion of Metals—I & II, A. E. Tucker and P. A. Tucker. Machinery, vol. 14, nos. 340 & 341, Apr. 3 and 10, 1919, pp. 29-30 and 47-48. Effect of a powerful deoxidizer on metal. Paper read before Birmingham Metallurgical Soc. Also abstracted in Ironmonger, vol. 166, no. 2366, Mar. 22, 1919, p. 79.

GAS ENGINES. The Manufacture of Marine Gas Engines, J. V. Hunter. Am. Mach., vol. 50, no. 17, Apr. 24, 1919, pp. 787-791, 20 figs. Manufacture of jigs and fixtures to adapt standard machine tools to rapid production of standard work in order to meet demands for powerful gas engines of comparatively light weight for marine and other powers.

GEAR CUTTING. Commercial Gear Cutting, W. Duckett. Machinery, vol. 13, no. 339, Mar. 27, 1919, pp. 723-725, 8 figs. Basis of machine cut gearing in engineering practice; particularly in manufacture of aero engine and automobile parts.

HOSIERY MACHINE. Manufacturing the Banner Hosiery Machine, pts. II and III Robert Mawson. Can. Machy., vo. 21, nos. 15 and 17, Apr. 10 and 24, 1919, pp. 345-348 and 391-394, 22 figs. Apr. 10: Operations performed on Jones and Lamson machines. Apr. 24: Operation of form milling sinker cams on Briggs milling machine; cutting raised cams; milling fashion cams and clutch cams.

MILLER, FORD-SMITH. Manufacturing the Ford-Smith Miller, J. H. Moore. Can. Machy., vol. 21, no. 12, Mar. 20, 1919, pp. 271-275, 9 figs. Concerning inspection methods involved.

MOTOR PARTS. Making Liberty Aeroplane Motor Parts —I. Machinery, vol. 14, no. 340, Apr. 3, 1919, pp. 8-13, 13 figs. Methods employed in machining cylinder inlets and exhaust elbows.

PRESSED STEEL, REINFORCING. Making Pressed-Steel Reinforcing. Iron Trade Rev., vol. 64, no. 17, Apr. 24, 1919, pp. 1073-1080, 16 figs. How various shapes of beams, plates, studs, concrete bars, etc., are adapted for building purposes.

ROLLER BEARINGS. Making the Timken Roller Bearing—I, Edward K. Hammond. Machy. (N. Y.), vol. 25, no. 9, May 1919, pp. 829-835, 13 figs. Methods of heat-treating, machining and inspecting.

RUBBER GOODS. Railroad Rubber Goods, G. W. Alden. Official Proc. Car Foremen's Assn. of Chicago, vol. 14, no. 6, Mar. 1919, pp. 65-100. Classification of various goods according to process of manufcture, together with exposition of recent developments of rubber industry.

SANDING MACHINE. Building a Sanding Machine, Robert Mawson. Machy. (N. Y.), vol. 25, no. 8, Apr. 1919, pp. 738-742, 15 figs. Methods of machining parts of a sanding machine; describing jigs and fixtures used and general procedure in assembling.

STEEL MILLS. Westinghouse Electric Blooming-Mill (Train bloming à commande électrique système Westinghouse). Génie Civil, vol. 74, no. 12, Mar. 22, 1919, pp. 225-228, 7 figs. Scheme of a. c. instalation developed by British Westinghouse Co. From Engineer, Dec. 13, 1918.

Large Rolling-Mill Plant. Electrical Review, vol. 84, no. 2157, Mar. 28. 1919, pp. 340-342. 7 figs. Electrical equipment for a 38-in. reversing cogging mill designed to roll 3-ton steel ingots 18 x 22 in. to 4 x 4 in. billets, with an output of 60 tons per hour. (Concluded.)

TRACTORS. Turning Out 100 Tractors per Day, P. M. Heldt. Automotive Industries, vol. 40, no. 15, Apr. 10, 1919, pp. 788-792, 7 figs. Machining and assembling methods employed at Milwaukee plant of Int. Harvester Co. (To be continued.)

WESTINGHOUSE MARINE SYSTEM. Building the Westinghouse Marine System. Edward K. Hammond. Machy. (N. Y.), vol. 25, no. 9, May 1919, pp. 789-796, 16 figs. Operations involved in forging, machining, assembling and testing various parts of equipment.

ORGANIZATION AND MANAGEMENT

ACCOUNTING

Brick Plant. Simplified System of Counting Cost, C. F. Mattes. Brick & Clay Rec., vol. 54, no. 7, Apr. 8, 1919, pp. 591-594. Suggested plan for average size brick plants.

Cost Accounting. Cost Accounting to Aid Production—VIII, G. Charter Harrison. Indus. Management, vol. 57, no. 5, May 1919, pp. 400-404, 1 fig. Diagram illustrating use of specification costs in ascertaining profits and losses made by individual salesmen.

Highway Contractors. Cost Keeping for Highway Contractors, H. P. Gillette. Contract Rec., vol. 33, no. 15, Apr. 9, 1919, pp. 336-338. Methods for determining unit costs, obtaining overhead costs and prorating them.

Inventories. How We Prepare for and Take Inventory, H. F. Harris. Factory, vol. 22, no. 4, Apr. 1919, pp. 681-686, 10 figs. Instructions given to men at plant of Republic Motor Truck Co.

EDUCATION

Employment Management. Government Course for Training Employment Managers, Meyer Jacobstein. U. S. Dept. Labor, Bur. Labor Statistics, Bul. 247, Jan. 1919, pp. 19-24. War-Emergency course.

Engineers. Specialization in Education of Engineers (Sulla specializzazione della educazione degl' ingegneri), Giuseppe Astorri. Ingegneria Italiana, vol. 3, no. 63, Mar. 13, 1919, pp. 169-171. High-school courses in italy are found to be insufficiently adaptable to form a basis for subsequent engineering education.

Foundrymen. Industrial Education. Foundry Trade Jl., vol. 21, no. 206, Feb. 1919, pp. 98-102. Considered as means for developing industry, particularly in relation to the operation of a foundry. Address delivered before Scottish Branch British Foundrymen's Assn.

Mining. Mining and the Industrially Disabled, J. C. Murray. Can. Min. Inst. Bul. no. 84, Apr. 1919, pp. 393-398. Work being done by Canadian Government in rehabilitating war cripples.

Telephone Operation. The Cripple in the Telephone Field, Douglas C. McMurtrie. Telephony, vol. 76, no. 17, Apr. 26, 1919, pp. 31-32. Re-education of injured or crippled employee estimated as more profitable to all concerned than disability compensation.

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See also: Sprinklers and Dust Inflammability.

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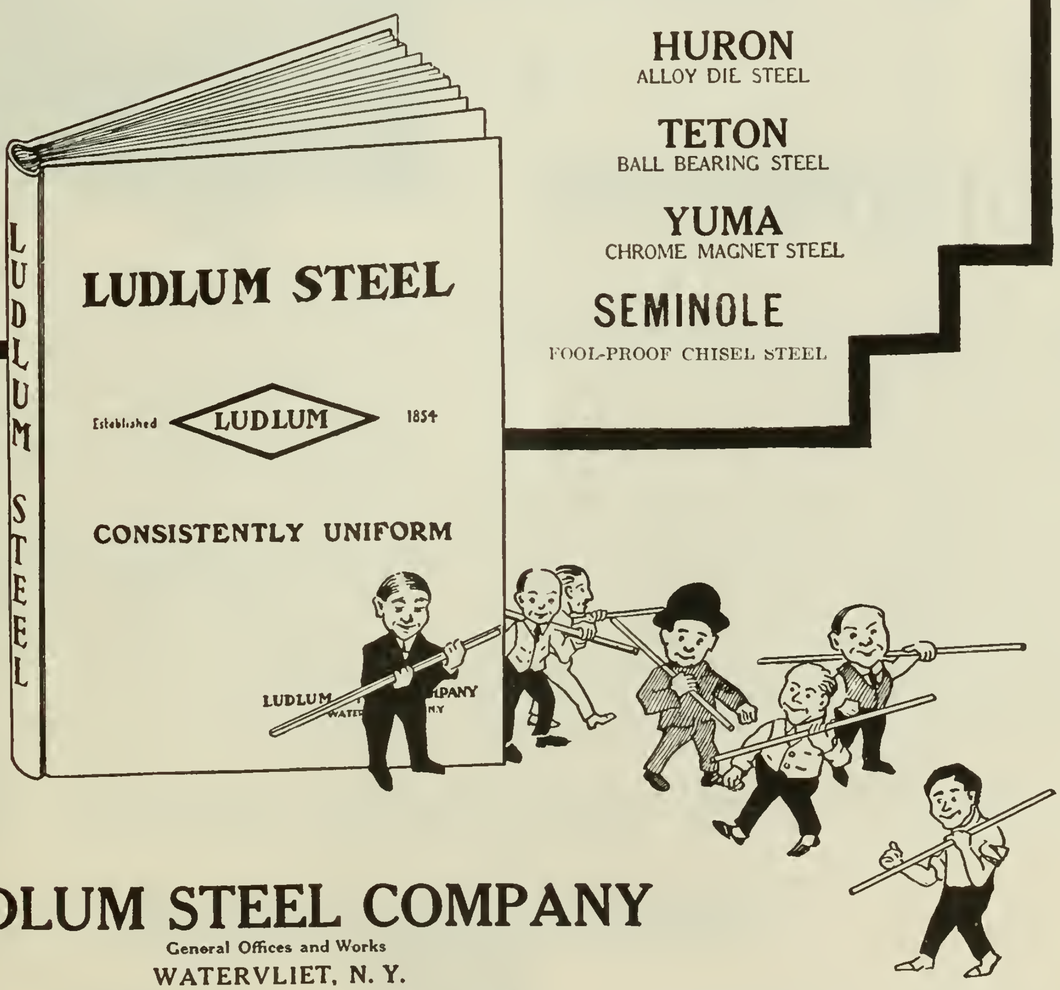

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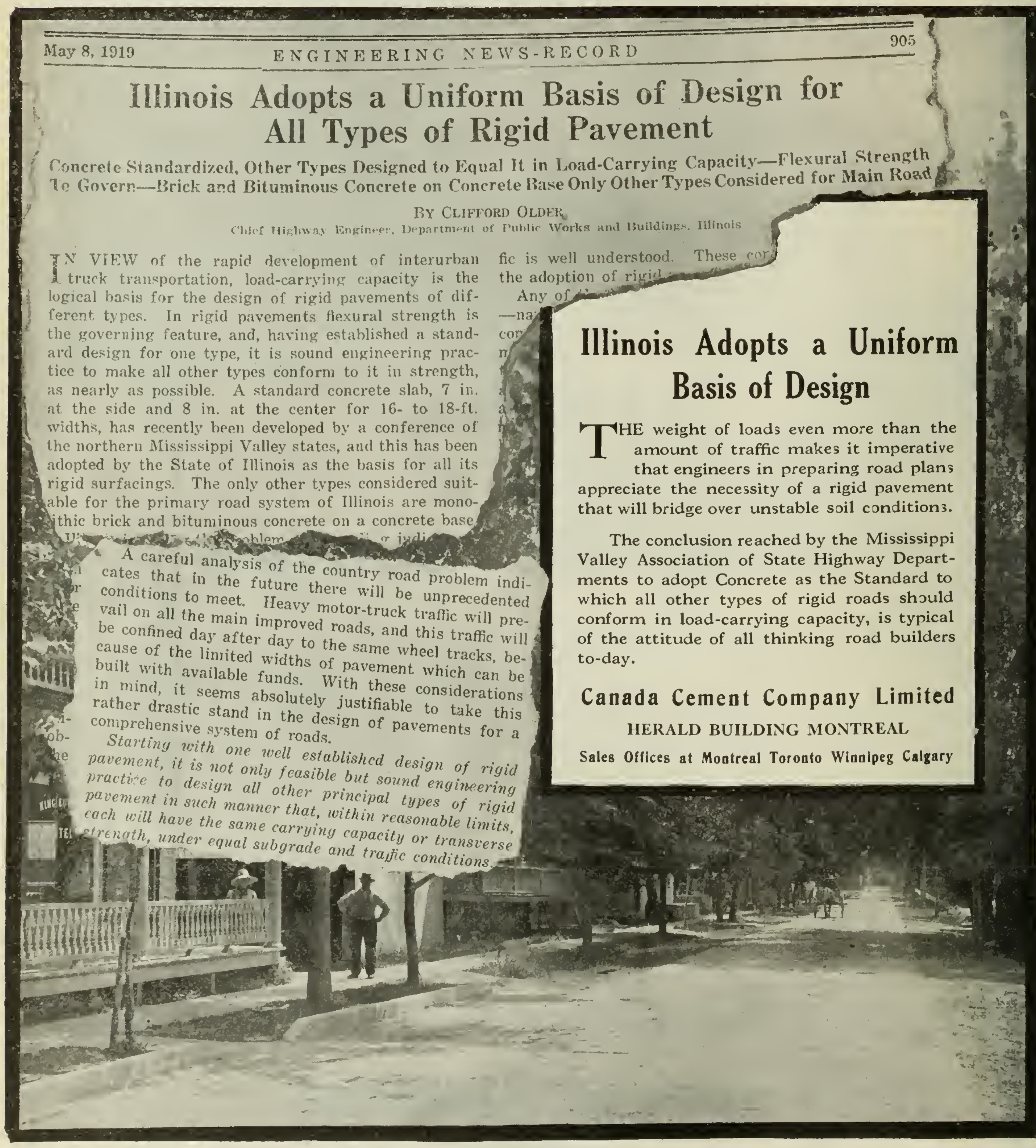

May 8, 1919 ENGINEERING NEWS-RECORD 905

Illinois Adopts a Uniform Basis of Design for All Types of Rigid Pavement

Concrete Standardized, Other Types Designed to Equal It in Load-Carrying Capacity—Flexural Strength To Govern—Brick and Bituminous Concrete on Concrete Base Only Other Types Considered for Main Road

By Clifford Older

Chief Highway Engineer, Department of Public Works and Buildings, Illinois

IN VIEW of the rapid development of interurban truck transportation, load-carrying capacity is the logical basis for the design of rigid pavements of different types. In rigid pavements flexural strength is the governing feature, and, having established a standard design for one type, it is sound engineering practice to make all other types conform to it in strength, as nearly as possible. A standard concrete slab, 7 in. at the side and 8 in. at the center for 16- to 18-ft. widths, has recently been developed by a conference of the northern Mississippi Valley states, and this has been adopted by the State of Illinois as the basis for all its rigid surfacings. The only other types considered suitable for the primary road system of Illinois are monolithic brick and bituminous concrete on a concrete base.

fic is well understood. These co... the adoption of rigid ...

A careful analysis of the country road problem indicates that in the future there will be unprecedented conditions to meet. Heavy motor-truck traffic will prevail on all the main improved roads, and this traffic will be confined day after day to the same wheel tracks, because of the limited widths of pavement which can be built with available funds. With these considerations in mind, it seems absolutely justifiable to take this rather drastic stand in the design of pavements for a comprehensive system of roads.

Starting with one well established design of rigid pavement, it is not only feasible but sound engineering practice to design all other principal types of rigid pavement in such manner that, within reasonable limits, each will have the same carrying capacity or transverse strength, under equal subgrade and traffic conditions.

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The Bloor Street Viaduct, Toronto, Ontario

By Thomas Taylor, M.E.I.C.

(1). Introduction.

The development of the City of Toronto, and particularly of the eastern part, has, since an early period, been seriously hampered by reason of the Don Valley and River. With the northward growth of that portion east of the Valley, it became clear that another crossing would be required north of those existing, and for many years there has been a growing conviction that the proper course would be to connect Bloor Street with Danforth Avenue, creating a cross town thoroughfare.

By-laws to sanction the issue of debentures for this purpose were submitted to the ratepayers at the annual elections on three occasions, viz:—in 1910, 1912 and 1913. The amounts asked for were $759,000.00, $1,783,000.00 and $2,500,000.00 respectively. The first proposal was decisively defeated, the second barely defeated and the third carried by a large majority. The remarkable increase in these estimates is due to the fact that each of the two latter schemes was greatly superior to its predecessor with respect to capacity and appearance. The verdicts rendered at the three elections indicate, on the part of the Toronto public, a growing appreciation of civic improvements.

The route adopted in 1912, and on which the third proposal was based, is shown in Fig. 1. The three divisions commencing at the east were named Don, Rosedale and Bloor Sections; the outstanding features being a bridge over the Don Valley, a bridge over the Rosedale Ravine, and sidehill construction on the western portion of the Bloor Section, to carry the traffic along the south slope of the Rosedale Ravine. After fuller consideration, the latter was dispensed with in favor of earth fill, for reasons of stability and economy. The balance of the improvement consisted of ordinary grading and street construction. The width adopted was 86 feet and the grade, throughout the whole project (5,267 feet), was nearly level.

(2). Preliminary to Letting Bridge Contracts.

(*a*) Subsurface Exploration.

Early in 1912, investigations were made with hand augers. The results, although inconclusive, confirmed a suspicion that, in a great portion of the Don Valley, the soil for a considerable depth was utterly unfit for the direct support of heavy loads. In places it was so wet that doubts arose as to the advisability of using piles, particularly if arch construction should be adopted.

In order to secure more complete and definite information, it was decided to penetrate to the surface of the rock by wash boring in casing pipe and into the rock by diamond drill. This was done where required under contract at a certain rate per linear foot. The total number of holes drilled on the three sections was 44 and the sum of the depths was 3,405 feet. Of these, 36 were carried into rock; the total rock drilling being 672 feet. Samples of the earth obtained by collecting a portion of the wash water and allowing it to settle, were not entirely satisfactory. They nearly always contained too high a percentage of sand and revealed nothing about underground water conditions. Something was learned by observing the number of blows of the drop hammer required to drive the casing pipe one foot and the number of feet bored per day. The permeability at different depths was also tested by shutting off the water supply and noting the rate at which the water in the casing disappeared. The data thus obtained led to the conclusion that, throughout certain areas, subsurface conditions were fairly constant.

In case soil bearing was proposed for a large pier and any doubt existed as to the ability of the earth to carry the load, a test pit was dug. This not only furnished reliable information for the design of the bearing in question but assisted materially in the interpretation of data obtained from wash borings in that vicinity.

After wash boring in each case had been continued to rock, core drilling commenced and results became more definite. The rock proved to be of the same general character throughout; consisting of layers of hard lime-

It is estimated that the cost of labor and supplies averaged approximately $1.50 per linear foot of boring.

(*b*) Surveys.

The surveys made prior to letting the contracts for the bridges were carried out with three objects in view;—first, to obtain data sufficiently comprehensive and accurate for use in designing and estimating; secondly, to obtain a permanent record of original conditions and thirdly, to establish, with a high degree of accuracy, base lines and bench marks from which the work could be quickly and correctly laid out.

During the first half of 1912, the investigations, relative to selection of route, were based largely on surveys made in 1911. After the route was chosen a thorough survey was made with reference to this route. At this time very little of the land had been acquired and the

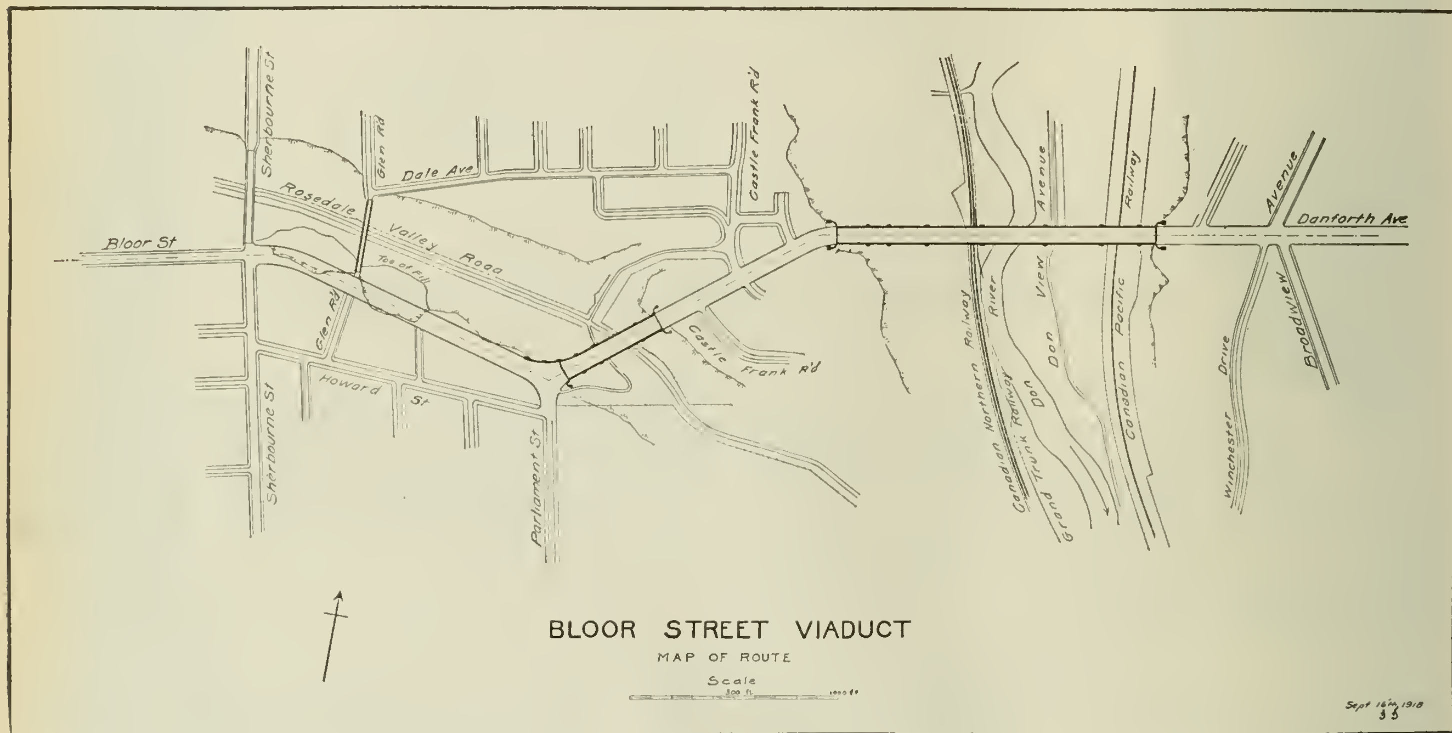


Fig. 1.

stone and layers of soft shale alternately, the latter constituting about 60 per cent of the whole. The cores obtained consisted mostly of the harder material and were found in the core barrel in short pieces mixed with a mud like substance which resembled wet, blue clay. In this were found fragments of soft laminated shale, which bore evidence of having been cut by the diamonds, then split off in the form of discs and partially ground to a paste by the action of the drill and the harder pieces of core. The fact that the drill cut steadily, indicated the solidity of the material; and it seemed likely that the formation was similar to that exposed in various excavations which had been made from time to time in Toronto. When excavation was afterwards made for the rock bearing piers of both bridges, this condition was found in all cases.

survey parties were not permitted to cut the trees and shrubbery that grew thickly over a great part of the site. Considering the short sights and frequent offsets, a fairly good centre line was run and profile on the same obtained. At right angles to this centre line and at intervals of ten feet, cross sections were taken extending on each side of the centre line for varying distances as required. Approximately fourteen thousand elevations were taken for this purpose. These elevations were first recorded in tabular form, then plotted as cross sections and finally a contour plan was made.

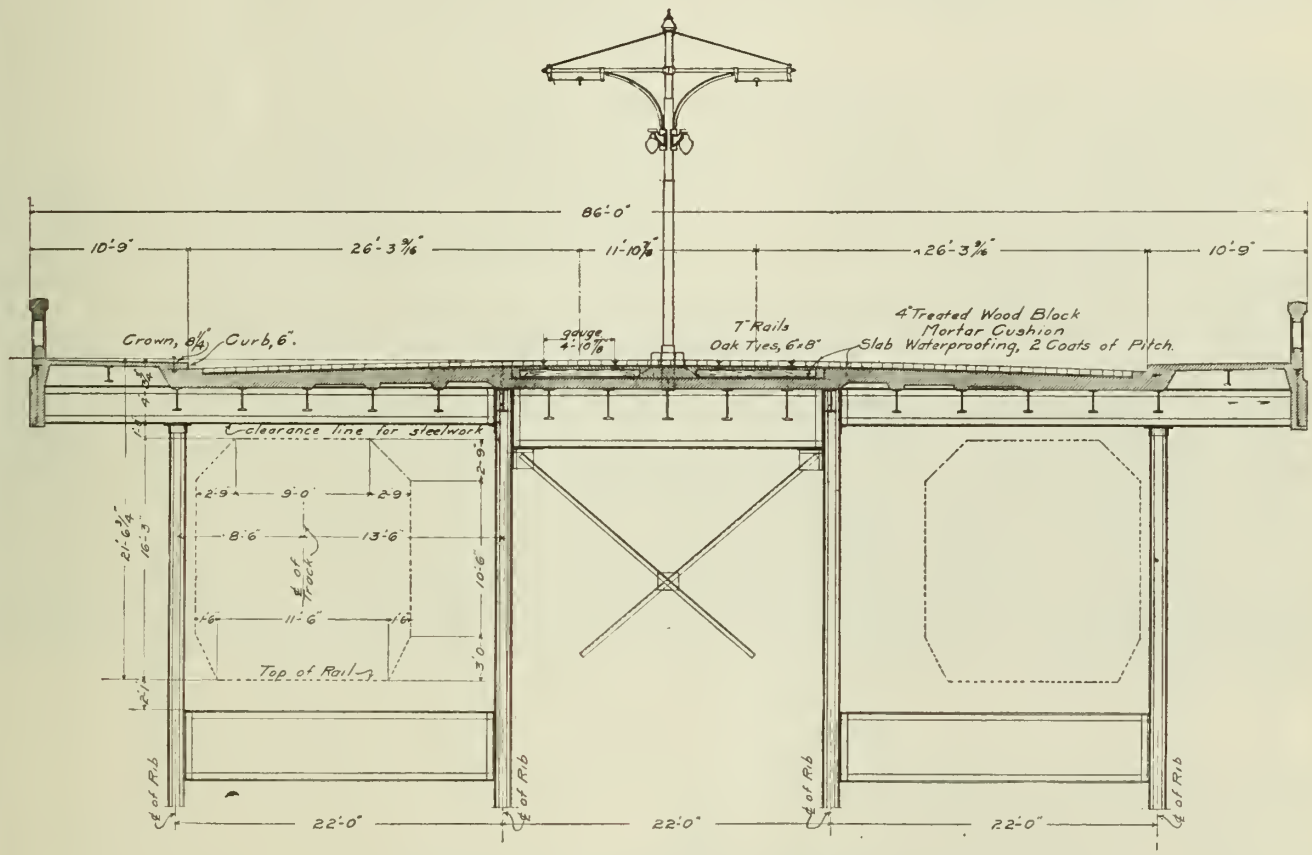
After notice of expropriation had been given in accordance with a by-law passed on May 19th, 1913, the survey parties were, for the first time, free to clear portions of the site. The centre line was then rerun and necessary corrections made. Intersecting and adjacent streets were located with reference to this centre line; houses, fences, etc., on these streets were tied in; and the whole plotted on a plan. Profiles of these streets were also made, showing the houses and the important elevations in connection with each.

An extensive set of photographs was made in order to record in greater detail than was possible on drawings, conditions prior to construction. On a key plan the position of the camera for each picture was shown by a small circle and the direction in which it was pointed by an arrow. In the circle was placed the number of the photograph.

monuments, measurements were made on the slope; the tension of the tape being kept constant while the temperature and the slope measurement were observed. By rearrangement of parties six independent observations were obtained in each case. The distances were corrected for temperature and the average taken as the slope distance. From these and the differences in elevation the horizontal distances between successive monuments were computed.

(*c*) Shale Tests.

The bearing value of the shale on which several



BLOOR STREET VIADUCT

CROSS SECTION OF BRIDGES

Fig. 2.

For use in construction, a liberal number of concrete monuments was placed for each bridge. In each case, these consisted principally of a pair on the centre line, one near each end of the bridge, and a row placed parallel to the centre line, one hundred feet distant, forming a base line. Levels were taken over the base line monuments and back, three times, the parties being rearranged so as to give six independent sets of results. The average of the elevations thus obtained for each monument was used. To determine the horizontal distances between

piers were to rest, being unknown, certain investigations were made.

In the first place, laboratory tests were made on specimens taken from the quarry of the Don Valley Brick Works. These were selected from the softest strata in the quarry face and were considered to be representative of the softest material beneath the piers. Owing to the laminated structure of the shale and its tendency to break down when exposed to air it was impossible to get specimens greater than two inch cubes; and of those obtained,

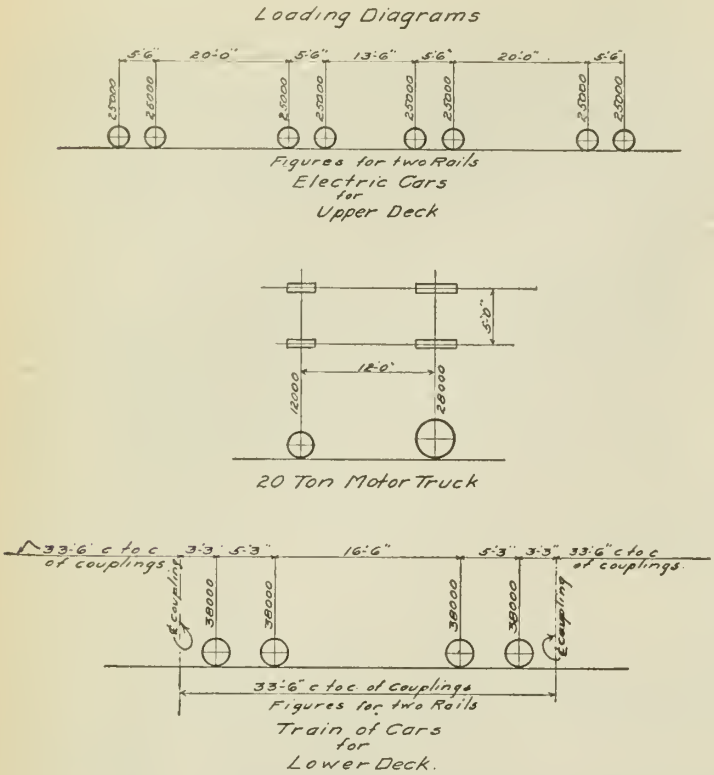


Fig. 3.

only one could be considered perfect. When tested in compression this specimen failed at 1,500 pounds per square inch, while the worst specimen sustained over 500 pounds per square inch, the others giving intermediate values.

As such shale in place has important advantages over small specimens, viz :—exclusion from air and lateral support, it was decided to secure information as to its carrying capacity when undisturbed. In the excavation for an addition to the John Street Pumping Station shale was exposed which was apparently identical in character with that obtained by the core drill in the borings for the Bloor Street Viaduct. With the co-operation of the Waterworks Section of the Department of Works loading tests were made there under favorable conditions, the layers being undisturbed and the surface being covered with water.

As heavy loads were required to give appreciable settlements, a special platform of steel shapes was constructed. After several strata were removed exposing the softer shale, the latter was carefully levelled off for bearing and the platform erected with the foot of the mast resting on a casting 8⅛ inches square, while the top was braced against overturning. Special care was taken to determine settlement and to check results.

On Dec. 10th, 1913, pig iron was gradually loaded on the platform from 1.30 to 4.45 P.M., the total load being 28,670 pounds, causing a gradual settlement of .09 inches during that time and a further settlement of .09 inches before 8.15 on the following morning. Additional pig iron was then added until 2.45 P.M., when the total load was 65,043 pounds or 986 pounds per square inch. The settlement during this period of loading was .12 inches and in the succeeding 24 hours a further settlement of .15 inches took place. Readings were taken on Dec. 13th, at 11 A.M., and Dec. 15th, at 9 A.M., neither of which showed additional settlement.

On removal of the platform the shale beneath was found to be so crushed that it could be rubbed to a paste in the hand. This effect extended for less than three inches in depth and the shale immediately around the loaded area showed no sign of injury. To determine the effect on the shale when loaded less heavily the platform was set up in another place, a few feet from the first location. On Dec. 20th, the loading was commenced but was discontinued at noon. The total load was then 11,320 pounds or 172 pounds per square inch. On Dec. 23rd, at 9.30 A.M., the settlement observed was .06 inches. By noon the total load was increased to 26,540 pounds or 402 pounds per square inch. During this time a settlement of .02 inches was noted. On Dec. 26th, no further settlement could be detected and the load was removed. On removal of the platform no injury to the shale was noticeable.

(*d*) Design of Bridges.

The same conditions of traffic volume and clearance applied to both bridges, the width being 86 feet, with 64 feet 6 inches between sidewalk curbs. It was orignally

Fig. 4. General Perspective, Don Bridge.

intended to use stone ballast under the upper deck tracks and to separate the track allowance from the 20 foot roadway on each side by curbs. This arrangement was discarded during construction in favor of an all paved deck shown in Fig. 2.

The bridges were so designed that, in the future, lower decks might be installed as a part of a subway system should the development of the City render the latter desirable. The clearances for this purpose, shown in Fig. 2, are continuous throughout the entire length of each bridge, openings being left in the pier tops and abutments. These lower deck clearances were obtained through the structural steel work by confining most of the diagonal bracing to the space between the two inner lines of columns and arch ribs.

In abutments and cross walls openings were provided at the lower deck level for two 42 inch water mains and under the sidewalks room was left to place ducts for telephone and other wires.

(iii) Sidewalk loads;

The slab, stringers and posts are designed for a uniform load of 100 pounds per square foot and the arches and foundations for a uniform load of 80 pounds per square foot.

(iv) Lower deck loads;

On each track, a train of cars, Fig. 3.

(v) Wind loads;

50 pounds per square foot of projected area of the unloaded structure. For lower deck construction, posts and arch ribs, the wind was assumed to act on twice the projected area.

In the case of stresses produced by railway loads, the combined dead load stress (D) and live load stress (L) were increased by an allowance for impact (I), using the formula

$$I = \frac{L^2}{D+L}.$$

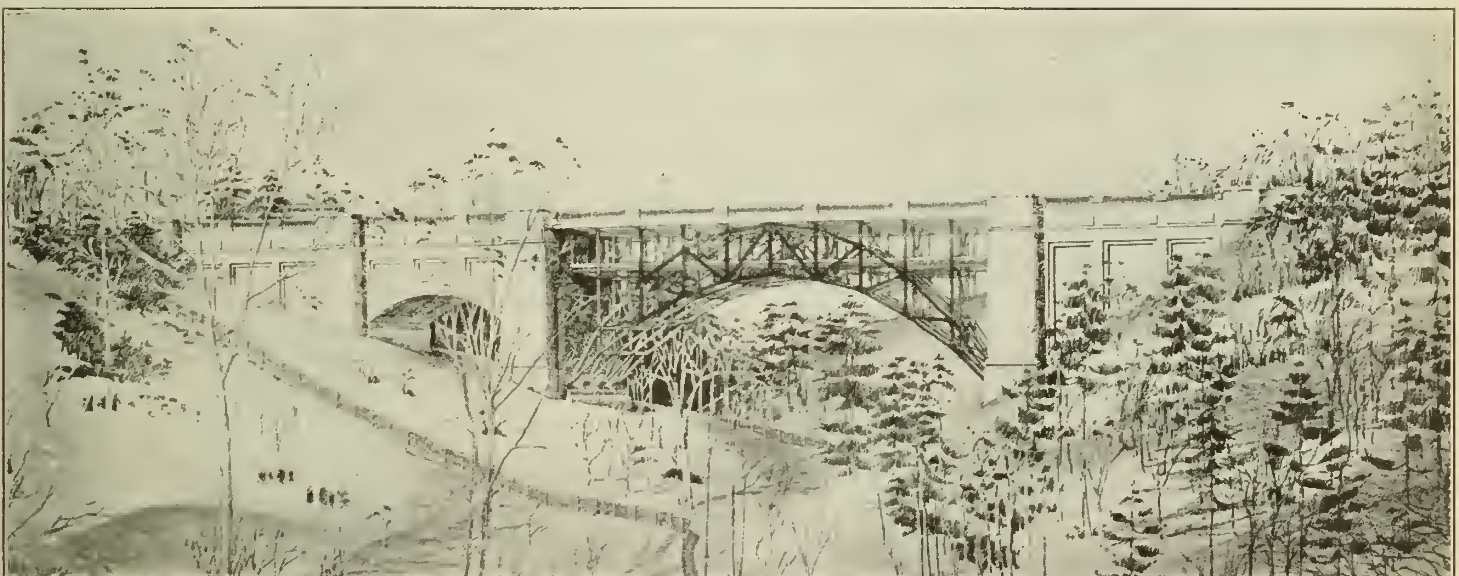


Fig. 5. General Perspective, Rosedale Bridge

The assumed live loads were as follows:—

(i) Upper deck railway loads;

For floor system and posts, two fifty ton electric cars on each track, Fig. 3.

For arches and foundations, a uniform load of 1,600 pounds per linear foot of track.

(ii) Roadway loads;

For floor system and posts, a uniform load of 135 pounds per square foot on the area remaining after deducting a strip 22 feet wide for tracks, or a 20 ton truck, Fig. 3. For arch ribs and foundations, a uniform load of 80 pounds per square foot for spans of 200 feet or over and $80 + \frac{200-S}{5}$ pounds per square foot for spans under 200 feet. S = span in feet.

For spans under 80 feet, the live load stress was multiplied by the factor $(1.40-\frac{l}{200})$, in which "l" is the loaded length in feet producing the maximum stress. This was then considered the live load stress and impact calculated as above.

The allowable stresses in pounds per square inch were as follows:—

Axial tension on net section of rolled plates and shapes, 16,000.

Axial compression on gross section of members,

Both ends fixed........ $16{,}000 \div \left[1+\frac{L^2}{18{,}000\, r^2}\right]$

One end fixed and one end pin........... $16{,}000 \div \left[1+\frac{L^2}{12{,}000\, r^2}\right]$

Both ends pin.......... $16{,}000 \div \left[1+\frac{L^2}{9{,}000\, r^2}\right]$

when L = the length and r = the least radius of gyration of the member expressed in inches.

Bending, on extreme fibres of rolled shapes, built sections and girders, net sect on 16,000
Shearing, shop driven rivets in reamed or drilled holes 10,000
power driven rivets in reamed or drilled holes. 9,000
all other rivets 8,000
lathe turned bolts in reamed or drilled holes. . 8,000
webs of girders, gross area 10,000
Bearing on diameter of rivets, twice the shearing values given above.
Bearing on pins, ... 22,000
Tension in steel reinforcement 15,000
Compression in 1 : 2 : 4 concrete in bending 500
Compression on 1 : 2 : 4 concrete under bearing plates and pad stones 400

to the east of their tracks insufficient. The objection was sustained by the Dominion Railway Board, who fixed the limits of encroachment on the Company's property. This necessitated a rearrangement of the structure, the new design being ratified by the Board under their Order No. 20580, dated October 15th, 1913.

From the beginning it had been felt that in designing a structure of this nature, architectural assistance should be secured and, now that the need had developed, Edmund Burke, of Toronto, was engaged as Consulting Architect. Accepting, as a basis, the cross-section, form and location of the main spans of the two bridges as previously determined, he laid out the general form and surface details of the exposed concrete, collaborating with the designing staff of the Bloor Street Viaduct in order to preserve consistency between these and structural

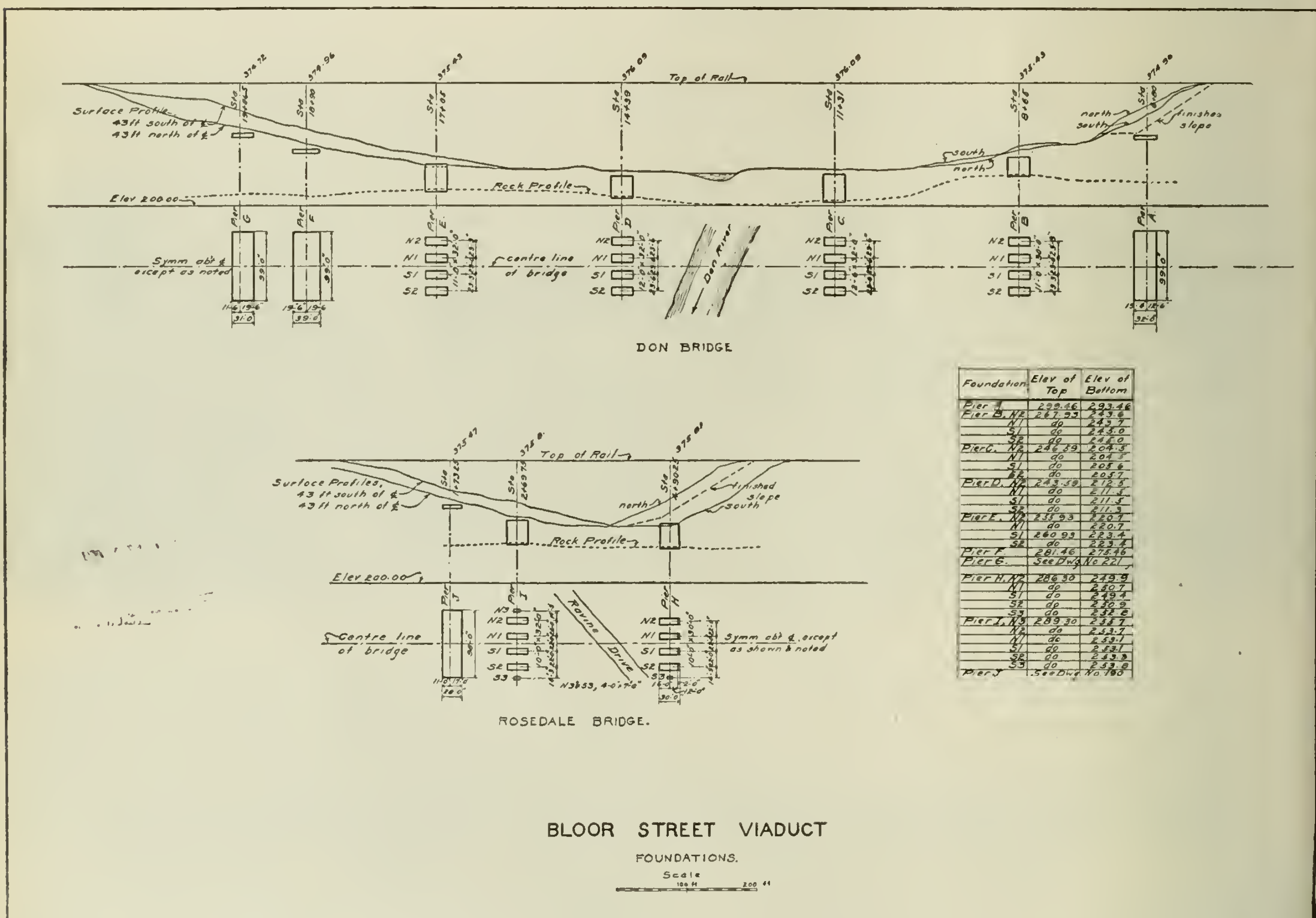


Fig. 6. Foundation Plan, Don and Rosedale Bridges.

In the Don Valley the problem of location of the piers was governed largely by the Grand Trunk and Canadian Northern right-of-way, the Don River, Don View Avenue, the Canadian Pacific right-of-way and a general desire for symmetry in the main spans. The first design met with objection on the part of the Canadian Pacific Railway Company, who considered the clearance

essentials. An idea of the outlines as finally designed may be obtained from Figs. 4 and 5, which show the south side of the Don Bridge and the south-east side of the Rosedale Bridge, respectively. These and other perspectives were carefully prepared from survey data, photographs of the sites and details of design and proved quite as useful to engineers as to laymen.

The Don Bridge, Fig. 4, consists of a central span 281 feet 6 inches long and 130 feet above the river, two flanking spans of 240 feet each and end spans, each 158 feet long. These, with piers and approaches, make a total length of 1,620 feet. For reference the piers have been named A to G inclusive, commencing at the east end. In the west approach, between piers F and G, is an arched opening.

The main feature of the Rosedale Bridge, Fig. 5, is an arch span 190 feet long, crossing the Valley Road at a height of 96 feet. The three piers commencing at the north east end are H, I and J. Between I and J is an arched opening similar to that in the west approach of the Don Bridge. From the far end of the south west abutment a curved retaining wall, of the counterfort type, extends, as indicated in Fig. 1, for a distance of 170 feet.

The two bridges resemble each other in many respects. The crescent shaped steel arches are three hinged, the crown pin being in the upper chord, while the lower chord is provided with a slip joint at the middle. The approaches are hollow, the floor loads being carried by four rows of steel columns in line with the four arch ribs. This steel work is masked by side walls of

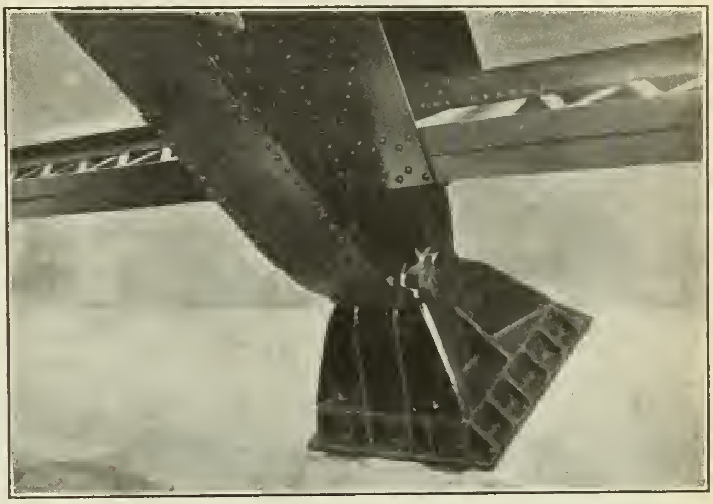


Fig. 7. Cast Steel Shoe, 158 foot spans.

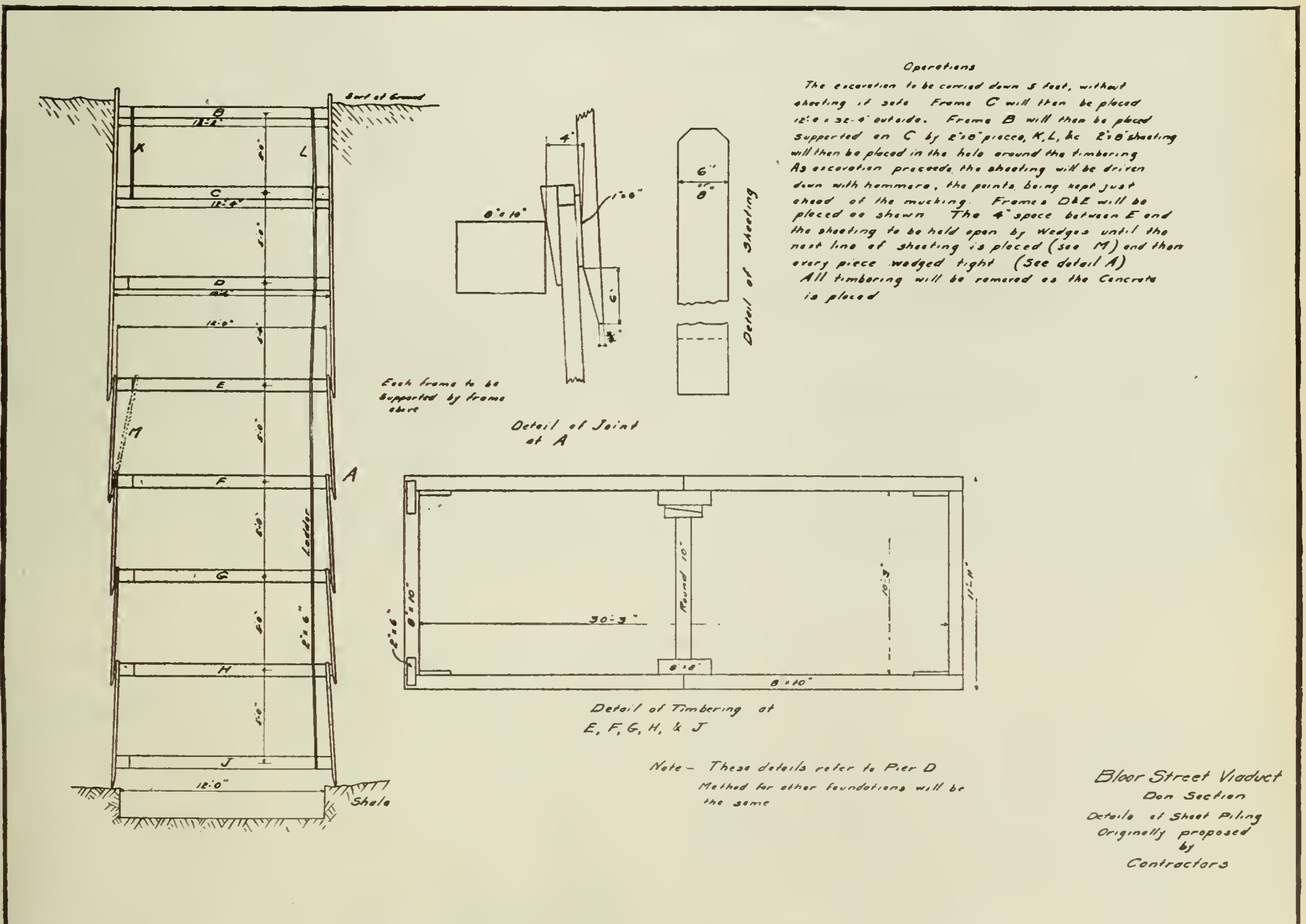


Fig. 8. Sheeting Proposed by Contractors, for Piers B, C, D and E, Don Bridge.

reinforced concrete, which, in general, rest on spread footings. This construction was adopted in order to produce a massive abutment effect in proportion to the size of the bridges.

The arched opening in the west approach of each bridge was introduced principally for the sake of appearance. The contours of the ground in each case make an angle of about 45 degrees with the centre line of the bridge. On the north side of the Don Bridge, west of pier F, the ground is 80 feet below grade and at the corresponding part of the Rosedale Bridge, i.e., on the northwest side, and behing pier I, it is 75 feet below grade. To avoid an excessive expanse of side wall at these places the arched openings were introduced. The main supports over these openings are four trusses, in line with the four arch ribs of the main spans. From these a soffit of reinforced concrete is suspended. The concrete side walls above these openings are supported by steel trusses imbedded in them and are stiffened laterally by struts to the adjacent main trusses.

The main piers, A to J, are hollow, the walls being massive below the bearings of the arches or trusses and considerably lighter above. Piers G and J are soil bearing and resemble each other closely in other respects. Piers A and F are similar to piers H and I respectively, the principal difference being in the foundations. The former are supported by spread footings, while each of the latter rests on rock. These piers are all of massive appearance and assist in producing the effect of substantial abutments. On the other hand, piers B, C, D and E of the Don Bridge have no counterparts in the Rosedale Bridge, their upper portions being proportioned and ornamented to produce a column effect. They also rest on rock. The arrangement of pier foundations is shown in Fig. 6. For each of the six rock bearing piers, a five foot slab of reinforced concrete rests on the foundations shown and on this slab is built the body of the pier.

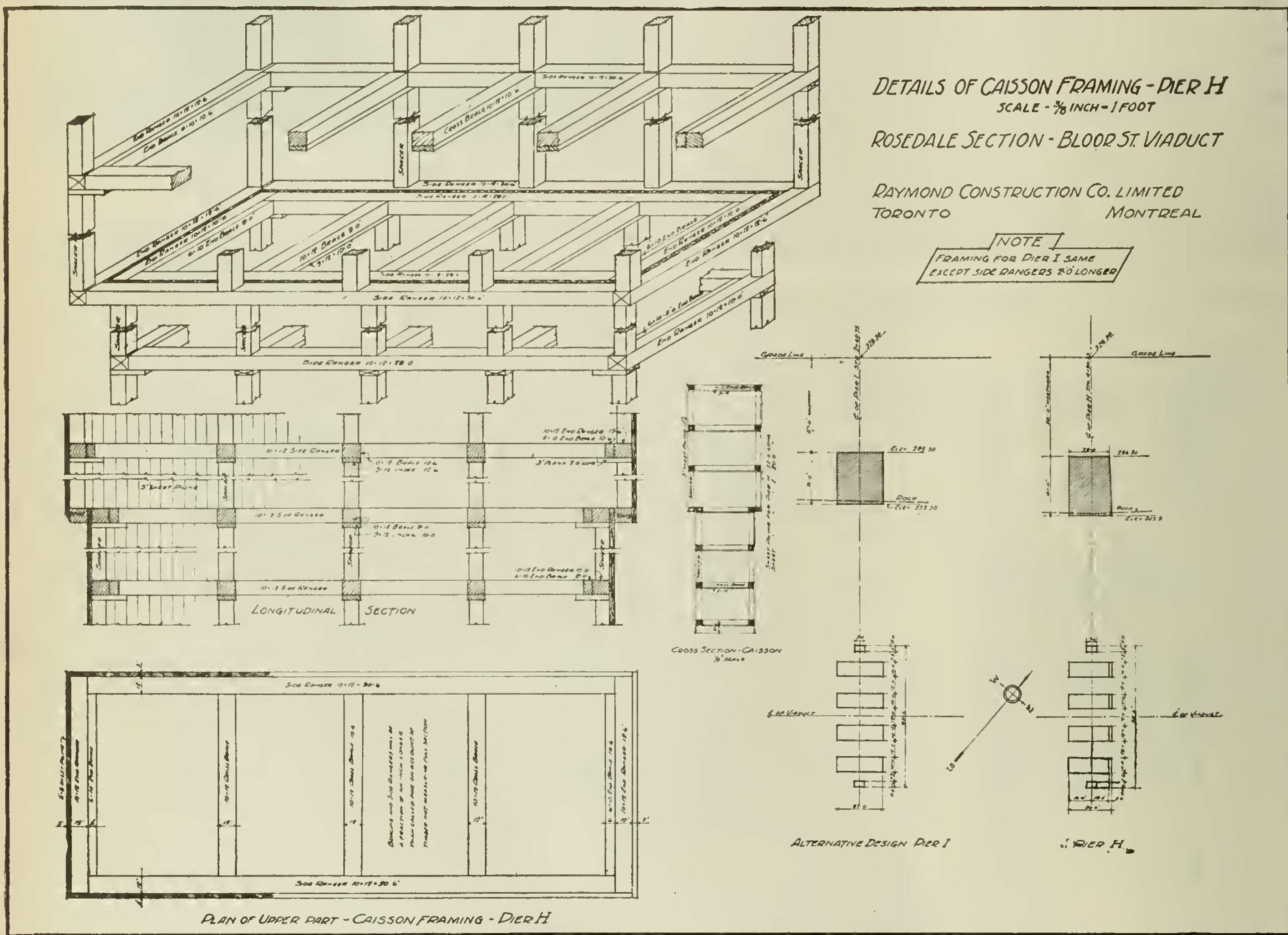


Fig. 9. Sheeting Proposed by Contractors for Piers H and I, Rosedale Bridge.

Neither in the calculation of stresses nor in the proportioning of members were any exceptional problems encountered. In many cases the dimensions of concrete were determined by considerations other than that of stress, an important exception being the floor slab. The steel work, from its nature, permitted a much closer adherence to the requirements of stress.

The lower bearings of the arch ribs are illustrated by Fig. 7, which shows the steel castings used in the 158 foot spans, the bearings for the other spans being somewhat similar. The bearings rest on granite blocks imbedded in concrete. The blocks were set so that they projected above the correct plane and were afterwards dressed to true surface. Sheet lead was placed between the shoes and the granite blocks.

Apart from the general lines of the concrete work, the principal attempt at ornamentation was in connection with the hand rail which, being of concrete, and of a heavy design, has been termed a parapet. The massive portions over the pier tops and at the ends of the bridges were designed to form bases for ornamental clusters of lights should such ever be desired. The spaces between these were subdivided by smaller pediments, each subdivision consisting of a balustrade. The top rail was made continuous between expansion joints, which were located chiefly at the pier tops and at pediments. A scrubbed finish was used for the parapet, in order to secure an interesting surface texture and pleasing color by exposing the particles of selected red granite used as coarse aggregate. This brought the parapet into striking contrast with the rest of the concrete, which was finished with a plain rubbed surface.

(*e*) Contractors.

The general contractors for the Don Bridge were Messrs. Quinlan and Robertson of Montreal, who sublet the structural steel work to the Hamilton Bridge Works Co. The contractors' engineer was T. T. Black, A.M.E.I.C. The contract for the Rosedale Bridge was awarded to the Dominion Bridge Co. of Montreal, who sublet all portions except the structural steel to the Raymond Construction Company. W. F. B. Rubidge, A.M.E.I.C., was the contractors' engineer during the greater part of the construction, his successor being A. Ramsperger.

Fig. 10. 281 ft. 6 in. Span, Don Bridge, during Erection.

(3). Construction of Bridges.

(*a*) Excavation.

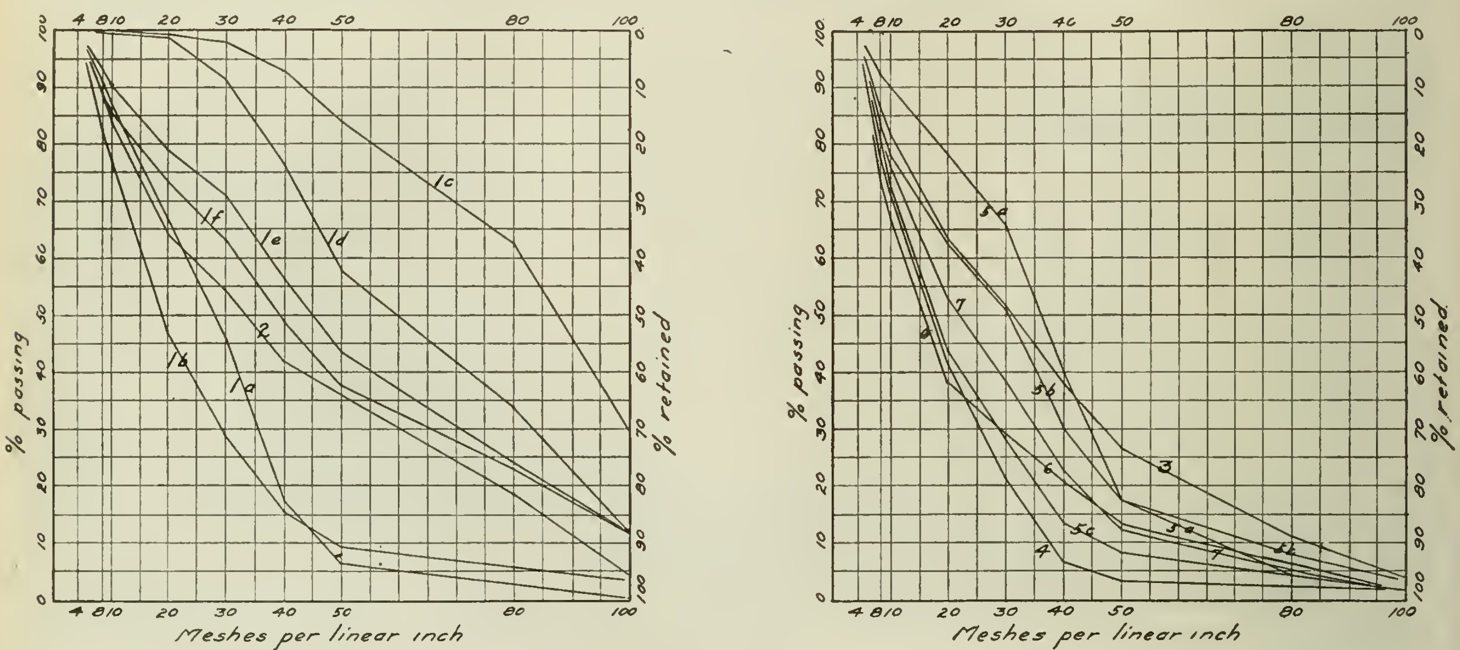
On the Don Section, the contractors commenced work at Pier D, making use of the system of wood sheeting shown in Fig. 8. It was the intention to make the clear space inside very little larger than the required foundation and to fill the space with concrete, leaving the sheeting in place but removing the timbers in advance of the concrete. This sheeting gave trouble by admitting a great deal of water and sand, which released the outside pressure in places, causing distortion. This system was therefore abandoned and the rest of the deep excavations were satisfactorily made by using longer sheeting and adequate timbering. In some cases wood sheeting was used, and in others, steel sheet piling.

On the Rosedale Section sheeting and timbering, as shown in Fig. 9, was used with good results in excavating for Piers H and I.

(*b*) Concreting.

The modes of handling materials for the Don and Rosedale Bridges, were as a result of their locations, radically different. For the former, materials were delivered by rail, unloaded by clam derricks, and stored adjacent to the railway tracks and the site of the bridge; while for the latter, deliveries were made by waggon or motor truck to the two approaches. In general, the and G. As work on the upper part of pier A progressed, a rehoisting tower with chutes was used.

In operating these chutes some trouble was caused by clogging. In time this was overcome by giving the chutes proper slope, keeping the consistency of the concrete uniform, and feeding the mixture evenly from the tower hopper into the chutes. Difficulty also arose from the fact that the mode of supporting the chutes did not permit ready movement of the discharge end, which necessitated too much shovelling of concrete in the forms. This was corrected, and resulted in better and more economical distribution, particularly in the thinner walls. After the steel work of the floors had been placed it was found convenient and satisfactory to hoist the concrete to this elevation and distribute it to the side walls, pier tops and floor slab by wheel buckets.



Grading of Sands.

Fig. 11.

materials used for concrete in Pier B and all portions east of that, were taken from storage beside the C. P. R. tracks, mixed at Pier B, and the concrete distributed from that point. Materials required for Pier C and all parts west of that pier, were taken principally from storage beside the C. N. R. tracks and distributed by cableway to the different concreting plants.

Both contractors placed the most of the foundation concrete by setting mixers as near as possible and using short chutes. Both soon prepared, however, to meet the harder conditions of distributing concrete at considerable heights by placing mixers in permanent locations and erecting elevator towers with lines of steel chutes. For the Rosedale Bridge two such plants were erected, one at each approach; while for the Don Bridge, five were used, being located on the north side of the bridge at piers B, C, D, E

(*c*) Structural Steel Work.

As the details were laid out in conformity with well established methods of fabrication, there is little to attract special attention.

To check the shape of the arch ribs, diagrams of the half ribs were made for the different spans. These showed the distance between the crown and heel pins as well as the perpendicular distances of all upper and lower chord panel points from this line. The members of each half rib were then laid down, the whole levelled up and the joints drawn tight. A piano wire was then stretched across the pin centres and the shape of the half rib checked by means of the diagram. After adjustments had been made, the rivet holes, which had been punched 3/16″ small, were reamed to size. The arches of both bridges were erected on false work. On the Don Bridge erection

Sample	7 day briquettes		7 day Cubes		28 day briquettes		28 day Cubes	
	pds per sq. in	% of Std Ott	pds per sq. in.	% of Std Ott	pds per sq. in	% of Std Ott	pds per sq. in.	% of Std Ott
Ottawa	249		1554		377		2392	
1 a	370	148	2875	185	480	127	3506	147
1 b	378	152	3471	223	489	130	4446	186
1 c	172	69	1150	74	312	83	1802	75
1 d	237	95	1233	79	329	87	2269	95
1 e	301	121	1439	93	391	104	2496	104
1 f	337	135	2424	156	439	116	3088	129
Ottawa	256		1367		362		2108	
2	332	130	2700	197	440	122	3671	174
Ottawa	253		1592		349		2235	
3	316	125	3064	192	435	125	3611	161
Ottawa	265		1404		308		1829	
4	495	187	3758	268	553	180	4491	245
Ottawa	311		1192		354		1954	
5 a	343	110	1946	163	407	115	3046	156
Ottawa	285		1550		358		2333	
5 b	392	137	2567	165	528	147	3742	160
Ottawa	281		1558		353		2379	
5 c	415	148	3175	204	574	162	4250	178
Ottawa	259		1475		399		2383	
6	472	182	3012	204	570	143	3975	167
Ottawa	205		1146		322		1650	
7	326	159	2417	210	430	133	3088	187

Each strength is an average from three specimens

Strength Tests
Sand
1915

Fig. 12.

was carried on from both ends by travellers, Fig. 10, and the timbering was necessarily heavy. On the Rosedale Bridge it was much lighter as derricks were employed for erection, those used for the greater part of the arch being located on Piers H and I.

The steel received three coats of paint, viz: one shop coat of red lead paint and two field coats known as A. and B. The latter were carbon paints. All paint was manufactured to the Department's specifications, provided by the City, and applied by the contractors.

Fig. 13. Concrete Test Cylinders and Moulds.

Location	Proportion	Date made	First test		Second test	
			Date	pds per sq in	Date	pds per sq in
Pier J, Footing North half	1 2½ 5	May 24	June 24	2099 1690	Aug. 31	2376 2376
Pier J Footing. South half	do	May 29.	June 28	2733 2895	Aug. 31	3241 3004
Pier H, S2 El 280	1·2¾:5½	June 25	July 23	2783 2749	Sept 24	a 3394 3299
Pier I S1 El 280	do	June 28.	July 23	3238 2681	Sept 24	a 3394 a 3394
Pier J El 315	1·2½:5	July 24.	Aug 31.	b 1846 2868	Oct 23	d 2366 b 1838
Pier H El. 290	do	July 26.	Aug. 31	1979 1744	Oct 25	2715 3109
Pier I El. 290	do	Aug. 20	Sept 24	2243 2179	Nov. 24	c 2001 2591
Pier J, El. 340	do.	Aug. 26.	Sept 24	2827 2851	Nov. 24	3042 3309
Cross Wall, West App	do.	Sept 4	Oct. 5	1873 1931	Dec. 3	1805 b 3037
Pier I El 310	do	Sept. 23	Oct 25	2260 1799	Dec. 23	c 2360 3299
Pier H El 310	do	Sept 24	Oct 23.	1670 2250	Dec. 23	3021 b 2138
Pier H El. 330	do	Oct 13.	Nov. 12.	c 1235 c 1149	Jan. 18	2967 b 2661
Pier I El 340	do	Oct. 23.	Nov. 24	b 1962 b 1931	Jan 23	b 2200 3046

Concrete Cylinders, Rosedale Bridge.
1915.

Fig. 14.

(4). Tests on Miscellaneous Materials.

(*a*) Sand.

Sources of sand proposed by each contractor were inspected by their engineer in company with a member of the City's staff, the latter taking such samples as were considered by both to be fairly representative. Seven deposits were thus inspected during 1915, six samples, a, b, c, d, e and f being taken from No. 1; three samples a, b and c from No. 5; and one sample from each of the others. Several of these samples were plainly too fine for concrete, but were selected and tested to illustrate the effects of varying degrees of fineness. Of each sample, only that portion passing a No. 4 sieve was considered as sand and tested. The samples were first graded and the results plotted, Fig. 11.

They were then tested for strength in comparison with standard Ottawa sand as follows. In each case a 1:3 mortar was made from a previously tested Portland cement and the sand in question. From this six briquettes were made, three to be tested in tension after seven days and three after twenty-eight days. Also six two inch cubes were made from the same mortar, three to be tested in compression after seven days and three after twenty-eight days. At the same time, using the same tested cement and standard Ottawa sand, six briquettes and six two inch cubes were made to be tested at the same times as the corresponding specimens made from the sand under examination. In each case the strength of the specimens made from the commercial sand was expressed as a percentage of the strength of the corresponding specimens made from standard Ottawa sand, Fig. 12.

Fig. 15. Don Bridge, North Side.

In the case of samples from source No. 1, the order with respect to increasing fineness was b, a, f, e, d and c. The order of decreasing strength was the same in all four classes of tests. In the case of the three samples from source No. 5, a similar correspondence between grading and strength was found to exist. This was true not only in connection with the averages shown in Fig. 12, but among the individual results from which these were compiled, with only a few trifling exceptions. The percentage of voids in each sample was determined but, from the data secured, no relation between voids and strength was apparent. After certain samples had been approved, shipments were judged in comparison with these, being inspected chiefly for grading and cleanness.

Fig. 16. Deck of Don Bridge, Looking Eastward.

(*b*) Steel Castings, in Lower Bearings of Arches.

The material in these was tested in accordance with the specifications for Class B Soft, contained in the 1913 Year Book of the American Society for Testing Materials. The specimens were annealed with the castings with which they had been poured, then cut off, machined and tested. The yield point, ultimate strength, elongation in 2 inches and reduction of area, were considerably in excess of requirements.

The following are the average, maximum and minimum results respectively, of tests from ten melts, taken at random from those made in one foundry for the Don Bridge.

	Yield Point	Ultimate Strength	Elongation, %	Reduction of Area %
Average....	40700	74800	29.8	43.6
Maximum..	43800	79600	32.8	51.8
Minimum..	36150	72400	28.1	32.5

The following are the results similarly compiled from tests of five melts, made in another foundry, for the Rosedale Bridge.

	Yield Point	Ultimate Strength	Elongation, %	Reduction of Area, %
Average....	42900	71600	28.2	41.6
Maximum...	44800	74900	29.0	48.7
Minimum..	40800	68000	27.0	30.0

The following are the requirements of the specifications:—

Yield Point	Ultimate Strength	Elongation, %	Reduction of Area, %
27000	60000	22.0	30.0

The bend tests on specimens machined to 1 inch x ½ inch were satisfactory. They not only stood the prescribed test of bending cold through 120 degrees, around a pin 1 inch in diameter, without cracking on the outside of the bent portion, but in many cases showed no cracking when bent to the same radius through 180 degrees. In some instances no cracking was perceptible even when the specimens were bent flat on themselves by the blows of a steam hammer.

(*c*) Concrete Cylinders.

These were taken at various times, particularly when any important change occurred in the conditions of running, such as change in size or quality of stone, consistency of mixture, or contractors' organization.

The moulds, Fig. 13, consisted of 12 inch lengths of standard 6 inch pipe, bored out, ends trued up, and slit longitudinally. Each mould was provided with two collars. When the bolts through the lugs of the collars were tightened, the slit closed; and, after slacking the bolts to remove the specimen from the mould, the latter would spring open, and separate easily from the cylinder. The bottom of the mould was a smooth steel plate. The concrete for the specimens was taken during the progress of a run, and when practicable from the forms. In order to make the cylinders as nearly as possible representative of the concrete in place, pains were taken to secure a fair proportion and distribution of stone and mortar and to avoid, with equal care, excessive and insufficient tamping. The specimens were kept in a moist condition, both before and after removal of moulds, until required for tes ing. In each case a set of six cylinders was made, two for 30 day test, two for 90 day test and two for test at a still longer period, should such be desirable, or to replace, if necessary, any specimens which might show improper workmanship. Fig. 14 gives the results of all such tests made during 1915 in connection with the Rosedale Bridge.

Explanation of letters in Fig. 14.

(*a*) Specimen not broken, capacity of machine not being sufficient.

(*b*) Poor distribution of material.

(*c*) Excess of large stone.

(*d*) Insufficiently tamped.

Careful examination of the specimens after testing, led to the conclusion that they were too small to do justice to the material in place, particularly when the latter, as in the present case, is massive and contains a fair proportion of the larger sizes of stone. A small irregularity in distribution, the presence of one poorly shaped piece of stone or the unfavorable position of another, particularly if it be large, is sufficient to cause failure of the specimen otherwise than by crushing. A larger specimen would in such cases give better lateral support.

Fig. 17. Rosedale Bridge, Northwest Side.

(5). Work Exclusive of Bridge Contracts.

These contracts included the bridges complete, except drain pipes, paving, electric railway track, overhead and lighting. The drain pipes were placed under separate contracts. The remaining work required to finish the bridges and to carry out the street construction on the balance of the route was performed by the Department of Works by day labor.

The Rosedale Bridge was opened for vehicular traffic on October 29th, 1917, being connected by temporary macadam roads with Parliament Street and Castle Frank Road. During the summer of 1918 the Don Section, including the Don Bridge, and that part of the Rosedale Section east of the Rosedale Bridge were completed and formally opened on October 18th, 1918.

On the Bloor Section temporary construction is necessary as the fill west of Glen Road is incomplete and that already placed will continue to settle for some time. The placing of macadam roadway on this section was discontinued on account of the winter. The temporary track, however, had been placed as near as possible to the south side of the viaduct property, and on December 15th, 1918, the Toronto Railway Company commenced to operate cars regularly over the whole of the improvement.

The following are the Civic officials most closely connected with the Bloor Street Viaduct:—

Commissioner of Works, R. C. Harris.

Deputy City Engineer, G. G. Powell, M.E.I.C.
Engineer of Railways and Bridges,

(prior to July, 1914), C. W. Power.
(since that time), G. A. McCarthy, M.E.I.C.

The design and supervision of construction were carried out by a branch of the Railway and Bridge Section, known as the Bloor Street Viaduct Division, of which the following were members:—

The author, Designing and Construction Engineer.

Geo. Oksvik, Principal Assistant, in charge of designing and drawing.

W. E. Janney, A.M.E.I.C., Engineer of Surveys, in charge of borings, surveys and construction measurements.

Chas. E. Stilson, Field Engineer, with supervision of construction of the Don Bridge.

John H. Ryckman, A.M.E.I.C., Field Engineer, with supervision of construction of the Rosedale Bridge, and charge of City labor on Rosedale and Bloor Sections during 1915, 1916 and 1917.

Fundamentals in the Make-Up of a Concrete Mixture

In the course of a study given before an annual convention of the American Railway Engineering Association, Prof. Talbot, of Illinois University, gave the following fundamentals in the make-up of concrete:—

(1) The cement and mixing water may be considered together to form a paste; this paste becomes the glue which holds the particles of aggregate together.

(2) The volume of the paste is approximately equal to the sum of the volume of the particles of the cement and the volume of the mixing water.

(3) The strength given by this paste is dependent on its concentration; the more dilute the paste, the lower its strength; the less dilute, the greater the strength.

(4) The paste covers the particles of aggregate partially or wholly, and also goes to fill the voids of the aggregate wholly or partially. Full coating of the surface and complete filling of the voids are not usually obtained.

(5) The coating or layer of the paste over the particles forms the lubricating material which makes the mass workable.

(6) The requisite mobility or plasticity is obtained only where there is sufficient paste to give a thickness of film or layer of paste over the surface of the particles of aggregate, and between the particles sufficient to lubricate those particles.

(7) Increase in mobility may be obtained by increasing the thickness of the layer of paste. This may be accomplished either by adding water (resulting in a weaker paste) or by adding cement up to a certain point (resulting in a stronger paste).

(8) Factors contributing to the strength of concrete are, then, the amount of cement, the amount of mixing water, the amount of voids in the combination of fine and coarse aggregate, and the area of surface of the aggregate.

(9) For a given kind of aggregate the strength of the concrete is largely dependent on the strength of the cement paste used in the mix, which forms the binding material between the particles of aggregate.

(10) For the same amount of cement and the same voids in the aggregate, that aggregate (or combination of fine and coarse aggregates) will give the higher strength which has the smaller total area of surface of particles, since it will require the less amount of paste to produce the requisite mobility, and this amount of paste will be secured with a smaller quantity of water. This paste, being less dilute, will, therefore, be stronger. The relative surface area of different aggregates, or combinations of aggregates, may readily be obtained by means of a surface modulus calculated from the screen analysis of the aggregate.

(11) For the same amount of cement and the same surface of aggregate, that aggregate will give the higher strength which has the fewer voids, since additional pore-space will require a larger quantity of paste, and, therefore, more dilute paste.

(12) Any element which carries with it a dilution of the cement paste may in general be expected to weaken the concrete. Smaller amounts of cement, the use of additional mixing water, increased surface of aggregate, and increased voids in the aggregate, all operate to lower the strength of the product.

(13) In varying the gradation of aggregate, a point will be reached, however, when the advantages in the reduction of surface of particles is offset by increased difficulty in securing a mobile mass, the voids are greatly increased, the mix is not workable, and less strength is developed in the concrete. For a given aggregate and a given amount of cement, a decrease in the amount of mixing water below that necessary to produce sufficient paste to occupy most of the voids, and provide the lubricating layer, will give a mix deficient in mobility and lower in strength.

A certain degree of mobility is necessary in order to place concrete in the forms in a compact and solid mass, the degree varying considerably with the nature of the work, and generally it will be found necessary to sacrifice strength to secure mobility.

More thorough mixing not only mixes the paste and better coats the particles, but it makes the mass mobile with a smaller percentage of mixing water, and this less dilute paste results in higher strength.—*Engineering News-Record, May 1, 1919.*

What is the International Joint Commission?

By Lawrence J. Burpee, Secretary, International Joint Commission.

A certain tribunal known as the International Joint Commission has been subjected to severe criticism, by some of the leading newspapers and technical journals of Canada, because of its decision in a recent power case on the St. Lawrence River. This criticism, although both ill-advised and ill-informed, has at least had the advantage of letting a number of Canadians know that such a tribunal exists. Unfortunately it has at the same time given them an entirely wrong idea of the nature and functions of the Commission. This misapprehension, indeed, seems to be widespread because, no doubt, of the fact that the Commission, like most judicial bodies, has a tendency to hide its light under a bushel. However, old ideas, practices and prejudices are being scrapped very rapidly in these iconoclastic days, and it might even be possible to add to the heap the notion that judges or their equivalents must never condescend to answer newspaper criticism, even for the sake of correcting dangerous misstatements. In any event, no exception can very well be taken to a plain statement as to the origin of the Commission and the purposes it is expected to serve.

Genesis of the Commission

As long ago as 1894 the Canadian delegates to the Irrigation Congress at Denver secured the adoption of a resolution urging upon the Governments of Canada, the United States and Mexico, the importance of creating an international commission to investigate questions arising out of the use for irrigation of international streams. A similar resolution was adopted at the Irrigation Congress held at Albuquerque, New Mexico, the following year. The Government of Canada took the matter up with the Government of the United States in 1896, but the latter government was not at that time prepared to create such a commission. It was not, in fact, until 1902 that the two countries by concurrent legislation created what was known as the International Waterways Commission. This body—not to be confused with the International Joint Commission—consisted of three members representing the United States and three representing Canada. Their duties were broader than those recommended in the Denver and Albuquerque resolutions, namely:—"to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada, including all of the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic Ocean, also upon the maintenance and regulation of suitable levels, and also upon the effect upon the shores of these waters and the structures thereon, and upon the interests of navigation by reason of the diversion of these waters from or change in their natural flow; and further to report upon the necessary measures to regulate such diversion and to make such recommendations for improvements and regulations as shall best subserve the interests of navigation in said waters." This Commission was purely an investigating body and possessed no final authority. It submitted, however, to the two Governments a number of very valuable reports covering a variety of subjects. Among other things, it recommended the adoption of certain principles as to the use of boundary waters between Canada and the United States, and the creation of an international body with larger powers than its own. The matter was taken up at Washington by Mr. (now Lord) Bryce, then British Ambassador, and Mr. Root, Secretary of State for the United States. The British Ambassador was assisted at various times and in connection with different phases of the Treaty by George C. Gibbons, of the International Waterways Commission, Dr. W. F. King, the Astronomer Royal of Canada and member of the International Bourdary Commission, and the Honourable J. W. Pugsley, then Minister of Public Works of Canada. After protracted negotiations a Treaty was finally signed at Washington on January 11th, 1909, so comprehensive and far-reaching in its terms that it may fairly be said to mark the birth of a new epoch in the relations of the two great democracies of North America.

Waterways Treaty of 1909

In the preamble of the Treaty its objects are set forth: "to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations or interests of either in relation to the other or to the inhabitants of the other, along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise."

Special clauses of this Treaty limit the diversion of water from the Niagara River, above the Falls, by either country to a specified quantity; and provide for the equal apportionment between the two countries of the waters of the St. Mary and Milk Rivers in the State of Montana and the Provinces of Alberta and Saskatchewan.

For the purpose of the Treaty boundary waters are defined as "the waters from main shore to main shore of the lakes and rivers and connecting waterways, or the portions thereof, along which the international boundary between the United States and the Dominion of Canada passes, including all bays, arms and inlets thereof; but not including tributary waters which in their natural channels would flow into such lakes, rivers and waterways, or waters flowing from such lakes, rivers and waterways, or the waters of rivers flowing across the boundary."

Boundary waters, as defined in the Treaty, therefore, include the St. Croix River and that portion of the St. John River between New Brunswick and Maine; the St. Lawrence from the point where the international boundary strikes the river to Lake Ontario; Lake Ontario; the Niagara River; Lake Erie; the Detroit River, Lake St. Clair, and St. Clair River; Lake Huron; St. Mary's River; Lake Superior; Rainy Lake, with the smaller lakes and rivers east of it through which the international boundary passes; Rainy River, and the Lake of the Woods. On the other hand, they do not include rivers flowing into these waters, such as the Seneca, Genesee, Sandusky, Grand, Thames, French and Nipigon; or rivers flowing out of them, such as the Winnipeg, Lower St. Lawrence, and Lower St. John; or rivers flowing across the boundary, such as the Red, Souris, Columbia and Kootenay.

It is agreed that the " navigation of all navigable boundary waters shall forever continue free and open for the purposes of commerce to the inhabitants and to the ships, vessels and boats of both countries equally." This right of navigation is also extended to the waters of Lake Michigan and to all canals connecting boundary waters, now existing or which may hereafter be constructed. Tolls may be charged on such canals, but without discrimination against the subjects or citizens of either of the High Contracting Parties. The equal right of navigation therefore extends both to the Canadian and the United States canals at Sault Ste. Marie, the Welland canal and the St. Lawrence canals above the boundary; but not to the Erie or Rideau canals.

It is further agreed that " the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other." As will be seen later, special action has since been taken to carry out the provisions of this clause, at least so far as boundary waters are concerned.

Creation of the Commission

By the terms of Article VII of the Treaty, the High Contracting Parties agreed to " establish and maintain an International Joint Commission of the United States and Canada composed of six commissioners, three on the part of the United States appointed by the President thereof, and three on the part of the United Kingdom appointed by His Majesty on the recommendation of the Governor-in-Council of the Dominion of Canada."

The personnel of the Commission has changed to some extent since its organization. The original members appointed by His Majesty the King, on behalf of Canada, were the Honourable Thomas Chase Casgrain, K.C., Charles A. Magrath, M.E.I.C., and Henry A. Powell, K.C.; and, by the President of the United States, Honourable Thomas H. Carter, James A. Tawney and Frank S. Streeter. Mr. Casgrain resigned in 1914 to become Postmaster-General in the Dominion Cabinet. Paul B. Mignault, K.C., was appointed in his place; but resigned in 1918, on his appointment to the Supreme Court of Canada. On the United States side, Senator Carter died in 1911, and his place was taken by Senator George Turner. Senator Turner resigned in 1914, and his place was taken by R. B. Glenn, formerly Governor of North Carolina. The previous year Judge Streeter had resigned, and Senator Obadiah Gardner of Maine took his place. Under the rules of the Commission no decision can be made except at a meeting of the six members, but a portion of the Commission may act in the taking of evidence or hearings leading up to the final decision. The Commission has two secretaries, one in charge of the offices at Washington and the other in charge of the offices at Ottawa.

Other clauses of the Treaty set forth the powers and provide the machinery and the legal authority, by virtue of which the Commission is to carry out its important duties. The Commission shall have " jurisdiction over and shall pass upon all cases involving the use or obstruction or diversion of the waters with respect to which, under Articles III and IV of this Treaty, the approval of this Commission is required."

Articles III and IV read as follows:—

Article III

" It is agreed that, in addition to the uses, obstructions, and diversions heretofore permitted or hereafter provided for by special agreement between the Parties hereto, no further or other uses or obstructions or diversions, whether temporary or permanent, of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line, shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdictions and with the approval, as hereinafter provided, of a joint commission, to be known as the International Joint Commission.

The foregoing provisions are not intended to limit or interfere with the existing rights of the Government of the United States on the one side and the Government of the Dominion of Canada on the other, to undertake and carry on governmental works in boundary waters for the deepening of channels, the construction of breakwaters, the improvement of harbors, and other governmental works for the benefit of commerce and navigation, provided that such works are wholly on its own side of the line, and do not materially affect the level or flow of the boundary waters on the other, nor are such provisions intended to interfere with the ordinary use of such waters for domestic and sanitary purposes."

Article IV

" The High Contracting Parties agree that, except in cases provided for by special agreement between them, they will not permit the construction or maintenance on their respective sides of the boundary of any remedial or protective works or any dams or other obstructions in water flowing from boundary waters or in waters at a lower level than the boundary in rivers flowing across the boundary, the effect of which is to raise the natural level of waters on the other side of the boundary unless the construction or maintenance thereof is approved by the aforesaid International Joint Commission."

Ruling Principles

In passing upon the cases which come before it under the terms of the above Articles, the Commission is governed by certain rules or principles. It is first laid down that the High Contracting Parties shall have, each on its own side of the boundary, equal and similar rights in the use of boundary waters. Then follows the order of precedence to be observed among the various uses of these waters. Uses for domestic and sanitary purposes are given the preference over all other uses; then uses for navigation, including canals for such purposes; finally, uses for power and for irrigation.

The importance of these principles adopted by the High Contracting Parties for the guidance of their Commission can hardly be overestimated. It must be borne in mind that the boundary waters over which the Commission is given jurisdiction support a population of over 7,000,000 people, American and Canadian, and that this population is rapidly increasing. The governing principles recognize, so far as these people are concerned, the pre-eminence of domestic and sanitary uses, or, in other words, the supreme importance of safeguarding the public health. All other uses of boundary waters must be disregarded in so far as they conflict with or restrain uses for domestic and sanitary purposes.

Then comes navigation. The navigation interests of the Great Lakes are of enormous and rapidly increasing importance. It appears from official reports that approximately 95,000,000 tons of freight, valued at more than $800,000,000 and carried by over 26,000 vessels, pass up and down the Detroit River during the season of navigation; more than three times the freight through the Suez Canal in an entire year. Not only is an enormous capital tied up in navigation or transportation on the Great Lakes, but the communities, large and small, along these waters are, to a considerable extent, dependent thereon, and, to a less degree, communities farther afield but connected by transportation lines with the lakes. The interests of navigation are the common interests of a very large population inhabiting the entire watershed of the Great Lakes. While secondary in importance to those of public health, they are nevertheless superior to the interests of power and irrigation. As a matter of fact, although bracketed together in the Treaty, power and irrigation do not bear at all the same mutual relation to navigation. Broadly speaking, power development along the international frontier belongs to the eastern half of the continent, and irrigation to the western half. Power may come in direct conflict with navigation; irrigation is unlikely to do so.

The relations of power to navigation and sanitation are recognized in the article relating to diversions for power purposes above Niagara Falls. The last paragraph of that Article reads: "The prohibitions of this Article shall not apply to the diversion of water for sanitary or domestic purposes, or for the service of canals for the purpose of navigation."

Use for power, though of less vital or general significance to the Great Lakes communities than uses for sanitation or navigation, are, nevertheless, of very great importance. On the St. Mary's River, the Niagara River, the Upper St. Lawrence and elsewhere along the international boundary, millions of dollars have already been invested in power development and the available power is far in excess of any attempts that have yet been made to utilize it for manufacturing and other purposes.

Leisurely Ways of the Old Diplomacy

It will be seen that in placing in the hands of an international commission, half American and half Canadian, the settlement of questions involving the more or less conflicting interests of sanitation, navigation, power and irrigation, along a 2,000 mile frontier, the Governments of the United States and Great Britain took a very important and significant step. These questions, large and small, have been a fruitful source of irritation in the past to the people living along both sides of the boundary. A question, perhaps a trivial one, arises at some point on or near the international boundary. Some diversion is contemplated or has already been carried out, or some work constructed on one side of boundary waters, affecting the interests of the inhabitants on the other. The local authorities have no powers or jurisdiction. The injured parties (let us assume they are Canadian) appeal to Ottawa. The case, cumbered with red tape, travels deliberately through several of the Dominion departments; rests perhaps for weeks in the file basket of one or other of the various officials; is referred back and forth between the federal authorities and their local officers; finally moves on to the Governor-General's Office, and is sent overseas to the Colonial Office in London. Thence it takes its dignified way to the Foreign Office, and back across the Atlantic to the British Ambassador in Washington. The Ambassador takes the matter up with the Secretary of State of the United States, and the weary process of red tape is repeated in the departments of the Washington government. By this time the original question has probably been more or less lost sight of under its load of official commentary. Eventually the original complaint, or its official version, reaches the source of the trouble. The other side of the question is presented by the people on the United States side of the boundary, and the documents, growing like a snowball as they move, start on their long, roundabout, diplomatic journey back to the local complainants in Canada.

It is no exaggeration to say that such a case may travel backward and forward, not merely for months but for years, and in the end the parties interested may be as far from a settlement of the question at issue as they were in the beginning. It is true that in recent years it has been found possible to cut out, in some cases, the overseas part of the journey and deal directly, or less indirectly, with the United States Government through the Governor-General's Office and the British Embassy, but even so the process has necessarily been exceedingly slow, cumbersome and not always effective. Meanwhile, bitterness of feeling has been allowed to grow between two neighbouring groups of people, separated only by an invisible boundary, and with every reason in the world for a neighbourly attitude toward one another.

That two such countries as the United States and Canada, with the same New World point of view and the same democratic and businesslike way of looking at things, should have submitted for so many years to the ponderous and circumlocutory traditions of diplomacy, is surprising enough. It must, at any rate, be matter for sincere congratulation to every thoughtful Canadian or American that, so far at least as the relations of these two countries are concerned, the shackles have been knocked off, and it is now possible for the citizens of the United States and Canada to settle their differences with as much ease, and perhaps a little more, as if the dispute were confined to one country. The most momentous question for the Peace Conference at Versailles is that of the creation of a League of Nations. However different the magnitude of the interests at stake, the members of the conference have an illustration in this Commission of the efficiency of such an agency for the peaceful settlement of international disputes.

Decisions of the Commission

Of the various cases that have come before the Commission since its organization for final settlement, one of the most important was for approval of a diversion dam on the St. Mary's River at Sault St. Marie. In reality there were two applications, one from the Michigan Northern Power Company, on the United States side, and the other from the Algoma Steel Corporation, a Canadian company. Each applied for authority to build works from its own side to the international boundary, the combined works making one structure across the river. At the hearings, legal and engineering representatives of various municipalities on both sides of Lake Superior, and of railway and other corporations, expressed anxiety lest the proposed works should have the effect of raising the level of Lake Superior and causing serious damage to wharves, buildings and sewage systems in Duluth, Fort William and other towns around the lake. After hearing the testimony of a number of expert engineers, including representatives of the United States and Canadian Governments, the Commission approved of the proposed works upon certain conditions as to construction and maintenance which, instead of being detrimental to the interests of navigation and of the several communities around Lake Superior, would, by maintaining the level of the lake between certain points, be very much to the public advantage. As part of their order of approval, the Commission made it a condition that the works, both during construction and thereafter, were to be under the direct control of an international board of engineers, one member of which was to be appointed by the Canadian and the other by the United States Government. The Canadian member of this Board is W. J. Stewart, M.E.I.C., Chief Hydrographer of the Department of Naval Service. Changes have been made from time to time in the United States representative owing to the exigencies of the war. The present representative of that country is L. C. Sabin. In this way it was found possible to settle, in a very short time, and to the satisfaction of all the very important interests concerned, American and Canadian, public, navigation, and power, a question which might have dragged along for years under the old diplomatic procedure and been the cause of international irritation and material loss on both sides of the boundary.

Among other cases disposed of by the Commission were applications from the St. Croix Water Power Company of Maine, and the Sprague's Falls Manufacturing Company of New Brunswick, for approval of a dam across the St. Croix River, which is a boundary stream. In this case also the Commission in its Order of Approval made provision for an International Board of Control, which has since been appointed, Mr. Stewart being the Canadian representative and C. F. Porter that of the United States. Another application was that of the Greater Winnipeg Water District for permission to divert water for domestic and sanitary purposes from Shoal Lake, a tributary of the Lake of the Woods. This project which involved the construction of a concrete aqueduct nearly 85 miles in length, at a cost of about $13,000,000, was approved by the Commission, which limited the quantity of water to be taken at any time to 100 million gallons per day, provided that the water so diverted must not be used for other than domestic and sanitary purposes, and that the Commission's approval was not to prejudice any claims for damages or compensation arising out of the diversion. Other applications finally disposed of were those of the Government of the United States for the approval of certain contemplated improvements in the St. Clair River at Port Huron; of the Rainy River Improvement Company for a dam at Kettle Falls at the upper end of Rainy Lake*; of the International Lumber Company for certain obstructions in Rainy River at International Falls; and of the Watrous Island Boom Company for a boom in the same river. Two recent applications on the St. Lawrence River are those of the St. Lawrence River Power Company for permission to construct a submerged weir or dam in the south branch of the St. Lawrence River at the Sault; and of the New York and Ontario Power Company for approval of its plans to reconstruct, repair and improve its dam, hydraulic structures and water-power property at Waddington-on-the-St. Lawrence. In the former case the Commission, on the urgent representations of the United States Government that the proposed works were necessary in connection with the production of aluminum for war purposes, issued an interim order approving of the dam for a term of five years. The dam is to be removed at the expiration of that period unless the Company in the meantime applies for its maintenance for a further period, in which case the whole matter will be reopened and all interested parties given an opportunity of being heard. The decision in the case of the New York and Ontario Power Company has not yet been rendered. It will be noted that to a very large extent the cases that have hitherto come before the Commission reflect the prevailing interest in the development of water powers.

In this case the Commission decided that it had not jurisdiction.

Articles IX and X

In addition to the exercise of its jurisdiction under Articles III and IV of the Treaty, in which case it acts as a judicial tribunal, the Commission is also vested with very wide powers under Articles IX and X of the Treaty, which are as follows:—

Article IX

"The High Contracting Parties further agree that any other questions or matters of difference arising between them involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along the common frontier between the United States and the Dominion of Canada, shall be referred from time to time to the International Joint Commission for examination and report, whenever either the Government of the United States or the Government of the Dominion of Canada shall request that such questions or matters of difference be so referred.

The International Joint Commission is authorized in each case so referred to examine into and report upon the facts and circumstances of the particular questions and matters referred, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.

Such reports of the Commission shall not be regarded as decisions of the questions or matters so submitted either on the facts or the law, and shall in no way have the character of an arbitral award.

The Commission shall make a joint report to both Governments in all cases in which all or a majority of the Commissioners agree, and in case of disagreement the minority may make a joint report to both Governments, or separate reports to their respective Governments.

In case the Commission is evenly divided upon any question or matter referred to it for report, separate reports shall be made by the Commissioners on each side to their own Government."

Article X

"Any questions or matters of difference arising between the High Contracting Parties involving the rights, obligations, or interests of the United States or of the Dominion of Canada either in relation to each other or to their respective inhabitants, may be referred for decision to the International Joint Commission by the consent of the two Parties, it being understood that on the part of the United States any such action will be by and with the advice and consent of the Senate, and on the part of His Majesty's Government with the consent of the Governor-General-in-Council. In each case so referred, the said Commission is authorized to examine into and report upon the facts and circumstances of the particular questions and matters referred, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.

A majority of the said Commission shall have power to render a decision or finding upon any of the questions or matters so referred.

If the said Commission is equally divided or otherwise unable to render a decision or finding as to any questions or matters so referred, it shall be the duty of the Commissioners to make a joint report to both Governments, or separate reports to their respective Governments, showing the different conclusions arrived at with regard to the matters or questions so referred, which questions or matters shall thereupon be referred for decision by the High Contracting Parties to an umpire chosen in accordance with the procedure prescribed in the fourth, fifth, and sixth paragraphs of Article XLV of The Hague Convention for the pacific settlement of international disputes, dated October 18, 1907. Such umpire shall have power to render a final decision with respect to those matters and questions so referred on which the Commission failed to agree."

Investigations under Article IX

Three questions have so far been referred to the Commission under Article IX of the Treaty, for investigation and report. One of these related to the construction of a dyke in the Detroit River. The enormous extent and value of the shipping using this waterway has already been suggested. It was found that certain dangerous currents swept across the Livingstone channel in the Detroit River, which were a menace to navigation. A dyke was proposed near the upper end of the channel to intercept these currents. At the hearings, Canadian interests objected to the building of the dyke in the position first proposed, on the grounds that it would have the effect of diverting Detroit sewage on to the Canadian shore, and would in other ways cause serious damage to communities in Canada. The Commission finally recommended to the two Governments that the dykô should be built on the west side of the channel, where it would serve the same purpose, so far as the dangerous cross currents were concerned, and at the same time would meet the objections raised against the dyke on the east side as originally proposed by the engineers.

The second question referred under Article IX related to the levels of the Lake of the Woods and tributary waters. The Commission was asked to report what levels, or range of levels, could be maintained in these international waters, which would be in the best interests of all concerned on both sides of the boundary—navigation, agriculture, fishing, lumbering and power. To give an intelligible answer to the question it became necessary to employ a staff of engineers, as neither government had so far carried out anything more than fragmentary surveys in this district. These engineers were under the direction of two consulting engineers, one an American, Adolph F. Meyer of Minneapolis, and the other a Canadian, Arthur V. White of Toronto. After several years work they submitted a final report to the Commission in 1916. The Commission's Final Report to the two Governments was submitted in 1917.

To most people the Lake of the Woods country is a comparatively unknown region, and the popular impression probably is that it is of little or no importance. As a matter of fact, however, the hearings held by the Commission brought out the facts that navigation, power, and other interests affected by the Commission's decision have invested something over $100,000,000 in the Lake of the Woods district; that the resources of the region are enormous and only beginning to be developed; and that communities as far apart as Duluth and Winnipeg were more or less directly interested in the fixing of a level on the Lake of the Woods and its tributaries which would give the maximum benefit to the people on both sides of the boundary.

The Commission in its final report recommended that it be authorized to exercise supervision and control over the operation of all dams and regulating works extending across the international boundary in these waters, as well as the dam and regulating works at Kettle Falls and at the outlets of the Lake of the Woods; and that it be empowered to appoint two engineers, one from each country, to act as its representatives, under such rules and regulations as it might prescribe for the exercise of the said supervision and control.

Pollution of Boundary Waters

The third question, and by far the most important, referred to the Commission under Article IX, related to the pollution of boundary waters. Such pollution, it will be remembered, is prohibited by the last paragraph of Article IV. With a view to the enforcement of this clause of the Treaty, the Governments of the United States and Canada sent to the Commission the following Reference:—

"1. To what extent and by what causes and in what localities have the boundary waters between the United States and Canada been polluted so as to be injurious to the public health and unfit for domestic or other uses?

2. In what way or manner, whether by the construction and operation of suitable drainage canals or plants at convenient points or otherwise, is it possible and advisable to remedy or prevent the pollution of these waters, and by what means or arrangement can the proper construction or operation of remedial or preventive works, or a system or method of rendering these waters sanitary and suitable for domestic and other uses, be best secured and maintained in order to secure the adequate protection and development of all interests involved on both sides of the boundary, and to fulfill the obligations undertaken in Article IV of the Waterways Treaty of January 11th, 1909?"

This Reference is dated August 1st, 1912. On January 16th, 1914, the Commission sent the two Governments a Progress Report on the first branch of the investigation, that is as to the extent, causes and localities of pollution. This Report embodied the result of exhaustive field investigations, by a corps of sanitary experts, under the general direction of Dr. Allan J. McLaughlin, of the Public Health Service of the United States, with the co-operation of Dr. J. W. S. McCullough, Chief Officer of Health of Ontario, and F. A. Dallyn, A.M.E.I.C., Provincial Sanitary Engineer of Ontario. Throughout the investigation the Commission had the cordial co-operation of the United States Public Health Service, and of the Boards of Health of Ontario, Quebec, New York and Michigan.

The investigation, which covered the examination of the waters of the Great Lakes and their connecting rivers, Rainy Lake, Rainy River, the Lake of the Woods, and the boundary portion of the St. John River in the east, wherever pollution might extend from one side to the other, disclosed the gratifying fact that the great bulk of the Great Lakes water remains in its pristine purity, in spite of the fact that some seven million people have contracted the very bad habit of dumping all their sewage into these waters, and that the entire shipping of the Great Lakes, carrying in one season not less than 15,000,000 passengers, has followed the same evil practice. Serious pollution was found at many points along boundary waters, and particularly in the Detroit and Niagara Rivers, where the cities of Detroit and Buffalo, with a number of smaller communities on both sides of the boundary, have been doing their best to make the water of these rivers unfit for human consumption.

Severe epidemics of typhoid fever in the lake cities have for years past warned these communities that, while they were spending hundreds of millions on their streets and buildings and in other ways adding to the comfort and convenience of their inhabitants, the most vital consideration of all, that of public health, was being grossly neglected. If the International Joint Commission should achieve nothing more than to awaken the cities of the Great Lakes to the vital importance of protecting their water supplies, it would have more than justified its existence.

In 1914, the Commission took up the second branch of the Pollution Investigation, and as an initial step held a conference in New York with a group of sanitary engineers, including men of international standing, such as George W. Fuller, M.E.I.C., Earle B. Phelps, and George C. Whipple.

As a result of this conference and the subsequent deliberations of the Commission, it was decided to adopt, tentatively at least, certain fundamental principles upon which the experts were in agreement. The most vital of these principles is, that while in certain cases, where the ratio of water to volume of sewage is unusually large, the discharge of crude sewage into boundary waters may be without danger, "effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters." The other principles relate more specifically to methods of sewage purification and water purification.

The field work in connection with the second branch of the investigation was carried out under the direction of Mr. Phelps, who made his report to the Commission in 1916. The Commission's Final Report to the two Governments was submitted in 1918. In that report, after setting forth the character and extent of the pollution and the remedial treatment recommended, it is suggested that the two Governments confer upon the Commission's jurisdiction to regulate and prohibit the pollution of boundary waters and the waters crossing the boundary.*

**The reports and decisions of the Commission in all these cases have been printed and are available for distribution to those interested.*

Miniature Hague Tribunal

No questions have yet arisen in either country which might be brought before the Commission under the terms of Article X of the Treaty. This Article, it will be noted, is extraordinarily broad. It is not limited to questions along the common frontier; in fact, there is no limitation either as to the nature or locality of questions that might be referred under this Article. It will also be noted that, under the conditions stated in the Article, the decision of the Commission is final. In fact, in the language of Justice Riddell, the Commission is constituted under Articles IX and X a "miniature Hague Tribunal" for the final settlement of all questions of difference between Canada and the United States.

It has probably been made clear in what has already been said that Canada and the United States took a big step forward when they negotiated the Waterways Treaty and created the International Joint Commission. The usefulness of that Commission will depend, however, to a very large extent upon the intelligent public support it receives from the two countries. It is important to remember that the Commission has no power to initiate proceedings. It can only act upon applications or references brought before it by, or through, the Governments of Canada and the United States.

Unintelligent or narrow criticism, based upon wrong ideas of the Commission's functions and powers, or upon the hypothesis that its members should think and act as partisans of their respective countries, must inevitably weaken the influence of the Commission, and nullify to a very large extent the effectiveness of its work in removing points of international friction and bringing into permanently friendly relations the peoples of these two neighboring countries.

Cement Joints for Water Mains

For making joints in cast-iron water pipes of all sizes from 6″ to 30″ in diameter, the Bureau of Water Works, Portland, Ore., is employing Portland cement, except in special cases where it has been necessary to put the main in service without leaving sufficient time for the cement to set. This practice was begun about three years ago and has given excellent results. In the past two years, some nine miles of cast-iron mains have been laid, using 19,256 lbs. of cement. The same work would have required 68,390 lbs. of lead at about sixteen times the cost. It was thought at first that the labour of making the joints would be materially less with cement than with lead, but since it is necessary to keep the cement joints wet for thirty-six to forty-eight hours it is about the same. In making a joint a small amount of yarn or oakum is first driven in to keep the cement from passing into the pipe. Neat cement is employed, only sufficient water being added to hold it together while it is being forced into place. To begin with considerable antagonism was displayed by the workmen towards this method, possibly due to a belief that it would lead to a reduced demand for their services, but the opposition has been overcome and the men have become skilled in making the joints. — *The Times Engineering Supplement.*

Overhead and General Costs in Manufacturing

*Thomas R. Deacon, M.E.I.C.**

It is probably not an overestimate to say that 99% of the general public, and especially those who have not had actual experience in business, either mercantile or manufacturing, have any proper conception of what the actual costs of manufacturing or selling goods are. How often you will hear people say, and frequently purely professional engineers too, that the raw material of such and such an article costs so much a pound, or yard, or unit of some kind, the labor of making so much, and there your are. It is the writer's opinion that only in rare cases does this represent more than two-thirds at most of the actual cost, to say nothing of profit. Also in every business, to keep it solvent and profitable, constant provision must be made for unforseen contingencies, such as spoilt material, broken machines and many other things which must be added to the total output of a business.

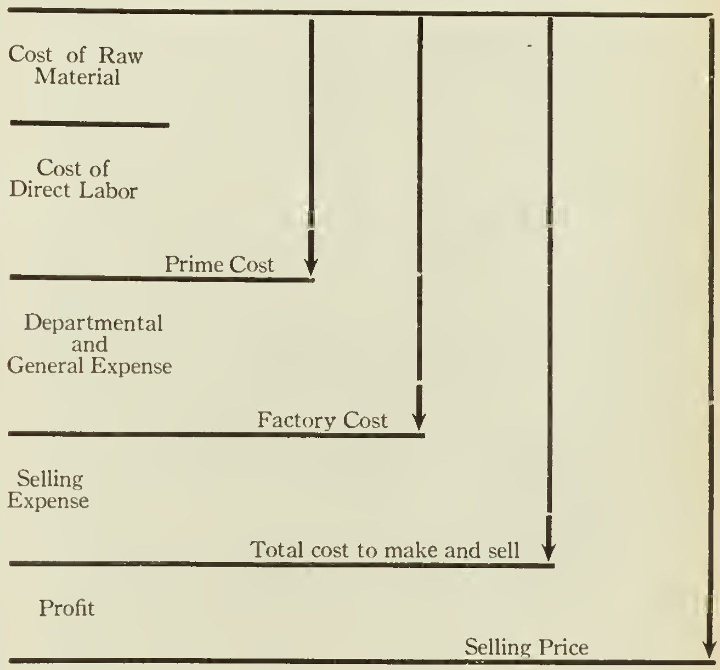
I have no doubt that if a table of business mortality were prepared, showing the average life of all businesses started and the cause of their death, it would be found that the cause of lack of sufficient provision for overhead expense occupied about the same ratio to the total that pulmonary consumption and cancer together do to the human death rate. Every receiver in bankruptcy can tell you stories about facts discovered in business autopsies which were responsible for failures, and which could have been discovered before it was too late, through the aid of good cost systems. Most receiverships, in other words, mean that many a business could easily have been saved by accurate cost accounting.

In a certain garment factory which made four lines of garments including undermuslins, brassieres, night robes and childrens' suits, costs were not departmentalized. Styles changed, petticoats and slips changed and became losing propositions, and profits began to dwindle. Frantic efforts were made to stimulate sales, but the campaign was unintelligent because it worked in the dark. The autopsy showed that two lines were making money while the other two were losing heavily.

A company manufacturing electrical specialties, got out one which it sold to the distributors at $100.00, to be retailed at $150.00. Four thousand of them were sold before an investigation of their actual cost brought out the fact that they were costing $108.00 each to make. That particular guess cost $32,000.00 before it was corrected by an accurate investigation of cost.

A leading foundryman of Pittsburg made the statement that he had offered to install cost systems for all his local competitors at his own expense, as it cost him far more trying to meet their inaccurate estimates, based on inaccurate cost data, than it would cost him to hire cost experts for all of them.

The chief distinction between financial accounting and cost accounting is that the former deals exclusively with money and credit transactions of a business, while the latter deals with the same transactions, but with reference to the cost of products and operations. The kind of costs that a manager of an industry wants to get, vary not only with the type of industry, but within each industry itself, according to the purpose for which they are wanted. In a continuous or tonnage type of industry, the aim is to ascertain the cost per unit of weight or length for each of the comparatively limited number of products, such as tons of castings, or yards or pounds of cloth. A rough summary of the knowledge that is absolutely essential in any manufacturing industry, to be sure of what is being done, may be diagrammatically shewn as follows:—



But, under each of these general headings, there is a long list of subdivisions of costs, every one of which should be known and detailed, otherwise the total cost is not known. It is in the failure to keep an accurate record of the items which come under these subdivisions that the first symptoms of the disease appear, which are ultimately, sooner or later, to prove fatal to the business or enterprise.

It is customary to divide total cost into two main elements—factory cost and selling cost—which, taken together and with the profit added, constitute the selling price. Of course, in a company carrying on a general contracting business or jobbing work, such as the ordinary iron and steel works, it is absolutely necessary, in order to avert disaster, to have an accurate knowledge of what a job has actually cost, so that when a similar job is to be estimated an approximately accurate estimate can be made. I use the word *approximate* advisedly, because, with even a good cost keeping system, so many things can occur between the taking of a contract and its completion, due to changes in market prices and labor conditions, that many a job that promised a good profit at the time the contract was made turns out a heavy loss.

**Read by the author before the Manitoba Branch on April 3rd, 1919.*

I could name now a number of prominent jobs around Winnipeg, taken before the war or in its early stages, where the changed conditions make the original estimates look ridiculous.

Factory costs are again subdivided into prime costs and indirect expense, the latter including all the expenses of administration and supervision. This is also variously known as *overhead, burden* and *non-productive* expense, and comprises all expenditure for labor and materials, which does not enter directly into, nor is sold with, the product. A diagram showing the various subdivisions of costs, actually incurred in producing an article or carrying out a contract, would be about as follows:—

Materials	Direct Expense
Labor	
Administration and Management	Indirect Factory Expense
Supervision, Superintendents and Foremen	
Rent	
Heat	
Light	
Power	
Taxes	
Fire Insurance	
Workmens' Insurance	
Interest	
Telephones	
Telegraphs	
Stationary	
Postage	
Office Salaries, Accounting and Stenographers	
Repairs	
Waste	
Depreciation	
Supplies—Oil, Coke, Sand, Waste, Lumber, Paint, &c.	
Tools	
Freight and Express	
Travelling Expenses	
Legal Advice	
Correction of Errors	
Safety Appliances	
Salaries	Selling Expense
Commissions	
Advertising	
Estimates	
Sketches	
Demonstrations	
Experiments	
Entertainment	
Donations and Subscriptions	
Memberships	

There are other items and subdivisions which might be made, but these are the main ones.

The relative variations in these main items may be seen in the following figures for 1914 and 1919:—

	1914		1919
Material	56.4%	Material	54.0%
Labor	15.3%	Labor	14.7%
Overhead	19.125%	Overhead	18.2%
Selling	9.175%	Selling	13.1%
	100. %		100. %

To find out what these indirect costs are and to get them into the selling price of the product, through which they must ultimately be recovered, with accuracy and justice to the various items of the product is no easy matter. Some firms take the productive labor as a basis and add to that a certain percentage based on the record of some fixed preceding period, usually a year. That is, the total productive payroll for a year is taken and the total indirect expense for the same period (we will say that the indirect expense is 100% or 125% as the case may be), and then, as each job progresses, only the productive labor is kept track of, and this percentage added for indirect expense or overhead. It is obvious that this may be an ever varying percentage, because the overhead will be constant while the productive payroll may decrease, in which case, if the overhead was say 125%, and there was a heavy decrease in the productive payroll, the percenage might rise to say 150% or even 200%. There are industries in which the overhead is as high as 300%, where the value of the individual article is small and the selling expenses very large. It is, therefore, obvious that it is in the interest of every manufacturer to produce as large a volume as possible and have as large a productive payroll as possible, in order to keep down the percentage of overhead costs. This explains to some extent why goods are sometimes sold in a foreign market below the home selling price, because they have helped to keep down the overhead percentage.

I have sometimes seen in engineers' specifications, a provision that in certain cases of extras being ordered, the contractor shall be paid for the cost of labor and material, plus 10% for overhead expenses. Only those who have had some practical experience in manufacturing or contracting can realize, in most cases, the absurdity of such a provision, unless under this head is included all labor, as well as the mechanics' wages.

I have tried to show briefly how important a place overhead expense occupies in any business, manufacturing or otherwise, and I think in many cases, in fact in the majority of cases where a legitimate business is started and fails, the cause of its death can be traced to inadequate provision for indirect or overhead expenses. This largely accounts for the differences seen in tenders for work or goods, one tenders knowing his costs and the other guesses at them.

Water Power of the Empire

The author of articles on the Water Power of the Empire in *The Times Engineering Supplement* suggests that the interests of the Empire as a whole and of the individual countries in which water power exists, can best be served by calling into consultation the financial community, the manufacturers of machinery, prospective power users and the owners of water power rights both privately held or those retained by the Crown. The idea would be to form a central committee representing these interests and its primary duty would be to co-operate hydro-electric enterprises in the British Empire and to bring those interested into close touch with each other. It is claimed that such a body would be in a position to give the soundest advice and should have the confidence of all concerned, and that if suitably composed and with loyal co-operation between its constituents it could do much to further the development of water power and of dependent industries.

Discussion on Papers Previously Published in The Journal

Design of Hydro-Electric Plants for Combatting Ice Troubles *

By R. M. Wilson, M.E.I.C.

R. F. Hayward, M.E.I.C. Along the Coast Range in British Columbia we are exceedingly fortunate in not having the ice question to deal with. All the large power plants are located either at tide water or very close to it and are supplied with power from streams or rivers flowing out of lakes. The Stave Lake power plant is a typical development in this respect. It has a water shed of about 450 sq. miles which consists of a combination of snow fields and glaciers and mountains covered with dense forest of Douglas Fir and Cedar. The Stave Lake has an area of 24 sq. miles or nearly 6% of the total water shed. The Stave River, in its natural state, never froze over at all and even with a week of zero weather no ice was formed even along the banks of the river, although the Fraser River, into which it flows only a few miles distant, has been so thick with ice that a cart could be driven across it. The reason for this is that the principal flow of water in the winter comes from the underflow of the forest and this water never gets very cold. Our screens are all in the open and only about once a week do we have a man remove any small amount of floating trash that may collect.

My experience in the neighbourhood of Salt Lake City was very different. There we were dealing with small quantities of water and high heads and had several different conditions to deal with. All the power plants were located at the mouth of, or within the canyons, of the Wasatch Range and during the winter the temperature in the canyons and around the intakes of the plant would be, during cold snaps, as low as 20 to 30° below zero. In the Bear River plant the water came from a broad valley into which flowed a number of spring fed streams. We had little or no trouble with ice, although the water was conducted through a canal about 2 miles long. In the Ogden plant which was supplied from a comparatively small intake and a 6 ft. wood stave pipe, although the temperatures were very low and there was much wind, we never had trouble with ice. The intake would freeze over solid, but there was sufficient inflow of spring water to prevent any freezing in the wood stave pipe.

In the Cotton Wood plant the stream would freeze up solid, and in the plant at Provo, which was supplied through an open flume, great difficulty with ice was encountered due to the fact that the intake was just below a series of rapids on which slush ice was freely formed, but this difficulty was entirely overcome by conveying into the flume a comparatively small stream of spring water.

My experience in the neighbourhood of Salt Lake, and in British Columbia, go to show that a comparatively small percentage of underground water flowing into a stream is sufficient to prevent the formation of ice during extremely cold weather.

*Published in Vol. II, No. 5.

The Production of Peat Fuel *

By Ernest V. Moore, A.M.E.I.C.

Frederick B. Brown, M.E.I.C. I have been following the question of peat production as an interested bystander, and it seems to me there are immense possibilities for the use of this fuel in a general way.

Can Mr. Moore tell us anything about the improvements that have been made in the machinery during the last year, what is the programme for next year's work at Alfred and elsewhere in Canada, and how the proposed type of plant will compare with what we have seen on the screen?

Another point on which I would be glad to have some information is how often the trolley supporting the conveyer buckets and the electric wires has to be moved sidewise in order to make provision for laying out more peat, and whether this moving is very much of an operation.

Ernest V. Moore, A.M.E.I.C. (the author). Answering the last question first, each of those rows represents about 20 tons of fuel, and we made a maximum of 5 rows a day. As soon as the end of a row was reached, the cableway had to be moved in its entirety. There were twelve men altogether operating the plant, six of them spent part of their time in preparing for the moving of the cableway. We could move it in about fifteen minutes. It was done by taking up the strain of the cables on the two trucks which were supported by anchor ties, and kept parallel, and all that was necessary to pull the cableway ahead was to wind in on a winch at either end of the anchor towers. The strain on the cable was sufficient to pull the intermediate towers along. As soon as the cableway had been moved three men moved ahead the anchor ties to the rail that supported the end tower on the outside, and as they came back they moved those little light sections of track back again, and the operation was done right along on an average of from 15 to 18 minutes. On a tryout we have done it in nine minutes.

The other question is more difficult to answer. The Peat Committee is very conservative, and does not want anything said until they can show something definite, holding that there has been too much advertising and nothing much to show heretofore.

Paul A. N. Seurot, M.E.I.C. In 1896 or 1898 they started using peat bricks on some of the railways in Russia, and the consumption was about 90 pounds per mile, as against about 48 pounds of soft coal. This practically agrees with the figures given by Mr. Moore. There seems to be room for improvement on the question of the cost of the peat, and I would like to ask Mr. Moore if he can give us any further information as to the probable cost of peat in Canada.

A man came into my office about two months ago with a fine sample of peat, which burned very well on a match being applied to it. He said he was putting it up in one hundred pound bags, or 500 pound blocks, or by

*Published in Vol. II, No. 6.

the ton, and that the cost was $31,00 or $32.00 per ton. Of course, that is hardly a price which would compete with coal even at $10.50 a ton.

Mr. Moore told us that a good deal of information in regard to peat came from Europe, but it seems to me that the reverse is now the case, and Europe is coming to Canada for information on the same subject. About two years ago when coal began to get extremely scarce in France a syndicate was organized to develop some peat bogs in Brittany and France, and they sent to the Consul here for some information. The communication was handed to me, and I was able to get a great deal of information from Dr. Haanel, which I sent to France and which was very much appreciated. They are very deeply interested in the subject, and with Mr. Moore's permission when his paper is printed, I would like to send it forward to them.

Mr. Moore: As I said in my paper, there has been a great deal of misunderstanding in regard to the word *cost.* In 1914 we were paying at Alfred for labor $1.50 a day, in fact we had some husky boys around 18 or 19 years of age for $1.25, and some yound fellows who could do some work, to whom we paid $1.00. It cost us under 50 cents to lay the fuel down cut, and on a contract basis, it cost us 12½ cents to pile it up in little cubes, and it cost us anywhere from 50 cents to $1.50 to get that old horse to drag them down to the platform and get them on the cars. We knew that was an exorbitant cost, but that was not what we were working for. The work was done originally to develop a satisfactory excavator and a satisfactory method of spreading.

It cost us 90 cents a ton to take that fuel from Alfred to Ottawa, a distance of 45 miles. We paid approximately 50 cents commission to the retailers, and we had to have it delivered under a special arrangement because they did not have the equipment to handle it properly. They took their ordinary coal carts, and put some boards around the tops, so that they could carry a ton of this fuel. They sharged us $1.25 for delivering from the railway car. We delivered from the car to the consumer. Those costs, $1.25, 50 cents and 90 cents were pretty nearly as great as the actual production cost of making the fuel on the ground. It would be ashamed to tell you what the overhead cost was.

A Member: What is the approximate age of the deposits, and the rate at which humufication takes place?

Mr. Moore: I can give you very little information about the age of the bogs, and I do not know a great deal about the rate of humufication. I read an article not long ago about a bog in Germany which had been watched for thirty years, and in that time the surface level came up over 3 feet. Of course, that does not mean there were 3 feet of well humufied peat, but there was a 3 foot growth of moss, which might be, perhaps, one foot of actual peat. I have not any data which would give you any definite idea as to the age of those bogs, or the rate of humufication. Humufication depends on a number of things.

A Member: Mr. Moore has only spoken of drying the peat until it has a water content of about 25 per cent. I would like to ask him if he considers that the commercial point to which it should be dried? I would also like to enquire what the water content was in the peat which he said was piled outside for two years.

Mr. Moore: I mentioned twenty-five per cent water content, but it is possible to dry it down to about eighteen per cent. At from twenty per cent to twenty-five per cent the fuel is tougher, and will stand transportation better. If you get much below twenty per cent, and the fuel is handled in the ordinary stoves, it requires much greater care, because it ignites very much more easily. The piles you saw on the screen contained about thirty per cent when they were piled, and close to that figure when they were shipped. Drying seems to go on in spite of weather conditions.

As we lay the peat out, it is very soft. If a heavy rain storm comes on within an hour, it will wash off perhaps ten per cent of the stuff, which goes down between the blocks, and cements them together. After the material has been out for ten hours on a bright summer day, all the rain we have ever seen will not injure the blocks at all.

We have noticed a very marked shrinkage in the blocks over three or four days of mist. Once the material has dried up it will not go back to its original state. I have seen those blocks immersed in a running stream for a couple of weeks, and burned practically immediately after they were taken out. You can take a piece of peat which has not too many little rootlets in it, and you may immerse it almost indefinitely without damaging it.

A Member: What is the length of the season you can work a peat bog in Canada?

Mr. Moore: The earliest we ever operated at Alfred was April 19th, and on one occasion we operated until October 9th. We have from 100 to 110 days on an average. The important factor is that the frost should be out of the ground sufficiently to permit of the excavation work being done. In the fall the peat has to be dried down until the water content is about 40 per cent or 50 per cent, before the frost comes along, because, if this is not done, and sufficient frost comes along, it will simply destroy the cohesion. If you take a block which has been frozen through the winter without being properly dried, in the spring it would practically go into a powder if you attempted transportation, although you could use it satisfactorily under the boiler on the work.

A Member: Inasmuch as the drying peat takes a fairly extensive area, about what capacity per unit area do you expect out of a bog during the season?

Mr. Moore: I cannot give you any definite figure offhand. The area I showed you was 1000 feet wide and 3000 feet long. I thing we should be able to go over that four times a season.

There is another point which I should, perhaps, mention. I was asked about this 25 per cent water content. There are a number of other things that can be done with peat apart from burning it in the stove. It will be possible later on to make a very much nicer looking fuel, but I do not think there is any way of changing the water content from 90 per cent down to 25 per cent more economically than some such general scheme as I have described. No doubt a number of things may be done with it, but I do not think you can get rid of the great water content more cheaply than by some such general system as I have outlined.

Walter J. Francis, M.E.I.C. If any one ever deserved a reward, it is the speaker of this evening, for the persistent and able manner in which he has followed and dealt with this very interesting subject.

About twenty years ago I burned peat for a whole winter in my house, just as an experiment, and it was one of the most satisfactory fuels I ever handled, so far as heat was concerned. At the same time, we had two troubles, one was that the ordinary grate we were using was not suitable for the fuel, which disintegrated rapidly; the other was the persistent question of every visitor to the house—"What is that smell?" The odor from the burning peat was very much like the smell of a dying bush fire. From the point of view of heat, however, it was a very useful and very convenient fuel, and the price at that time was also very satisfactory.

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOL. II. July 1919 No. 7

WESTERN PROFESSIONAL MEETING POSTPONED

Owing to the unsettled labor conditions in Western Canada, the Western Branches consider it necessary to postpone the Edmonton Meeting until early in October. The new date of the meeting, to be arranged later, will be published in the September issue of *The Journal*, after confirmation by Council.

Professional Meeting in St. John, N.B.

The Professional Meeting in St. John, N.B., will be held on September 10th, 11th, and 12th, 1919.

What is a Professional Engineer ?

One of the serious difficulties encountered by the Special Committee of *The Institute*, when drafting proposed legislation, was to arrive at a definition of *professional engineer* that would cover all branches of engineering and yet be terse and to the point. The definition in the proposed Act has not met with universal approval, showing that there is, doubtless, room for improvement.

When in Chicago recently, the Secretary met T. L. Condron, Chairman of the Committee on Licensing Engineers of the Engineering Council, who gave him a copy of a definition, the result of an entire week's work. This definition arrives at the goal by describing the practice of a professional engineer. It reads:—

> "By professional engineering is meant any or all branches of the profession of engineering other than military engineering; military engineering means engineering which is concerned only with such structures, works or processes as have a solely military purpose.
>
> The practice of professional engineering embraces designing and responsible supervision of the construction, operation or maintenance of private or public utilities or works, and designing or responsible supervision of processes of production, means of transportation and methods for the disposal of waste, when such designs or supervision involve and require the intelligent application of the principles of physics, mechanics, hydraulics of thermodynamics in the determination of the proper selection, use, removal or disposition of material for the attainment of a definite purpose.
>
> By professional engineer is meant any person engaged in the practice of professional engineering."

Other definitions have been sent in by Secretary Alfred D. Flinn. These are designed to describe what is meant by engineering. They are:—

> "Engineering is the application of science to development and control of resources of Nature for the use of man, involving ingenuity in directing forces, utilizing materials and organizing human efforts for fabrication of machines, erection of structures, invention of processes and production of articles of commerce."
>
> "Engineering is the art which applies science and scientific methods to develop and control resources of Nature for the use of man; it involves ingenuity in directing forces, utilizing materials and organizing human efforts for fabrication of machines, erection of structures, invention of processes and production of articles of commerce."

These definitions are published for general information, to promote discussion and in the hope that, before a definite definition has been adopted, either by the Engineering Council or by *The Institute*, it will be one which can be universally used on this continent at least.

Salaries and the Civil Service

An editorial, which appeared under this heading in the June issue of *The Journal*, referred to a letter received from W. Foran, Secretary of the Civil Service Commission. The full text of that letter is as follows:—

CIVIL SERVICE COMMISSION
Office of the Secretary,
OTTAWA, May 13th, 1919.

Editor, *Journal*,

In reply to your letter of the 7th instant, I beg to inform you that the Organization Branch of the Civil Service Commission has given very careful consideration to the question of the salaries to be fixed for engineering and other technical positions, and it is hoped that, when the reclassification is approved by Parliament, it will be found that adequate remuneration has been provided for this class of employment, and that the engineering positions have been considered not only in relation to the salaries offered in similar positions outside the Government, but also in relation to other classes of employment in the service itself. In the meantime, it should be clearly understood that the Civil Service Commission is not responsible for the salaries now advertised as attached to positions such as that of private secretary. Hitherto, the salaries have been fixed by the Department, and have had no bearing one upon another. It is hoped that, after the reclassification has been adopted and these matters have been placed under the direct jurisdiction of the Civil Service Commission, the salaries offered in the various positions will be more in accordance with the value of the service to be performed and the remuneration which such service could command in the business world in general.

Yours truly,

W. FORAN,

Secretary.

The following are some of the letters received by the Secretary from Members of Parliament showing their attitude toward the engineering profession:—

House of Commons
Canada

Ottawa, June 4th, 1919.

Fraser S. Keith, Esq.,
Secretary,
Engineering Institute of Canada,
176 Mansfield St.,
Montreal.

Dear Sir:—

I beg to acknowledge receipt of your favor of the 12th ultimo. I have also received a memorandum covering matters referred to in this letter, all of which will receive my attention.

You can rest assured that I will do all I can to place the civil servants on a sound basis.

Yours truly,

T. M. TWEEDIE,

Member for Calgary,

West Riding.

House of Commons
Canada

Ottawa, May 27th, 1919.

Mr. Fraser S. Keith,
Secretary,
The Engineering Institute of Canada,
Montreal, Que.

Dear Sir:—

I beg to acknowledge your favour of the 12th instant also other matter with regard to engineering under separate cover.

I can assure you that I will be glad to render any assistance possible in placing the engineering profession on a better footing in this country and particularly in the Government service.

Yours faithfully,

S. F. TOLMIE,

Member for Victoria City.

House of Commons
Canada

Ottawa, May 29th, 1919.

Fraser S. Keith, Esq.,
Secretary,
Engineering Institute of Canada,
176 Mansfield Street,
Montreal, Que.

Dear Sir:—

I have your communication of the 12th instant and am entirely in sympathy with the views of your association and have already vigorously and persistently supported this and will follow it up with added effort.

I am,

Yours very sincerely,

H. H. STEVENS,

Member for Vancouver, Centre.

House of Commons
Canada

Ottawa, May 26th, 1919.

Mr. Fraser S. Keith,
Secretary,
Engineering Institute of Canada,
176 Mansfield St.,
Montreal, P.Q.

Dear Mr. Keith:—

I have your circular letter of the 12th instant, enclosing facts and figures concerning the engineering profession, for which accept my thanks. It will give me great pleasure to support the aims and objects of your *Institute* when the Civil Service Bill comes before the House.

Faithfully yours,

J. C. McIntosh,

Member for Nanaimo.

House of Commons
Canada

Ottawa, May 26th, 1919.

Fraser S. Keith, Esq.,
Secretary,
Engineering Institute of Canada,
Montreal.

Dear Sir:—

I desire to acknowledge the receipt of your letter of the 12th instant in reference to the greater attention which should be given to the profession of engineers in Canada. It is my pleasure to study your memorandum and you may rest assured that I will give my hearty support to any measure which would recognize the value of engineers in public service with the remuneration they deserve.

Yours faithfully,

O. Turgeon,

Member for Gloucester.

House of Commons
Canada

May 23rd, 1919.

Fraser S. Keith, Esq.,
No. 176 Mansfield St.,
Montreal.

Dear Sir:—

In reply to your favor of the 12th instant I beg to say that I am in entire sympathy with your letter, as I believe that young men to-day who are educating themselves along technical lines are not receiving the consideration they should, as in a great many cases mere clerks and stenographers are receiving as much consideration as highly educated and trained engineers.

When the matter comes up I will look after it you can rest assured.

With best wishes, I am,

Yours very truly,
R. W. Wigmore,
Member for St. John City and
Counties of St. John and Albert.

Hon. A. K. Maclean, acting Minister of Trade and Commerce, who has had particular charge of all matters relating to the civil service, has given notice of the resolution on which the bill providing for the reclassification of the civil service, will be based.

Under the terms of this bill upwards of fifty thousand members of the inside and outside civil service will be reclassified.

The principle underlying the new classification will be that members of the service will be put into classes corresponding with the nature of the work they are doing. Civil servants doing engineering work, for instance, will be classed as engineers and other members of the service doing work calling for special qualifications will be similarly treated.

The new classification will in all likelihood straighten out some of the present difficulties between the Government and the members of the civil service.

Mr. Maclean's resolution is as follows:—

1—That the Civil Service Commission shall consist of not more than five members appointed by the Governor-in-Council; provided, however, that after the expiration of three years from April 1, 1919, no person shall be appointed a commissioner until the number of members of the commission is reduced to less than three, and after such reduction the number of members of the commission shall not exceed three.

2—That the chairman of the commission shall be paid a salary of $7,000, and each of the other commissioners $6,000.

3—That the provisions of the Civil Service Act relating to temporary employment, dismissals,resignations, hours of attendance, annual reports, regulations, examinations, classifications, appointments, promotions, transfers and compensation be amended, and that provision be made for reclassifying the civil service and for any additional expense.

Compensation of Engineers

A Schedule of Engineering Salaries Covering Various Branches of the Profession

At the Annual Meeting of the American Association of Engineers, held in Chicago, May 12th to 14th, an exhaustive report of the Compensation Committee was presented and adopted. It represents a great amount of work on the part of the men engaged on this Committee and is the first definite attempt to arrive at a basis of the classification of salaries of engineers employed in various lines. It does not include those employed in the civil service of the country. The schedule for railway engineers adopted was similar to that published in the April issue of *The Journal.*

The report states that the committee having carefully considered salaries, wages and working conditions as reflected in records and private correspondence, and through personal correspondence and investigation, finds that:

1. No profession can for any length of time continue to attract to its ranks high class ability unless the rewards offered are commensurate with the expense and effort required to attain and maintain a respectable position in such profession. At this time the pay of engineers is out of proportion to the high degree of responsibility required and the money spent to obtain the necessary technical education.

2. The interests of investors as well as the safety of employees and the general public require that the design and execution of engineering work shall be in the hands of competent and highly skilled men. All classes are vitally interested in enforcing a square deal, insuring to engineers such pay as will attract and retain in the profession men of ability.

Summary of Conclusions

1. That the profession of engineering, taken as a whole, is insufficiently paid, or is not paid in proportion to the high degree of responsibility entailed or the technical training required to perform the work.

2. That the principle of a square deal for everybody should underlie all rules of compensation, and that technical men must demonstrate their worth both to their employers and the public before they receive the compensation due them.

3. That this demonstration should be made by individual salesmanship, and by proper methods of publicity directed by this Association to establish co-operation between employers and employees and to insure proper recognition of the services of the engineer by the public.

4. That while salesmanship may produce results in individual cases, it is necessary to operate collectively for the rank and file of engineers and desirable that some forms of grades for engineering services be adopted with a minimum rate of pay for each grade.

5. That the rates suggested herein are not the maximum standards, but rather indicate the rate of pay of anyone who can perform the line of work and that individual effort should be encouraged to the fullest extent and be paid for accordingly.

6. That in the determination of a just compensation, consideration must be given to the effort or cost of the educational training; the years and character of experience in the particular line, as well as total years experience; length of time in employer's service; character and personality; degree of efficiency and special qualifications.

7. That the uncontrolled law of supply and demand is not a just method by which to determine the compensation for valuable services. Therefore, steps should be taken to control its operation so that it may not become oppressive, especially in the lower grades of service.

Specific Recommendations:

1. That the hours of employment for technical men of grades 1, 2, and 3, hereafter defined, should not exceed eight hours per day or forty-four hours per week.

2. That overtime in above grades should be paid for at an increased rate.

3. That no one in charge of engineering or construction forces should be paid less than any man for whose work he is responsible.

4. That when by a superior's orders an employee is shifted to a point requiring him to change his place of abode, the employer should bear the entire expense of moving employee and his family.

5. That employees should be given national holidays and not less than one day's vacation for each month employed during the year, and that provision should be made for disability due to the hazard of employment.

(Grades were recommended, of which the first three are named as showing what was intended in the above recommendations, the rates having been ordered eliminated.)

Grade 1. A position requiring chiefly mechanical skill and little or no experience, but which, however is desirable or necessary for the technical men to do for a short time as preliminary training for higher grades of work; or a position requiring a small amount of technical knowledge, such as may be obtained in a high school or manual training school, but without responsibility.

Grade 2. A position requiring the equivalent of a high school education, as well as the elements of engineering, such as may be obtained in a night school or correspondence school, and demanding a certain amount of proficiency which would ordinarily be obtained with one year's experience, lacking a college education.

Grade 3. A position in which graduation from a recognized college of engineering is desirable for its potential value, and which requires a part of that technical knowledge, or a position requiring as much as Grade 2, with two years experience and demanding additional technical study such as the completion of night or correspondence school courses.

Schedule

NOTE.—Salaries in the following schedules are for continuous positions, positions where employment is continuous throughout the year, and where the employee may look to a steady advancement in rank and pay as a reward for efficient service.

In seasonal employment, where the work continues from year to year and the same opportunities for advancement exist, but where from the nature of the employment there is an idle season, as an inspector of dredging or employee of the Geological Survey, and where the place is open at the commencement of the succeeding season, the pay should be such as to amount to about half pay for the necessarily idle season. Thus, for an eight month working season, where the schedule shows a rate of $2400 per annum, the position should pay $250. per month.

For temporary positions, where there is no developing future to the work, the pay should be 50% above the schedule.

Architectural Engineers

Architect in charge of office	$5,000	to	$8,000
Designing Draftsman	4,000	to	5,000
(Above were eliminated by the Chapter).			
Construction Design Draftsman, by committee	3,000	to	3,600
Rate adopted by the Chapter	4,000	to	5,000
Outside Superintendent, by committee	3,000	to	3,600
Rate adopted by the Chapter	4,000	to	5,000
Senior Draftman, by committee	2,400	to	3,000
Junior Draftsmen, by committee	1,500	to	2,100
Student Draftsmen, by committee	900	to	1,200

Adopted as Amended.

Highway Engineers

The following schedule is suggested for a state where there are from 60,000 to 100,000 miles of roads on which the Highway Department spends not less than $5,000,000 annually.

Chief Highway Engineer— In entire charge of all engineering work for the entire organization	$8,000	to	$10,000
Road Engineer— Responsible for surveys, plans and construction of all road improvements	5,000	to	7,000
Maintenance Engineer— Responsible for maintenance of all engineers	4,500	to	6,000
Bridge Engineer— Responsible for design, construction and maintenance of all bridges	4,500	to	6,000
Engineer of Tests— In charge of tests on all materials used in road and bridge work	3,000	to	4,000
Division Engineer— In charge of one division (usually 7,000 to 10,000 miles of road). Under higher officials, is in charge of all work on division	3,600	to	5,000
Assistant Engineer— Assists Road, Maintenance, Bridge and Division Engineers	2,700	to	3,600
Resident Engineer— In charge of important bridge work, road improvement, etc., under Division Engineer	2,700	to	3,600
Junior Engineer, Class A— In charge of road surveys; does instrument work; prepares plans and profiles for road improvement and does drafting in bridge department	2,100	to	2,700
Junior Engineer, Class B— Leveler on road surveys; works on plans and profiles for road improvements; does drafting in bridge department. (Technical education or experienced in highway work).	1,500	to	1,800
Chief Designing Engineer— In charge of designing and drafting under Bridge Engineer	3,000	to	4,000
Designing Engineer— Independent designing in bridge department	2,700	to	3,300
Inspector— Technical training desirable while not essential, but must have had experience in highway construction if lacking such training	1,320	to	1,800

Adopted by Chapter as submitted.

Municipal Engineers

City Engineer— Annual volume of work, $5,000,000.	$12,000	to	$15,000
City Engineer— Annual volume of work, $2,500,000.	8,000	to	10,000
City Engineer— Annual volume of work, $1,000,000.	6,000	to	7,500
City Engineer— Annual volume of work, $500,000	4,000	to	5,000

Adopted by Chapter as submitted.

Pay should be graded according to responsibility, scope and character of work.

Department Engineers— In charge of departments or bureaus.	$5,000	to	$7,500

Division—		
In charge of several parties or several pieces of work. Considerable responsibility	4,000 to	7,500
Assistant Engineer—		
In charge of party, handling work from standpoint of grades and inspection. Under direction	3,000 to	3,600
Instrumentman—		
Preferably a technical graduate. Running transit and level, giving lines and grades and inspecting. All under direction	2,000 to	2,400
Rodman—		
No educational requirement except high school, second grade	1,080 to	1,500
Inspectors—		
Slight educational requirements for entrance, with acquired experience for higher grades. Paving, concrete work, etc., on routine under direction	1,380 to	1,800
Architect—		
Developing work of standard character	3,000 to	5,000

Above three adopted as submitted.

Designing Engineer—		
Technical graduate. Ten years minimum experience. Responsible.	4,000 to	6,000
Designer—		
Technical graduate with at least five years experience. Able to take responsibility	3,300 to	4,200
Detailer—		
Preferably technical graduates; developing drawings under direction. From little experience to five year	2,000 to	3,000
Tracer—		
Education at least equal to technical high school. Routine copyist	1,200 to	1,800
Draftsmen—		
Using the following titles as commonly understood:		
Architectural	1,800 to	3,000
Map or topographical	1,800 to	2,400
Structural	1,800 to	2,400

Public Utility Corporation Engineers

(Furnishing Light and Power to a population of 50,000.)

General Manager—	
Preferably a technical trained man. Volume of business and special considerations	$5,000 to $8,000
Assistants,	
A. Where employer has been accustomed to demand a technical education and ten years experience and considerable responsibility is assumed	3,900 to 5,000
Assistants	
B. Same education and experience as A, but working under direction	3,000 to 4,200
Assistants,	
C. Where employer has been accustomed to demand a technical education and a minimum of five years experience. Under direction	2,400 to 2,700

Assistants,

D. Office and field positions doing drafting and instrument work to pay same rates as shown for like positions in Municipal schedule.

Railroads Engineers

This schedule of salaries has already been published in Vol. II, No. 4 of *The Journal.*

Railroads Electric

1. A Road with the Equivalent of 60 Miles of Single Track.

Chief Engineer—	
In charge of track, structures and transmission lines	$3,600 to $4,800
Asst. Engr., Field—	
Doing instrument work and inspection, under direction	2,400 to 3,000
Roadmaster—	
Preferably a technically trained man	2,400 to 3,000
Mechanical-Electrical Engineer—	
An engineer trained in both branches, having charge of power house, plant, cars and equipment	4,200 to 5,400
Office Engineer—	
Equivalent to a first class machine draftsman, working under direction	2,400 to 3,000
Line Superintendent—	
Duties not easily described, but quite commonly understood	2,400 to 3,000
Sub-Station Man—	
Duties such as commonly apply to this position	2,400 to 3,000

2. A Road with the Equivalent of 200 Miles of Single Track.

General Manager—	
Responsible for all maintenance and operation. Preferably a technical man	$6,000 to $10,000

Chief Engineer—

Has full charge of construction and maintenance of way and structures	4,000 to	5,400

Assistant Engineer—

Drafting and instrument work in field and office under direction....	2,400 to	3,000

Roadmasters—

Preferably technical men. Usual duties........................	2,400 to	3,000

Mechanical-Electrical Engineer—

Trained in mechanical and electrical engineering. In full charge of power house, transmission and equipment....................	4,500 to	6,000

Assistant Engineers—

Perform drafting and design under direction. Able to turn out finished work....................	2,400 to	3,000

Line Superintendent—

Preferably a technical man. Training for a higher position.........	2,400 to	3,000

Sub-Station Man—

Duties such as commonly apply to this position. Preferably a technical man....................	2,400 to	3,000

Adopted as submitted.

Rural Engineers

County Surveyor—

This is not usually a salaried office, but is of such importance that a sound policy would provide this officer with an office and pay for it being kept open a stated number of days per week, the number depending upon the wealth and population of the county.

The per diem rate for land surveying should be adjusted to correspond with the value of the lands surveyed, as the surveyor is responsible for the accuracy of his work, and may be sued for damages due to or suffered from erroneous work.

Where land is valued at less than $25.00 per acre,	Surveyor........	$12.50
	Assts...........	3.75
Where land is valued at $25.00 per acre, but not over $200.00 per acre,	Surveyor........	18.00
	Assts............	5.00
Where land is valued over $200.00 acre,	Surveyor........	20.00
	Assts............	5.00

Drainage, Levee and Road Work—

Intermittent work of this class should be paid for at the per diem similar to that above for land surveys. A specific number of days should be paid for each month in addition to the actual time in the field, to cover consultation with directors and contractors and correspondence.

Salaried Employees in Rural Engineering—

Deputy County Surveyors, having responsible charge of work and directing same.................	$3,000 to $4,200
Drafting and Instrument work under direction......................	2,100 to 2,700
Subordinate positions as in municipal or slightly lower.	
Generally speaking, drainage and levee work is done on a percentage.	

County Engineer (Good roads organization.)

(For counties spending at least $500,000 annually on highway work.)

County Highway Engineer—

In charge of all bridge and road work in county. May be under State Highway Department...........	$4,200

Assistant Engineer—

Responsible for such work as may be assigned to him.................	3,000

Junior Engineer, Class A—

In charge of road surveys; does instrument work; prepares plans and profiles for road improvements; does drafting............	2,400

Junior Engineer, Class B.—

Leveler on road surveys; does instrument work; works on plans and profiles for road improvements; computes notes; does drafting...	1,800

Inspector—

Technical Training desirable, while while not essential, but must have had experience in highway construction if lacking such training......................	1,500

A similar organization is desirable for levee and drainage work, but must adapt itself to a wider variation than in road work.

Adopted as submitted.

State Public Utility Road

Proposed schedule of salaries for engineering department of a state Public Utility Commission, for a state with a population of 5,000,000.

Chief Engineer—

Charged with the administration of the Engineering Department and engaged in valuation work, standards of service, inspections and investigations having engineering aspects, etc. He may or may not be assigned to the duty of hearing cases, preparing opinions, etc. During his employment by the Commission and for one year thereafter he shall accept no employment from any utility subject to the jurisdiction of the Commission.................... $12,000 to $15,000

Assistant Chief Engr.—

Reports to the Chief Engineer, who assigns his duties............... 9,000 to 10,000

Chiefs of Div. Railroad, Gas, Telephone, Water Works—

These men shall not accept employment from any Public Utility subject to the jurisdiction of the Commission during their employment by the Commission or for six months thereafter. Are engaged in valuation of Public Utilities, within their own division, assisting in formulating standards of service and engaged on investigations and inspections having engineering aspects. They may be assigned the duty of hearing cases, preparing rate schedules, opinions, etc...........................

Railroad	8,000 to 9,000
Gas	6,000 to 7,500
Telephone	6,000 to 7,500
Water Works	6,000 to 7,500

Assistant Engineers—

Reporting to the chiefs of the above departments, graduates of technical schools, or having an equivalent technical knowledge.

Grade 1—

Corresponding in training and ability to a Division Engineer on a railroad...................... $3,600 to $4,800

Grade 2—

Corresponding in training and ability to an Assistant Division Engineer on a railroad.......... 3,000 to 3,300

Grade 3—

Corresponding in training and ability to an Instrumentman on a railroad.......................... 2,400 to 2,700

Grade 4—

Corresponding in training and ability to a junior draftsman or instrumentman on a railroad.......... 1,800 to 2,100

Adopted as submitted.

State Public Improvement Project

(Illinois River Improvement or similar project.)

Chief Engineer—

An engineer of such standing as to command respect for and confidence in the conduct of the work. $15,000

Assistant Chief Engr.—

In personal charge of surveys and construction. A first class executive........................ 9,000

Principal Asst. Engr.—

In charge of investigation and design. A highly technical engineer...................... 8,000

Bridge Engineer—

Equal to the bridge engineer on the strongest railroads.............. 7,500

Office Engineer—

Inside Executive reporting to the Chief or Asst. Chief Engineer.... 6,000

Office Assistants—

Same grades and rates as shown in the Municipal schedule.

Field Engineer—

Outside executive, reporting to the Assistant Chief Engineer........ 6,000

Field Assistants—

Same grades and rates as shown in the Municipal schedules.

Adopted as submitted.

Large Structural or Mechanical Organisation

Chief Engineer—

Having entire charge of the Engineering Department of a given organization................... $12,000

Assistant Chief Engr.—

Duties assigned by Chief Engineer. Performs duties of Chief Engineer during his absence.............. 9,000

Construction Engineer—

In charge of a particular job or jobs of construction. Reports to Chief Engineer..................... 3,600 to 6,000

Inspecting Engineer. Senior Class—

Inspects Engineering materials or workmanship. Reports to Chief Engineer. Minimum of ten years experience required............. 3,000 to 6,000

Inspecting Engineer, Junior Class—

Similar duties to senior class, but with but five years' experience... $1,800 to $2,700

Office Engineer—

In charge of all office engineering, designs, estimates, plans, files, etc., reports to Chief Engineer... 4,800 to 6,000

Engineer of Design— Has charge and supervision of all design. (And estimating). Reports to Office Engineer.........	4,200 to 5,000
Assistant Eng. Design— Makes design drawings, layouts, etc. May have charge of detail drawings. Reports to Engineer of Design or Office Engineer........	2,400 to 3,000
Engineer of Estimates— Has charge of all estimates when they are not under Engineer of Design. Reports to Office Engineer or Engineer of Design.....	3,300 to 4,000
Squad Engineer— In charge of a squad of not more than ten men on preparation of plans of particular job or jobs. Reports to Office Engineer.......	3,300 to 4,000
Assistant Engineers, Class 1— Engineers whose duties require their having a thorough technical training in civil, structural or mechanical engineering, together with four to six years' practical experience to properly prepare the work of drafting, designing, estimating, etc............................	3,000 to 3,600
Assistant Engineers, Class 2— Same requirements as class one, except that but three years' practical experience is required to qualify for duties to which they are assigned...............	2,400 to 2,700
Junior Engineer— Should preferably have a thorough technical education, with or without practical experience. Works under direction only............	1,500 to 2,100
Student Engineer— One pursuing studies leading to an engineering degree by home study or at school and performing field or office work of the lower grades, under direction................	1,000 to 1,400

Adopted as submitted.

Telephone Service

(A company serving a population from 1,500,000 to 2,000,000.)

Chief Engineer— Should be a technical graduate with fifteen years or more experience in the telephone field. Has entire charge of all engineering work in an executive capacity.........	6,000 to 8,000
Equipment— Should be a technical graduate with eight to ten years' experience. Has entire charge of all telephone equipment engineering, such as laying out, estimating and directing; the installation of telephone and power plants. Reports to Chief Engineer.................	4,200 to 5,000
Layout Engineer— Technical man, with three to five years' experience. Makes up plans, layout exchanges, equipment and sometimes supervision of specification writers. Under direction of Equipment Engineer.	2,500 to 3,500
Specification Engineer— Technical man with two or three years' experience. Write specifications and compute apparatus under direction of group heads, from routine instructions........	1,900 to 2,400
Estimating Engineer— Same qualifications as Specification Engineer. Makes up estimates of cost of equipment from specifications written by Specification Engineers. Reports to Equipment Engineers........................	1,900 to 2,400
Inspectors— Technical men or telephone men of experience in telephone equipment. Inspect new equipment under direction of Equipment Engineer......................	1,900 to 2,400
Construction Engineer— Executive position, same qualifications as Equipment Engineer. Work not quite so technical in nature. Has entire charge of plant outside of exchange........	4,200 to 5,000
Assistant Const. Eng.— Same dutes as Construction Engineer.........................	3,000 to 3,600
Specification and Estimating Engineer— Makes up estimates and writes specifications from plans submitted by field men. More or less routine....................	1,900 to 2,400
Inspector— Technical man. No experience required. Make tests of cable and wire plant from routine instructions..........................	1,600 to 1,900
Field Engineer— Technical man with two to five years' experience, or old construction foreman. Must go out on the ground and lay out pole lines and aerial and underground cable lines, and all outside construction......................	2,400 to 3,000
Traffic Engineer— About the same qualifications as Equipment Engineer. More routine work, less technical. Reports to Chief Engineer. Makes up studies of exchange traffic, over specified periods, plans extensions of service and gathers data for basis of equipment extension....	4,000 to 4,500

Layout Engineer—

Technical man with from three to five years' experience. Makes up plans for extensions of service from data furnished by Investigating Engineers $1,900

Investigating Engineer—

Technical man with no experience, or telephone men with four or five years' experience. Make tests of service, investigate probabilities of growth and complete data..... 1,700 to 1,900

Drafting Department—

Usually under Chief Engineer or Equipment Engineer. Nearly all routine work such as requires good tracers or detail men.

Chief Draftsman—

Usually has from twenty to twenty-five men under him .... 2,400 to 2,600

Draftsman—

As above .... 1,500 to 1,800

Adopted as amended.

To cover objections which were made at the Chapter meeting to the use of the words *technical man* in the report, the following explanation is added:

In this report the term *technical man* means a man having that command of technical engineering knowledge which can ordinarily be obtained in any of the ways described below. This definition relates to the amount of knowledge possessed rather than the means by which it may be obtained. The description herein of particular ways by which the amount of knowledge referred to may be obtained is not to be construed as excluding other ways not mentioned or denying that exceptional men may acquire the same knowledge in shorter time.

1. By completion of a four year technical college course leading to a degree.
2. By completing two years of a technical college course and engaging in engineering work for two years thereafter.
3. By engaging in engineering work for four years, accompanying his work by a diligent study of the science relating thereto.

In this report the term senior technical man means a man having a thorough and extended knowledge of exact science relating to engineering and having a thorough knowledge of the technical aspects of engineering; having a knowledge of technical matters in a greater degree than is ordinarily had by engineers other than those engaged in the more technical and exacting branches of engineering.

The terms technical man and senior technical man are not to be construed as terms describing rank or degree of professional skill, but are rather descriptive terms indicating the character and kind of knowledge possessed.

Telegraph Service

The following schedule for Telegraph Service has been submitted, but was not discussed by the full committee.

Gen. Supt. of plant and engineering—

Entirely responsible in an executive capacity for the construction, maintenance and development of plant. Preferably a technical graduate with 20 years' or more experience .... $15,000 to $20,000

General Plant Engineer—

Entirely responsible in an executive capacity for all plant engineering work. A technical graduate with 15 years or more experience...... 8,000 to 10,000

General Construction Engineer—

Responsible for all engineering work in connection with the construction of the outside plant. Technical graduate with 10 years or more experience .... 6,000 to 7,000

Construction Specifications Engineer—

Prepares general plant construction specifications. Technical man with 4 or more years' experience. 2,400 to 3,600

Line Efficiency Engineer—

Engaged in the testing of circuits and devising apparatus to improve their speed; technical man with 4 or 5 years' experience .... 2,400 to 3,600

Materials Engineer—

Handles testing of materials and preparation of specification for their manufacture. Technical man with 4 or 5 years experience...... 2,400 to 3,600

Inductive Interference Engineer—

Handles testing and development work in connection with prevention of inductive interference. Technical graduate with 8 or more years' experience .... 3,000 to 4,000

Electrolysis Engineer—

Handles testing and development work in connection with prevention of Electrolysis. Technical graduate with 5 years' experience .... 2,400 to 3,600

Apparatus Engineer—

Executive position, charge of the development of telegraph apparatus, preferably a technical man with 10 years' or more experience..... 5,400 to 6,600

Assistant—

Develops and prepares specifications for printing telegraph apparatus. Technical man with 5 to 8 years' experience .... 2,700 to 4,000

Assistant (b)—

Develops and prepares specifications covering time service and call circuit apparatus. Technical man with 5 years' experience .... 1,800 to 2,400

Assistant (c)—

Develops and prepares specifications covering Morse apparatus. Technical man with 7 years' experience 2,400 to 3,600

General Equipment Engineer— Responsible for all engineering work in connection with the installation and maintenance of equipment in the telegraph offices. A Technical graduate with 10 years' or more experience	6,000	to	7.000
Equipment Specifications Engineer— Prepares general plant equipment specifications. Technical man with 4 or 5 years' experience	2,400	to	3,600
Building Engineer— Responsible for the design and construction of buildings; technical man with 10 years' experience	4,000	to	5,000
Power Plant Engineer— Responsible for the development of power apparatus. Technical man with 8 years' experience	3,600	to	4,800
Equipment Estimate Engineer— Responsible for the checking of equipment estimates. Preferably a technical man with 5 years' experience	2,400	to	3,600
General Supervisor of Lines— Executive position, general supervision over the construction of the outside plant. Preferably a technical man with 15 years of telegraph construction and engineering experience	7,000	to	8,000
Estimate Engineer— Responsible for the checking of all estimates covering construction of the outside plant. Preferably a technical man with 10 years' experience	4,800	to	5,500
Construction Methods Engineer— Engaged in the development and promulgation of efficient construction methods. Preferably a technical man with 10 years' experience	3,000	to	3,600
Valuation Engineer— Executive position. Entire charge of the valuation of the plant; preferably a technical man with 15 years' experience	6,000	to	7,000
Assistant Valuation Engineer— Duties similar to those of Valuation Engineer	4,800	to	6,000
Div. Plant Supt.— An executive position. Entirely responsible for the construction and maintenance of plant in an area having 40,000 miles of line or 300,000 miles of line wire. Preferably a technical man with 15 years' experience	6,000	to	8,000
Division Engineer— Responsible for all plant engineering in a division such a described above. A technical graduate with 10 years' experience	5,000	to	6,000
Div. Construction Engr.— In charge of engineering in connection with the outside plant. A technical graduate with 10 years' experience	4,200	to	5,000
Asst. Div. Construction Engineer— Assistant to Division Construction Engineer, a technical graduate with 8 years' experience	3,300	to	4,000
Estimating Engineers— Responsible for plans, specifications and estimates for outside construction work. Preferably a technical man with 5 years' experience	2,000	to	3,000
Division Electrolysis Engineer— Responsible for the prevention of electrolysis in the division. A technical graduate with 5 years' experience	2,000	to	3,000
Division Elec. Engineer— Responsible for the prevention of inductive interference on pole lines and in cables. Technical graduate with 8 years' experience	3,300	to	4,200
Division Equipment Engineer— In charge of all engineering and installation work in connection with the inside plant in a division. A technical graduate with 10 years' experience	4,200	to	5,000
Asst. Div. Equipment Engineer— Principal assistant to division Equipment Engineer. A technical graduate with 8 years' experience	3,300	to	4,000
Division Power Plant Engineer— Responsible for the layout out, installing and maintaining of power plants, a technical graduate with 6 years' experience	3,000	to	3,600
District Equipment Engineer— In charge of installation and maintenance of inside equipment in a city of 1,000,000 to 2,000,000 population or in an area having 10,000 miles of line. Technical man with 5 years' experience	2,700	to	3,300
Equipment Layout Engineers— Engaged in preparing layouts specifications and estimates for the installation of inside equipment. Technical man with 3 years' experience	2,000	to	2,600
Equipment Inspectors— Inspect offices and equipment and assist the equipment engineers. Preferably technical men	1,500	to	1,900

Division Val. Engineer—			
In charge of the valuation work in connection with both the inside and outside plant in a division. A technical man with 10 years' experience	3,600	to	4,200
Division Supervisor of Lines—			
Executive position. General Supervision over the construction and maintenance of the outside plant in a division. Preferably a technical man with 15 years' experience	4,800	to	5,500
Assistant—			
Supervision of outside construction. Preferably a technical man with 6 years' experience	2,400	to	3,300
General Superintendent of Traffic—			
Executive position. Has entire charge of the operation of circuits. Preferably a technical graduate with 15 years' experience	14,000	to	18,000
Layout Engineer—			
Has entire charge of the assignments of circuits. A technical man with 12 years' experience	5,000	to	6,000
Assistant—			
Assists the layout engineer. Preferably a technical man with 6 years' experience	2,400	to	3,600
Automatic Engineer—			
Charge of operation of Printing Telegraph circuits over entire system. A technical man with 12 years' experience	5,000	to	6,000
Assistant—			
Assists the Automatic Engineer. Preferably a technical man with 6 years' experience	2,400	to	3,600
Efficiency Engineer—			
Develops the routing of circuits to five maximum speed of transmission. Technical man with 12 years' experience	5,000	to	6,000
Division Traffic Supt.—			
Executive position. Entire charge of the operation of circuits in the division. Preferably a technical man with 15 years' experience	6,000	to	8,000
Div. Layout Engineer—			
Charge of circuit assignments in a division. Technical man with 10 years' experience	4,000	to	4,800
Division Automatic Engineer—			
Charge of operation of Printing Telegraph circuit in a division. Technical man with 10 years' experience	4,000	to	4,800

South Shore Town Planning

The South Shore, as generally understood, comprises the municipalities of Longueuil, Montreal South, St. Lambert and Greenfield Park, lying along the south-east shore of the River St. Lawrence, opposite the city of Montreal.

Last year the South Shore Board of Trade, whose membership is drawn from the above municipalities, appointed a committee of six members under the leadership of Wayland Williams, Esq., to study a Town Planning Scheme for the South Shore. This Board of Trade Committee has now been succeeded by a committee composed of D. F. Kyle, Alex. Thurber, Omer Lecuyer, Edmond Hardy, J. E. Campbell, E. P. Gordon, S. J. Milligan, E. Backhoven, J. W. Oakley, E. Drinkwater, Jas. Ewing, M.E.I.C., W. J. Carmichael, A. Vincent, A.M.E.I.C., R. deL French, M.E.I.C., and two aldermen from each municipality, under the title of The South Shore Joint Town Planning Board. This is the first time in Canada that adjacent municipalities have combined in this way to secure co-ordination of their efforts along reasonable and economical lines for the improvement and beautification of the town and the well-being of the residents.

The South Shore at present is a jumble of sub-divisions each laid out by some land speculator whose only interest was to dispose of the property at a good profit. To remedy this evil the firm of Ewing, Lovelace and Tremblay, Consulting Engineers, has been appointed by the Board to prepare a plan of the South Shore, showing, among other things, the physical features, both natural and artificial, and the public and semi-public buildings. It is expected that this plan will be ready about October 1st when the Board will proceed to lay out a scheme of highways; industrial, business and residential areas; parks; sites for future buildings; railways and harbor facilities; etc. This town plan will then be submitted to the citizens for their discussion and criticism and, if approved, an Act will be introduced in the Provincial Assembly providing for the ratification of the plan, and for the necessary authority to put into effect the improvements shown thereon. The cost of the preparation of the plan is being defrayed by the municipalities concerned.

Messrs. Ewing, Lovelace and Tremblay are all corporate members of *The Engineering Institute of Canada* and the South Shore Joint Town Planning Board may rest assured that the plan submitted will be based on the best engineering practice.

British Trade Fairs

These fairs, representative of the various branches of British industries, will be held concurrently in London, Birmingham and Glasgow early next year according to information received from G. S. Milne, the Senior British Trade Commissioner of Canada & Newfoundland. The London fair will be organized by The Imperial Board of Trade, and the fairs at Birmingham and Glasgow by the municipal corporations and Chambers of Commerce of these cities, but under the auspices of the Board of Trade. Full particulars may be obtained at the office of the Senior Trade Commissioner, 367 Beaver Hall Square, Montreal, and applications by Canadian manufacturers for space will be received by the Senior Commissioner up till the 31st of August next.

CORRESPONDENCE

Legislation

Editor, *Journal:*

Regarding the objections to the proposed Legislation now developing on the part of Students and Juniors certain comments are pertinent.

As I interpret clause 7 (i) of the proposed bill, such a situation as outlined, of employers of engineers filling positions with unskilled instead of skilled employees, would be quite impossible under a live administration of the Act; it would also be improbable as such a proceeding is uneconomical. There are, however, certain duties to be performed in the practice of engineering which do not of necessity call for much skill on the part of the person performing them and to do which any intelligent person may be trained in a very short while. I refer to such duties as holding the chain, tape, picket or rod in field work or even reading a level under certain conditions, also in office work doing such duties as tracing, minor draughting, blueprinting, etc. Under the proposed bill there is nothing to prevent the employment of any kind of person on this work or any kind of a person doing it and I am personnally quite unable to conceive of any type of legislation which would prevent it. There is no existing precedent in any other profession for such restrictions. Any person can act as a clerk to a lawyer and thereby do everything which the lawyer does except appear in court as a lawyer. Any person can assist a doctor in his work as long as the doctor is present and directs the performance of the work, except possibly in acts of surgery, and so on in the other professions of dentistry, pharmacy, etc.

The fact of a young law or medical student being able to obtain legal recognition immediately he has completed his course of studies and passed his examinations should not be used as an analogy for the engineering profession as the conditions of training are not similar. In the other professions theoretical training can be combined with sound practical experience in the confined limits of an office or hospital and university, but with engineering the necessary practical experience can only come after the university training except in very exceptional cases and it was for that reason that the bill proposed to make a period of two years experience necessary in addition to university training. Even at that, a young engineer may become qualified at the age of 23 if he starts his experience early enough by starting in at college at seventeen. The junior engineer will not find himself greatly handicapped as against the other professions if he has the ability to conform to the requirements of the act.

The students and juniors of the profession should be advised to rely upon their ability to perform their work more efficiently than untrained persons, to obtain employment for them in the lower stages of the profession rather than seek protection by legislation, which no other profession enjoys. The greatest help towards the encouragement of engineering students and juniors will be a campaign of education among the public at large in regard to the improved status of the engineering profession as a whole.

Yours truly,
C. C. Kirby,
A.M.E.I.C.

Editor, *Journal:*

After reading the proposed Act respecting the Engineering Profession in the May issue of *The Journal*, and the views of prominent members of *The Institute*, in the June issue; it is very evident to me that the usefulness of *The Institute* will be seriously impaired if not entirely destroyed if the Act as it stands at present, is made law in the different Provinces.

I, therefore, venture to suggest that instead of pressing forward the proposed Provincial legislation that our legal advisors should be instructed to modify it so as to include present Provincial members of *The Institute* as *ipso facto* members of the proposed organization, and members of any other recognized engineering societies, potential members.

We now have Provincial Divisions of *The Institute*. Why not make those Divisions the new bodies to be incorporated and afterwards consolidated under the present *Institute*?

The annual fees and methods of administration could remain the same as at present. It may be necessary to have a registration fee, but annual fees should not be paid to two different associations, as it would inevitably result in joining the one with lesser fees to the detriment of the other.

Yours truly,
Duncan MacPherson,
M.E.I.C.

Belgian Railway Electrification

A commission composed of several Belgian business men, engineers and heads of the Railway Department, with the engineers of the French State Railways and of the Midi Railway and Mr. Philip Dawson, was appointed in 1916 by M. Seghers, then the Minister of Railways, to investigate the advisability of electrifying the Belgian State Railways; and after several sittings had been held in Paris an interim report was issued advocating the electrification of a considerable portion of the lines.

When the Belgian Government was re-instated in its capital a new commission was appointed, with Baron Ancim as president and M. Mazin of the French State Railways, and Mr. Philip Dawson, as vice-presidents, to go over the work of the previous commission and to investigate not only the electrification of the railways, but also the problem of unifying the supply of electricity for all purposes all over the country. This commission has recommended the immediate preparation of a scheme for the electrification of the Brussels-Antwerp line and of the railways in the immediate neighborhood of Brussels, and its next task is to inquire into the question of co-ordinating existing electric supply undertakings and the erection of new super-power stations. — *The Times Engineering Supplement.*

Report of Council Meetings

The adjourned meeting of the Council was held at the headquarters of *The Institute* on Tuesday, June 3rd, at 8.15 P.M., when the following subjects were considered:—

Scientific and Industrial Research: A letter giving the opinion of Council, favouring the encouragement of research by the Dominion Government, prepared by Julian C. Smith and Professor Ernest Brown, in accordance with a request of the last meeting of Council, was approved, with slight changes. The Secretary was directed to forward the letter to Ottawa.

Revision of By-laws—Form "E": The Secretary submitted a draft of Form "E" as required by the revision of the by-laws, which was approved. The Secretary was instructed to send out an additional card and letter to all who had not subscribed to *The Journal.*

Civil Service Salaries: Communications from the Committee of the Ottawa Branch were read, outlining the situation and urging the attendance of a delegation from *The Institute* when the Bill should go forward. In response to this, Col. Leonard came to Montreal by way of Ottawa, spending a day in the interests of engineers in the Civil Service. He reported that the Bill was now being printed, but, inasmuch as the budget was being presented, the Bill would not likely come up for a week or more.

Dedication of Pittsburg Experiment Station: An invitation from the Bureau of Mines, Department of the Interior, to attend the dedication of the Pittsburg Experiment Station of the Bureau of Mines, was presented. The Secretary was instructed to ask members in Pittsburg to attend, as representatives of *The Institute.*

James Watt Centenary: An invitation to the President of *The Engineering Institute* to attend the James Watt Centenary, at Birmingham, was presented. President Leonard agreed to arrange to have one of our members residing in Great Britain attend.

Committee on Deterioration of Concrete in Alkali Soils: The appointment of C. G. MacKenzie to the Committee of *The Institute* investigating the deterioration of concrete in alkali soils was approved and note was made that the University of Saskatchewan had set aside one thousand ($1,000) dollars for this investigation.

Western Professional Meeting: A tentative programme for the Western Professional Meeting, submitted by the Secretary of the Edmonton Branch, was approved.

Maritime Professional Meeting: The suggestion of the St. John and Halifax Branches to hold the general professional meeting in St. John, on September 10th, 11th and 12th was approved. Note was made that both branches have committees investigating the subject of concrete in local sea water.

Bureau of Education, Washington: An invitation from the Chairman of the Conference Committee on Commercial Engineering to a conference on commercial engineering, to be held in the New Willard Hotel, Washington, was presented. The Secretary was instructed to write Eugene Stern, M.E.I.C., of New York, and after receiving suggestions, to forward them to the Chairman of the Conference.

Royal Commission on Industrial Relations: A letter was presented from the Secretary of the Halifax Branch suggesting that the Council arrange that engineers be represented before the Royal Commission on Industrial Relations. No action was taken.

Bureau of Municipal Research, New York: Note was made that R. A. Ross, M.E.I.C., had been appointed a member of an advisory committee of the Bureau of Municipal Research, New York.

Canadian Engineering Standards Assoc'n: A suggested letter to be sent out to the corporate and junior members of *The Institute,* on behalf of the Canadian Engineering Standards Association, was approved and the Secretary authorized to have the same sent out as arranged between himself and the Secretary of the Standards Association.

The late Ernest Marceau: In recording the death of Mr. Ernest Marceau, it was resolved to place on record the loss sustained by *The Institute* in the death of Mr. Marceau who had occupied so prominent a place in the engineering profession of Canada and in the activities of *The Institute.* The Secretary's action in forwarding a wreath in the name of the President and the Council, was approved. It was resolved that a letter of sympathy be forwarded to Mr. Marceau's family.

Legislation—form of ballot: The Pro and Con circular submitted by the committee of Council was approved and the Secretary instructed to send it, together with the letter of the committee and a ballot asking the question "Are you in favour of legislation along the lines proposed in the act published in the May issue of *The Journal,* as prepared by the special committee of *The Institute?*".

Summer Meetings of Council: Owing to the Secretary's proposed absence it was decided that no regular meeting of the Council be held in June and until his return, except for the purposes of opening the ballot.

Finances: The financial situation was discussed. The Secretary presented a statement showing the collections and overhead expenses, which indicated that additional revenue would be required to finance *The Institute* during the current year, unless a greater proportion of arrears of dues are paid. It was decided that the Finance Committee be authorized to make arrangements, if necessary, and the Secretary was instructed to prepare a letter to be sent out to all delinquents.

Miscellaneous: Note was made of considerable correspondence dealing with miscellaneous matters.

Ballot: A ballot was canvassed and the following declared elected:—

Members.

Robert Archer Baldwin, of Toronto, Ont., asst. engr., C.N.R., Richard Lafontaine Haycock, of Ottawa, Ont., B.Sc. (M.E.), McGill Univ., General Supply Company, William Robert Carnac Morris (M.I.C.E.), of Vernon, B.C., since 1915 on munition inspection, Imperial Min. of Munitions, Montreal, Herbert Phillips, of St. John, N.B., div. engr., St. John & Que. Ry., William Nelson Smith, M.E., Cornell Univ., of Winnipeg, Man., consulting elec. engr., Winnipeg Elec. Ry., James W. Tyrell, of Hamilton, Ont., general engineering work.

Associate Members.

Harold Ernest Radclyffe Barnes, A.M.I.M.E., of Dartmouth, N.S., civilian foreman, i/c of gen. constr. works, M. D. Dept., Royal Engrs., 3rd Div. Officer, M.D. 6, Halifax, N.S., George Claxton, of Shawinigan Falls, Que., i/c of constr. and designing, Belgo Pulp & Paper Co., Allan David Watt Cuthbert, of New Glasgow, N.S., sr. transitman, Can. Nat. Rys., James McNaughton Davidson, of Winnipeg, Man., res. engr., Can. Nat. Rys., Cecil Earle Joslyn, B.Sc., Queen's Univ., of Ottawa, Ont., inspector of shell components, Im. Min. of Munitions, Thomas Kearney, B.Sc., B.E., asst. engr., Can. Nat. Rys., Thomas Halder Kirby, B.Sc. (C.E.), McGill Univ., of Winnipeg, Man., asst. engr., Greater Winnipeg Water District, David Kyle, M.E., of Sault Ste. Marie, Ont., Vice-Pres., i/c of operations, Algoma Steel Corp., Joseph Honore Landry, B.A., B.Sc. (C.E.), Laval Univ., of Montreal, sr. asst. engr., P.W.D., Sidney Guy MacDermot, B.Sc., McGill Univ., of Montreal, supt. i/c mechanical and electrical depts., Canadian Johns Manville Co. (Montreal Branch); Peter James MacDonald, of Swift Current, Sask., member of firm, Martyn and MacDonald, consulting engineers, Thomas Douglas Mylrea, B.Sc. (C.E.), Univ. of Ill., ch. engr., Trussed Concrete Steel Co., Toronto, Frederick Thomas Nichol, B.A.Sc., of Toronto, Ont., engr., Archibald & Holmes, Ltd., John Henry Porter, of Hamilton, Ont., designing engr. and estimator, Hamilton Bridge Works Co.; Hugh Goffen Randlesome, of Vancouver, B.C., Lieutenant Canadian Engineers, prior to enlistment, in charge of party, Government Water Rights, Sydney Frank Ricketts, E.E., of Winnipeg, Man., apparatus sales engineer and asst. manager, Canadian General Electric, Winnipeg District, Ernest LeRoy Tait, of New Westminster, B.C., acting engineer of construction and way, B.C. Electric Ry., Leonard Thomas Venney, B.A.Sc., Univ. of Tor., D.L.S., of Windsor, Ont., Canadian Steel Corp., Ojibway, Ont, James Howard Wheatley, B.Sc. (M.E.), McGill Univ., of Westmount, Que., 2 years (1916-18), with British Munitions Co., Verdun, Que., at present unemployed.

Juniors.

Charles Sydney Creighton, B.Sc., (C.E.) Transitman for R. W. McKenzie, Crown Land Surveyor. Atlee James, Transitman, C. P. R., Location Party, Wymark, Sask. Harry W. Patterson, engaged by Owen McKay at Walkerville, Ford and Sandwich in various capacities.

Transferred from Associate Member to Member.

John Davidson Craig, B.A., B.Sc., D.L.S., Engr. with Internat. Boundary Comm., Ottawa, Ont., Ross Leonard Dobbin, B.A.Sc., in full charge of water supply and design, Peterboro Utilities Comm., Peterboro, Ont. William Flockhart Drysdale, B.Sc., Special Engr., Representative in Europe, American Loco Sales Corp., Paris, France. Ernest Vivian Moore, B.Sc., Consl. Engr., Peat Committee of the Ont. and Dom. Govts., Montreal. Emil Andrew Wallberg, C.E., Engr., designer and owner of Hydro Electric Plants, Toronto, Ont.

Transferred from Junior to Associate Member.

William Dalziel, B.Sc., Mechanical Supt., Caron Bros., Longue Pointe. Lawrence James Devereux, Res. Engr., i/c Constn. and Maintenance at different western points, Edson, Alta., Donald Francis McIsaac, B.A.Sc., Engineer, Dominion Iron & Steel Co., Sydney, N.S. Walter Corning McLaren, res. engr., C.N.R. & H. & S.F. Railway, Toronto, Ont. John Evans Milne, Municipal engineer, Corp. of Burnaby, Edmonds, B.C. Stuart Erskine Oliver, B.Sc. (C.E.), res. engr. Quebec & Saguenay Ry., Quebec. John Strachan, Jr., Hudson Bay Junction, Sask. Stanley Roy Turner, B.Sc., engineer, William Hamilton Co., Peterborough, Ont.

Transferred from Student to Associate Member.

Louis Joseph Gustave Boisseau, B.A.Sc., Supvr. of Constn., of Lake Burle Storage Dam, Montreal. Geo. Oliver Thorne, B.Sc., (C.E.), Saskatoon, Sask., awaiting discharge.

Transferred from Student to Junior.

Chas. Albert Boulton, B.Sc., Murphy & Underwood, Consulting Engrs., Saskatoon. William James LeClair, Ottawa, Ont. Harry Elsmere McCrudden, B.Sc., Assistant Director Representative, Soldiers' Civil Re-Establishment, Montreal. Edwin Harry Scott, B.A.Sc., Canadian National Railways, Toronto, Ont. Jack Northmore Williams, B.A.Sc., Foundation Company, Limited, Montreal.

A second adjourned meeting of the Council was held at the headquarters of *The Institute*, on Monday, June 9th.

A.S.M.E. Summer Meeting: Owing to the inability of General Bertram to attend the summer meeting of the American Society of Mechanical Engineers to be held in Detroit, June 16th-19th, in response to an invitation from President Cooley, it was decided that the Chairman of the Border Cities Branch be asked to represent *The Institute*, together with the Secretary, who had planned to go west via Detroit and St. Paul.

Classifications: Classifications were made for a ballot returnable in July.

In accordance with the ruling of the last meeting of Council that no regular meeting be held in the month of June, owing to the Secretary's absence, except for the purpose of opening the ballot for the election of members, the local Members of Council met at headquarters on Tuesday, June 24th at 5 o'clock. The ballot was canvassed and the following declared elected:—

Members.

Watson Lanley Bishop, of Dartmouth, N.S., District Engineer of Highways, Province of Nova Scotia; Thomas Fawcett, D.L.S., D.T.S., O.L.S., of Ottawa, Ont., engineer in charge of Boundary Commission.

Associate Members.

Charles Louis Arcand, of Three Rivers, Que., assistant to District Engineer, Department of Public Works; James G. Campbell, of Windsor Ont., structural engineer, Canadian Steel Corpn., Ojibway; Donald John Fraser, B.A. (Queen's Univ.), D.L.S., of Ottawa, Ont., with

Geodetic Survey of Canada; John William Macleod, B.A., M.A. (St. Francois Xavier Univ.), B.Sc. (McGill Univ.), Director and Secretary, Greenwood Coal Co.; Ralph Clinton Purser, B.A.Sc. (Univ. of Toronto), of Ottawa, Ont., chief on Dominion Land Surveying field work; Edward Green Richards, of Edmonton, Alta., since 1917 with Canadian Railway Troops, France, 2nd in command of "A" Co.; William John Shaw, Jr., of St. Thomas, Ont., Divisional Engineer, Michigan Central Rly.; Phillip Sherrin, of Ottawa, Ont., Supt. Engr., Dept. of Nat. Resources, Intelligence Branch; Barry Wilson, of St. John, N.B., city electrician.

Associate.

Gerald Moffat Christie, D.L.S., B.C.L.S., of Kamloops, B.C., since 1914, engaged in making surveys of right-of-way for C.N.R., through B.C.

Juniors.

Herbert James Freeman, Lieut., of Halifax, N.S., on active service since 1914. At present instructor in England; Percy W. Freeman, of Halifax, N.S., enlisted in 1914, gazetted Captain in March, 1918, awaiting demobilization; John Bevan Walcot, of Montreal, with Can. Engrs., C.E.F., during 1918, since Jan. 1919, with Walter J. Francis & Co.

For Transfer from the Class of Associate Member to Member.

Thomas Richardson Loudon, B.A.Sc. (Univ. of Toronto), of Victoria, B.C., since May, 1916, Major with C.E.F., 2nd in Command, 1st Batt., Ry. Troops, at present, C.R.C.E., Mil. Dist. No. 11; George Albert McCubbin, O.L.S., of Chatham, Ont., municipal engr., for Lambton County; Lesslie R. Thomson, B.A.Sc. (Univ. of Toronto), of Montreal, Que., Secretary, Lignite Utilization Board of Canada; Harvey Thorne, B.A. (Dalhousie Univ.), B.A.Sc. (McGill Univ.), on engineering staff of Canadian Steel Corpn., Ojibway, Ont.

For Transfer from the Class of Junior to Associate Member.

Joseph Marie Hector Cimon, B.A.Sc. (Laval Univ.), of Quebec, Que., engineer for Price Bros. & Co.; Robert D. Innes, of Woodman's Point, N.B., supt., N.S. Construction Co., Halifax.

SPECIAL NOTICE

Civil Service

The Ottawa Branch has sent the following notice to the Branch Membership:—

Members of *The Institute* who are affected by the new classification of the Civil Service are asked to note the information given to the Press as follows: That all suggestions or objections in reference to the classification should be made in writing to the Civil Service Commission through the Head of the Branch or Deputy Minister of the Department.

Particulars of any evident omissions or inconsistancies in the classification as they affect engineers should also be sent to the Secretary of the Ottawa Branch for transmission to the Committee of Council which has been in touch with the Government and has endeavoured to safeguard the interests of the engineers.

BRANCH NEWS

Halifax Branch

Frederick R. Faulkner, M.E.I.C., Sec'y.-Treas.

The regular monthly meeting of the Halifax Branch was held at the Green Lantern on Wednesday evening, June 4th. Following the custom inaugurated this spring, this was a supper meeting.

No papers were presented and the evening was devoted to an informal discussion of the proposed legislation. No objections were offered to the general principles of the Bill and the discussion was entirely on the details. As a result two resolutions were passed, to be transmitted to the Council and to be published in *The Journal.*

Moved by F. W. W. Doane, M.E.I.C., and seconded by F. P. Jennings, A.M.E.I.C.,—That this meeting of the Halifax Branch of *The Engineering Institute of Canada* does hereby endorse the general principles of the proposed act respecting the Engineering Profession, but is of the opinion that after the Act is approved by *The Institute,* another general meeting of the Branch should be called to further consider the details of the Act before submitting the Proposed Act to the local legislature.

Moved by W. P. Morrison, M.E.I.C., seconded by F. W. W. Doane, M.E.I.C.,—That when the local executive receives notice from the Council that the Proposed Act has been accepted by *The Institute,* the executive committee send out notices to this effect to the members of the Branch, requesting them to forward to the secretary of the Branch, any recommendation or objections they wish to make in connection with the details of the Bill and that a general meeting of the Branch be called to discuss these recommendations and objections before the act is submitted to the local Legislature.

Montreal Branch

Frederick B. Brown, Sec'y.-Treas.

Banquet to Brigadier General Charles Hamilton Mitchell, C.B., C.M.G., D.S.O.

The event of the season in Montreal Branch activities was the banquet held at the Ritz Carlton Hotel on June 12th, in honor of Brigadier-General Charles Hamilton Mitchell, C.B., C.M.G., D.S.O.,etc., "on the occasion of his return to civil life, after distinguished service with the Allies during the Great War, and upon assuming the Deanship of the Faculty of Applied Science and Engineering of the University of Toronto."

General Mitchell only arrived in Halifax the day before the banquet, yet by means of wireless and telegraph, his approval of the arrangement had been obtained. The banquet was a great success and the Montreal Branch are to be congratulated on the completeness of their arrangements. A beautifully engraved four leaf menu card was provided, the first two pages of which, reduced to about one third size, are reproduced on the next page.

There was a large assembly of engineers to welcome General Mitchell, including many of the leading men of the profession. The chair was taken by Walter J. Francis, M.E.I.C., President of the Montreal Branch, and with him at the table of honor were General Mitchell; Sir John Kennedy, Hon. M.E.I.C.; Dean Moyse, of the Arts Faculty, McGill University; Lt.-Col. Arthur E. Dubuc, D.S.O., M.E.I.C.; M. H. Ponsot, French Consul-General; J. M. Robertson, M.E.I.C.; Mgr Choquette; Dr. W. H. Ellis, M.E.I.C., Toronto University; Controller R. A. Ross, M.E.I.C.; W. F. Tye, M.E.I.C., and P. H. Mitchell, A.M.E.I.C.

The other members and friends present were as follows:—

Bertram Sir Alexander, M.E.I.C.
Bickerdike, Lt.-Col. Robert, M.E.I.C.
Blaiklock, M. S., M.E.I.C.
Brown, E., M.E.I.C.
Brown, Frederick B., M.E.I.C.
Burgoyne, St. George.
Busfield, J. L., A.M.E.I.C.

Cameron, N.C., A.M.E.I.C.
Campbell, Norman M., A.M.E.I.C.
Caron, J. G., S.E.I.C.
Chadwick, R. F. C., A.M.E.I.C.
Challies, J. B., M.E.I.C.
Cowie, Frederick W., M.E.I.C.
Crandall, C. F.

Dickson, G. W.
Doucet, A. E., M.E.I.C.
Duchastel, J., M.E.I.C.
Duggan, G. H., M.E.I.C.
Dundass, C. S.

Fairbairn, J. M. R., M.E.I.C.
Fairlie, H. W.
Farmer, John T., A.M.E.I.C.
Flegg, R. L.
Fortin, S., M.E.I.C.

Ghysens, A., A.M.E.I.C.
Goad, V. A. E.

Hannaford, R. M., M.E.I.C.
Harkness, A. L., A.M.E.I.C.
Henry, A. R., M.E.I.C.
Herdt, L. A., M.E.I.C.
Howard, Major Stuart, M.E.I.C.

Jamieson, J. A., M.E.I.C.
Johnston, H. C.

Keith, Fraser S., A.M.E.I.C., Secretary, The Engineering Institute of Canada.
Kendall, G. R., M.E.I.C.
Kennedy, Wm. Jr., M.E.I.C.
Kipp, L. F.

Lash, N. M.
Lea, R. S., M.E.I.C.
Lefebvre, O., A.M.E.I.C.
Lemont, Arthur.
Leluau, C., M.E.I.C.

Macdougall, A. C.
MacKay, H. M., M.E.I.C.
MacKinnon, W. C.
Mackenzie, A. M.
MacLeod, G. R., M.E.I.C.
MacVicar, Norman.
Marshall, S. A.
Massue, H, A.M.E.I.C.
McKechnie, F. H., A.M.E.I.C.
McKergow, C. M., A.M.E.I.C.
McLeod, C. K., Jr. E.I.C.

Nares, B. L., Jr. E.I.C.
Nicholson, Dr. J. A.

Palmer, C. E.
Palmer, E. D.
Papineau, L. G., A.M.E.I.C.
Pearce, K. K., A.M.E.I.C.
Peden, Alex., A.M.E.I.C.
Pelletier, Georges.
Porter, John Bonsall, M.E.I.C.

Reynolds, G. B.
Roberts, J. R., A.M.E.I.C.
Rolph, H., A.M.E.I.C.
Ross, J. G.
Ruttan, Dr. R. F.

Seton, B. W., Jr. E.I.C.
Seurot, Paul A. N., M.E.I.C.
Shearwood, F. P., M.E.I.C.
Simard, J. W., A.M.E.I.C.

Banquet
in Honour of
Brig.-Gen. Charles Hamilton Mitchell
C.B., C.M.G., D.S.O.
Consulting Engineer
on the occasion of his return to civil life after distinguished service with the Allies throughout the Great War and upon assuming the Deanship of the Faculty of Applied Science and Engineering of the University of Toronto

Given at Montreal
June 12th 1919.
by
The Members of the Montreal Branch of the Engineering Institute of Canada and other Friends in the Engineering Profession

Charles Hamilton Mitchell
Brigadier General
Companion of the Bath
Companion of the Order of St. Michael and St. George
Companion of the Distinguished Service Order
Officier de la Légion d'Honneur
Officier de l'Ordre de Léopold
Croix de Guerre de Belgique
Cavaliere Ufficiale della Corona d'Italia
Croce di Guerra

de Sola, C. I.
Squire, G. E.
Steenbuch, H. L., A.M.E.I.C.
Stephen, Chas., A.M.E.I.C.
St. George, P. W., M.E.I.C.
Surveyer, Arthur, M.E.I.C.
Sutherland, Wm. H., A.M.E.I.C.

Tarte, E.
Tennant, D. C., M.E.I.C.

Thornton, K. B., A.M.E.I.C.
Turley, E. J, A.M.E.I.C.

Vaughan, H. H., M.E.I.C.
Walker, R. Marshall, Jr. E.I.C.
Watson, J. P., Jr. E.I.C.
White, H. M.
Williamson, F. Stuart, M.E.I.C.
Wilson, L. R.
Wright, L. A., Jr. E.I.C.
Zunini, Chevalier.

The toast to "Our Guest" was proposed by Walter J. Francis, M.E.I.C., Chairman, who touched upon the earlier work of General Mitchell as a student and engineer, remarking that the whole course of his life had been marked by two watchwords, *duty* and *service*, which he had carried to such conspicuous success during his years at the front with both the Canadian Corps and the Imperial Army.

General Mitchell, when he rose to reply, was greeted with prolonged cheers. It was, he said, a surprise and delight to him to meet so many of his old colleagues of the engineering profession immediately after his return from years of service overseas. This was singularly appropriate, since it was the engineering profession that had carried the great burdens of the war, and to a large extent made its victorious end possible.

General Mitchell, in personal vein, said that for years before the war he had studied problems in connection with the intelligence branch of the work, and the result was that he concluded in time of peace it was a truly patriotic duty to study the possible problems and emergencies of war. "I consider that the studies I made long before the war were not lost, and my experiences at the front showed me their value, in the assistance they gave to my work," he said.

In this connection General Mitchell paid a tribute to the general efficiency and expert knowledge of the British staff officers wherever he had served, declaring that some of the aspersions cast upon them were entirely unfounded.

He, however, pointed out that at the beginning of the war the enemy had been almost uncannily equipped in its intelligence work, learning in apparently mysterious ways everything the British were doing. Later it was found how they used electrical listening devices and other equipment to collect the British signals. The British engineers discovered these, and eventually beat the Germans at their own game, not only on land, but in the air, so that in the final operations the enemy could not do anything or plan anything without the British knowing and preparing for it.

In this work, he said, the Canadians would have a lasting place in the history of the war for the manner in which they devised the plan of raids to secure evidence of what the enemy was planning, and some of his instances of this were rather grim, especially the collection of information from the dead during these raids.

His description of his own work, as intelligence officer, 20 miles behind the lines, at the end of a field telephone, in a battle of wits with a German intelligence officer doing the same thing 20 miles back of their lines, gave a graphic idea of the manner in which information was collected and collated, so that enemy plans could be defeated, and our own attacks made with success.

In concluding General Mitchell gave an account of the operations in which he served with the Allies on the Piave front, leading to the overwhelming defeat of the Austrians and Germans there.

"Now," he said, "I am going to my next war, to resume my duties and work as a civilian, at Toronto University, and I hope, with the assistance of my old friends there, that I shall succeed."

General Mitchell attended in uniform, the rows of ribbon on his breast showing the many honors he had won on various European battlefields.

A full account of General Mitchell's remarkable military career appeared in Volume II, No. 5 of *The Journal.*

St. John Branch

A. R. Crookshank, M.E.I.C., Secretary.

The St. John and Halifax Branch committess have started active work in preparation for the General Professional Meeting to be held in St. John on Sept. 10th, 11th, and 12th, and the tentative programme promises an interesting and enjoyable time for all who attend.

A committee of the Halifax Branch, under the convenership of A. F. Dyer, A.M.E.I.C., is working in conjunction with our committee, under chairmanship of A. Gray, M.E.I.C., in the study of the subject of concrete in sea water, and it is hoped that they will be able to give some interesting and instructive information in regard to the behaviour of concrete in local waters at the meeting next fall.

The employment bureau under the leadership of G. N. Hatfield, A.M.E.I.C., has been doing effective work, in close co-operation with the Soldier's Civil Re-establishment and the Dominion Provincial Labour Bureaus. A circular letter was sent to the employers of engineers in this Province telling of the formation of our Bureau, offering its services and asking for their co-operation. The colleges were also notified and a number of engineering students have been placed in positions. The Branch requests the co-operation of the New Brunswick members, and asks thay they notify Mr. Hatfield, City Hall, St. John, when they hear of any vacancies in engineering positions. Applications for assistance in obtaining employment should also be addressed to him. Nearly all the Branches have offered to co-operate with our Bureau and it is hoped that in time through close organization, and with clearing house at Headquarters, this line of activity will prove most useful to the engineers of Canada. In this connection, the publishing of the up-to-date record of each member in the Year Book would be of material service to the Employment Committees.

The committee appointed to ascertain the salaries and fees received by *The Institute* members in New

Brunswick, so that minimum schedules may be drawn up later, has started work, and hopes to report at the first fall meeting.

The addition of a department of Vocational Training in connection with the High School of the City of St. John is being advocated, and the Branch has appointed representatives to the Committee backing this project.

The last meeting of the Branch was held in the laboratory of Frank P. Vaughan, A.M.E.I.C., who read an interesting paper on Experiments with High Potential High Frequency Electric Currents, and gave a spectacular demonstration of the wonderful effects that can be produced with these currents.

Mr. Vaughan, who is the pioneer in this district in wireless telephony and telegraphy experiments, has built a very complete set of high tension electrical experimental apparatus, the equivalent of which it would be hard to find in Canada. The ordinary 110 volt current of 60 cycles, or 120 frequency, is stepped up by his machines to a maximum of over half a million volts, with a frequency of over one million impulses or vibrations per second. With this apparatus anything in the line of wireless telegraphy and telephony, X-Ray work, therapeutic treatments, and separation of mixed gases as is now being used commercially in the metal industries, is possible.

In 1906, Mr. Vaughan talked by wireless to Partridge Island, three miles away, but as it was found necessary to use damped oscillations with his apparatus, and these would not allow of a high enough spark frequency to give uniform satisfactory results, it was limited to laboratory use. It was not until the discovery of the so-called *valve* in recent years, that allowed the use of undamped oscillations, that wireless telephony became commercially successful.

Among the number of interesting experiments shown was the burning of a 32 candlepower lamp, while held in the hand, the current passing through the body, the wire from the central terminal being held several inches from the machine. Also the passing of a current of electrical sparks from six to eight inches long, requiring a current of up to three-quarters of an ampere with a pressure of from 250,000 to 300,000 volts; the momentary dissipation of energy being at the rate of 500 to 600 horsepower. When it is taken into consideration that only one-tenth ampere at 2,300 volts, at ordinary frequency, is used in the execution of criminals in the United States, the difference between the low and high frequency currents is manifest. Suggested reasons for this partial immunization is that the latter currents tend to remain on the surface of an object, and that the rate of vibration is beyond the capacity of the nerves to respond to. Mr. Vaughan plans on repeating the demonstration at the General Professional Meeting next fall.

At a previous meeting another interesting paper was read by G. S. Macdonald, A.M.E.I.C., Resident Engineer of the Marine & Fisheries Department in this district, on Aids to Navigation in New Brunswick Waters. Mr. Macdonald described the different types of lighthouses, foghorns and buoys, and dealt with the development of the various oil and acetylene burning lamps, with different types of lens, prisms and reflectors attached to both the stationary and flashing lamps. There were, he said, three types of foghorns, the old fashioned steam whistle; the trumpet type, operated by a stream of air acting on a vibratory lip; and the new diaphone type operated by a rapid series of gusts of air blown through slots in the inner circumference of the horn. The diaphone can be heard several miles farther than the other types of the same size. By use of gasoline or oil engines and air compressors, the cost of foghorn operation has been reduced to about one-sixth the cost of the steam whistle.

A marked improvement in buoys has taken place in recent years. Many are lighted by acetylene generated from carbide, but the latest types are operated by compressed gas in cylinders, and will burn for over a year without attention. Some of these are now equipped with light operated automatic valves which shut off the main light during the daylight period, leaving only the small pilot flame burning.

An interesting discussion on the behaviour of the concrete of the various structures described by Mr. Macdonald brought the meeting to a close.

Toronto Branch

W. S. Harvey, A.M.E.I.C., Sec'y-Treas.

A special general meeting of the Toronto Branch was held in the lecture room of the Engineers' Club on June 12th. This meeting was called by special request from several of the younger members of the Branch to continue the discussion of the Draft Bill of the proposed legislation.

Clause 7 (i), dealing with assistants working under a professional engineer, appeared to be the principal clause in the Bill to which objection was taken. J. C. Krumm, A.M.E.I.C., expressed the view that if the Bill were passed with Clause 7 (i) in its present wording it would mean that all engineers other than chiefs of departments would not be considered as professional engineers. H. A. Goldman, Jr. E.I.C., stated that Clause 7 (i) has been defended by some engineers on the ground that other professions do not require assistants to be professional men. He argued such defence cannot be admitted, the very nature of the engineering profession and the magnitude of the engineering organizations not permitting it to be handled in the same way as, for instance, the legal or medical professions. It must be realized that the engineering profession differs from the others in this respect, that while the great majority in the case of the other professions are in private practice dealing directly with the public, in engineering, the great majority are salaried men reporting to superiors and, therefore, any Bill passed on behalf of engineers should be to the benefit of the majority. He believed that in the future greater recognition will have to be given by our engineering societies to the salaried engineer than has been the case in the past. He drew attention to the fact that even the code of ethics of *The Engineering Institute* does not contain a single clause which would apply to a salaried engineer. This was the opinion of those who took part in the discussion.

Frank Barber, A.M.E.I.C., thought that the Bill in its present form does not exclude all salaried engineers from becoming professional engineers.

Willis Chipman, M.E.I.C., read several letters from the members of the Legislation Committee stating that young graduates cannot expect to be considered professional engineers immediately upon graduation. E. T. Wilkie, M.E.I.C., believed that the Committee deserved considerable credit for drafting this Bill, and is of the opinion that it should be supported.

It was moved by J. C. N. B. Krumm, A.M.E.I.C., seconded by Frank Barber, A.M.E.I.C., and carried—"that a committee of five members be elected to carefully consider the Draft Bill, in detail, and to submit recommendations at a general meeting to be called at a later date for that purpose; the committee to meet weekly." The following members were nominated to this committee:—W. Chipman, M.E.I.C., convener; Professor H. E. T. Haultain, M.E.I.C., T. H. Hogg, A.M.E.I.C., J. C. N. B. Krumm, A.M.E.I.C., and H. A. Goldman, Jr. E.I.C.

* * *

Brigadier General Charles Hamilton Mitchell, C.B., C.M.G., D.S.O., after a most distinguished career in France and Italy, having returned to Toronto, was entertained at an informal dinner by the Engineers' Club and *The Engineering Institute of Canada* on the 17th instant, and was given a very hearty welcome home.

* * *

An employment bureau has been appointed in connection with this Branch for the purpose of bringing the members in touch with vacancies in the engineering profession and to assist engineers seeking advancement. The members are asked to notify the Secretary of The Employment Bureau Committee of any vacancies or possible vacancies which come to their notice.

Hamilton Branch

C. F. Whitton, A.M.E.I.C., Sec'y.-Treas.

The Annual Meeting of the Hamilton Branch was held on May 30th. Though one of the newer Branches of *The Institute*, it is nevertheless in a very flourishing condition. The officers elected for the coming year are as follows:—

Chairman	R. K. Palmer, M.E.I.C.
Sec'y.-Treas	C. F. Whitton, A.M.E.I.C.
Executive	E. H. Darling, M.E.I.C.
	J. A. McFarlane, A.M.E.I.C.

Niagara Peninsula Branch

R. P. Johnson, S.E.I.C., Sec'y.-Treas.

A meeting was held at the Engineers' Club, Thorold, on June 12th, 1919, for the purpose of discussing the Act Respecting the Engineering Profession prepared by the Special Legislation Committee, when E. R. Gray, A.M.E.I.C., Chairman of the Hamilton Branch and member of the Special Legislation Committee, outlined the history and context of the Draft Bill. Mr. Gray told of the work of the Special Legislation Committee and of some of the problems confronting them. He explained that the Committee had considered that it would be necessary to form an association of engineers in each province in order to administer the Act in an impartial manner, these provincial associations to be in no way connected with *The Engineering Institute.* This scheme was considered necessary in order to obtain the co-operation of The Canadian Mining Institute and other technical bodies in Canada.

The Draft Bill was then gone over by Mr. Gray, clause by clause, and various points explained and discussed in order of occurrence as follows:—

Section (7)—Clause (e):—

In view of the fact that each provincial association would be at liberty to revise the draft, or any other bill, the question arose as to whether one provincial association might exclude engineers of another provincial association. After some discussion it was decided that there was no way to prevent this, but the consensus of opinion was that this would be so manifestly injurious to the profession that no such situation would ever arise.

Section (7)—Clause (f):—

This concerns American and foreign engineers employed or practicing in Canada.

Some members thought that all foreign engineers should not be excluded from Canada and that, in some cases, it would be extremely difficult to do this, as for instance, the M.C.R. engineers with headquarters at St. Thomas, Ont.

The opinion was expressed that this clause would react upon Canadian engineers in the States. The opinion was expressed that clause (i)—Section (7), left the junior field open to foreign engineers in Canada as it proposed that the act should apply only to chief engineers, consulting engineers and engineers in private practice.

The question arose as to the meaning of the term *resident* as used in the clause.

The acting chairman called for a show of hands as to whether the clause was satisfactory as it stood or should be amended. Four members expressed satisfaction with the clause as drafted. The large majority of those present believed that the term *resident* must be defined before the meaning of the clause is clear.

Section (7)—Clause (i):—

This clause, concerning those to whom the act should apply, provoked considerable discussion and dissatisfaction.

Almost unanimous exception was taken to the clause on account of the narrow application of those to whom the act would apply. As it stands, the clause makes the bill apply to only chief engineers, consulting engineers and engineers in private practice.

The point was made that all members of any one provincial association should come within the application of the Bill.

It was the opinion of the majority of those present that the meaning which was manifestly conveyed in the clause was not intended by the committee which drew the Bill and this belief was confirmed when Mr. Gray explained that the clause was designed only for the purpose of providing that extreme juniors, such as rodmen and chainmen, might be employed on an engineering staff without the necessity of taking membership in the provincial association of engineers.

The suggestion was made that the word *responsibility* used in the clause should be defined and that the difficulty would then be cleared up.

Some members thought that the clause under discussion conflicted with clause (b)—Section 2. The latter set forth the qualifications required of a professional engineer and the former set severe limitations upon those who should be legally constituted professional engineers and is based upon position rather than qualifications.

The suggestion was made that those not intended to come under the Bill should be defined but it was pointed out by Mr. Gray that this would be extremely difficult on account of the great variety of the minor engineering employees.

Some members thought that the clause would be satisfactory if the following words were eliminated :—"other than to their direct superiors."

It was, however, moved by E. P. Johnson, A.M.E.I.C., seconded by F. S. Lazier, A.M.E.I.C., and carried, that:—"in the opinion of the Niagara Peninsula Branch of *The Engineering Institute of Canada* clause (*i*) of Section (7) should be struck out of the Bill."

Saskatchewan Branch

J. N. deStein, M.E.I.C., Sec'y.-Treas.

The third Annual Summer Meeting of the Saskatchewan Branch was held on Saturday, June 21st, at Regina, the preceeding two meetings having taken place at Moose Jaw (1917), and Saskatoon (1918). The date was set this year to coincide with the promised visit of Brigadier General Sir Alexander Bertram, K.B., M.E.I.C., and our members were very disappointed to hear that General Bertram was prevented from joining our General Secretary, Fraser S. Keith, A.M.E.I.C., on his Western trip.

Our Branch has had the privilege of welcoming Mr. Keith at every one of our summer meetings, and the reception committee was present at the station this year, and gave Mr. Keith a very hearty welcome. A luncheon at the Parliament Buildings opened the programme for the day which was followed by an inspection of the buildings, and later by a visit to the Imperial Oil Company's plant, the City power house, and other places of interest. A dinner was served in the evening at which a large number of members were present. Among the guests of the evening were, Hon. W. M. Martin, Premier of Saskatchewan; Col. J. A. Cross, D.S.O., O.C., M.D. No. 12; Col. J. L. R. Parsons, C.M.G., D.S.O., etc; and D. M. Balfour, President of the local Board of Trade. The dinner was followed by a short business meeting, after which a number of the guests delivered addresses.

The Hon. W. M. Martin spoke on proposed legislation and stated that he could not see any reason why engineers should not be protected by legislation, and promised the earnest consideration of his government whenever we deemed it expedient to approach them in this matter.

Mr. Keith gave a short outline of the activities of *The Institute* and of its splendid organization, which is being taken as a model in other countries, and expressed great satisfaction that the government of this Province recognizes the services of the engineer. He also spoke on the subjects of legislation, remuneration and the strained relations existing between capital and labor, and expressed his belief that the engineer is, by virtue of his training, pre-eminently fitted to settle this dispute.

Colonel Cross urged that immediate steps be taken for the betterment of the profession, which he described as one of the most valuable national assets. He was anxious, he said, to see Saskatchewan develop from a shipper of raw material to a manufacturing province, which could be done with the co-operation of the engineering profession.

Colonel Parsons dwelt upon the work done by the Canadian Engineers in the overseas corps, and the great and valuable assistance given by them to the Allies.

Mr. Balfour then addressed the meeting and promised the hearty co-operation of the Board of Trade.

The Chairman, H. S. Carpenter, A.M.E.I.C., extended a hearty welcome home from overseas to Major A. J. McPherson, A.M.E.I.C., Major W. T. Daniel, A.M.E.I.C., Captain R. H. Murray, A.M.E.I.C., Captain H. J. McBean, A.M.E.I.C., and Lieut. Wm. Longworthy, S.E.I.C.

Calgary Branch

C. M. Arnold, M.E.I.C., Sec'y.-Treas.

A meeting of the Executive Committee was held at the Board of Trade rooms at 8.30 P.M., on May 8th, 1919.

The tentative programme of the summer meeting at Edmonton was read by G. N. Houston, M.E.I.C., and was then discussed. It was decided to appoint a committee consisting of G. W. Craig, M.E.I.C., G. N. Houston, M.E.I.C., and C. M. Arnold, M.E.I.C., to act in conjunction with the Edmonton Branch in arranging the final programme. On the suggestion of A. S. Dawson, M.E.I.C., it was arranged to send invitations to the Mining Institute and other allied organizations, and on the suggestion of F. H. Peters, M.E.I.C., the meeting decided to extend an invitation to Sir Alexander Bertram, who would be present at the meeting, to give an address. C. M. Arnold, M.E.I.C., suggested that a paper bearing on the economic side of Irrigation would be of particular interest at the present moment in view of the prevalent skepticism regarding its benefits. The special committee was asked to deal with these matters when considering the final programme.

* * *

A general meeting of the Branch was held on May 15th, 1919, at the Board of Trade rooms, when a very interesting paper was contributed by G. W. Craig, M.E.I.C., and A. S. Chapman, A.M.E.I.C., dealing with the latest developments in Sewage Disposal and was followed by an active discussion.

Vancouver Branch

A. G. Dalzell, A.M.E.I.C., Sec'y-Treas.

The following members were elected to the offices noted at the Annual Meeting:—Chairman, E. G. Matheson; Vice-Chairman, Newton J. Ker; Secretary-Treasurer, A. G. Dalzell; Acting Secretary-Treasurer, C. Brakenridge; Executive Committee, C. Brakenridge, Major W. G. Swan, D.S.O., Major G. A. Walkem, Wm. Anderson.

The following resolution was passed at our last general meeting on Friday, June 13th:—

"At a well attended gathering of professional engineers called by the Executive Committee of the Vancouver Branch of *The Engineering Institute of Canada*, formerly known as the Canadian Society of Civil Engineers, to discuss the attitude to be adopted by the Vancouver Branch in reference to the present industrial situation, the following resolution was heartily endorsed:—

'We, the members of the Vancouver Branch of *The Engineering Institute of Canada* absolutely condemn the sympathetic strike now in progress in the city of Vancouver as being opposed to the true interests of the labouring men, as being opposed to to all the teachings of true unionism and as being absolutely antagonistic to the best interests of the community and that we as a body do pledge ourselves to give our support to the Civic and other authorities if called upon and we offer our services as engineers to assist in keeping the public utilities in operation or to do any other work which may help to protect the lives and food supply of the citizens.' "

Personals

G. H. Duggan, M.E.I.C., past president of *The Engineering Institute of Canada*, has been elected a Director of The Steel Company of Canada.

*

Lieut. J. D. McBeath, A.M.E.I.C., who recently returned from overseas, has been appointed Assistant City Engineer, of Moncton, N.B.

*

J. C. Ball, A.M.E.I.C., has returned from the front and rejoined the staff of the Welland Ship Canal on Section No. 3 at Thorold.

*

C. Collingwood, A.M.E.I.C., has recently returned from overseas. Mr. Collingwood served with the 12th Canadian Railway Troops in France.

*

F. W. Teele, M.E.I.C., has been appointed General Manager, of the Mexican Light & Power Company, Mexico Tramway Co., and allied interests of Mexico City.

*

L. C. Dupuis, Jr., E.I.C., has been appointed Division Engineer, Saguenay Division, Canadian National Railways, with headquarters at Quebec.

*

E. P. Muntz, S.E.I.C., has just returned from the front and rejoined the staff of the Welland Ship Canal on Section No. 2.

*

H. H. Vaughan, M.E.I.C., Past President of *The Engineering Institute of Canada* has been elected a Director of The Armstrong-Whitworth Company.

*

C. H. N. Connell, A.M.E.I.C., has been appointed District Engineer of the Montreal and Saguenay Division of the Canadian National Railways, with headquarters at Quebec.

Eugene W. Stern, M.E.I.C., late Major of Engineers in the United States Army has returned from France and has resumed his practice as consulting engineer with offices at 156 West 45th Street, New York.

*

A. J. Gayfer, M.E.I.C., returned from France on April 8th and has been placed on the retired list with the rank of Major. Mr. Gayfer has been appointed Divisional Engineer of Construction, Canadian National Railways, Hanna, Alta.

*

Lieut.-Col. Blair Ripley, D.S.O., M.E.I.C., who returned to Canada about two months ago and resumed his position with the Canadian Pacific Railway Company, has recently received further recognition of the splendid services he rendered with the Canadian Railway Troops in France by having bestowed upon him the title, Commander of the British Empire.

*

T. Linsey Crossley, A.M.E.I.C., who has been associated for a number of years with Doctor J. T. Donald, of Montreal, and who established the Toronto laboratory of J. T. Donald and Company, consulting chemists, has taken over the Toronto office and laboratory of that firm at 43 Scott Street, and will there carry on the business of consulting chemist and chemical engineer.

*

J. E. Pringle, B.A.Sc., S.E.I.C., has returned to Canada after service in the Canadian Army with the Queen Victoria's Own Sappers and Miners, having seen service both in India and Palestine. In both of these countries he was engaged in engineering work and in Palestine the work of the engineers was devoted largely to water development and securing a constant supply for British purposes.

Captain E. A. Earl, R.E., A.M.E.I.C., who previous to the war was engaged in private practice in Vancouver, and who joined the Canadian Engineers in October 1914, has gone to Vladivostok in the capacity of Army Interpreter. Captain Earl was commissioned in January, 1916, and spent two years in France with the 84th Field Company, R.E. He was wounded in June, 1916, and again in February, 1918. In May, 1918, he was appointed an instructor in engineering, which position he still held on leaving for Vladivostok.

*

Robert L. C. Pinget, A.M.E.I.C., has lately returned from France. Lieutenant Pinget left Canada early in 1914 and was demobilized about two months ago. He won the Croix de Guerre and 5 "citations" from the French Government and the Cross of St. John of Jerusalem from the English Government. He is returning to France but he wishes to keep his connection with *The Institute*. His address will be:

ROBERT PINGET,
17, rue de l'Yvette,
PARIS, 16ième, France.

*

Lieut.-Col. H. J. Lamb, D.S.O., M.E.I.C., who recently returned from overseas has been promoted to the position of Supervising Engineer for the Province of Ontario, in which capacity he will supervise all harbours and rivers in Ontario, with offices in the Equity Chambers, Adelaide Street, Toronto. Colonel Lamb has been

Lieut.-Col. H. J. Lamb, D.S.O., M.E.I.C.

nineteen years with the Government and during the construction of the international tunnel under the Detroit River he represented the Dominion Government as Engineer-in-Charge. An account of Colonel Lamb's military career appeared in the June issue of *The Journal.*

Lieut.-Col. H. L. Trotter, D.S.O., A.M.E.I.C., Officer Commanding the 11th Battalion of Canadian Engineers, arrived with his battalion, on board the liner Olympic, in Halifax on June 11th. Colonel Trotter has had a remarkable career at the front and has brought distinction to himself, his country and his profession.

Lt.-Col. H. L. Trotter, D.S.O., A.M.E.I.C.,
Comanding 11th Battalion,
Canadian Engineers, B.E.F.

The following are some of the engagements in which the 11th Canadian Engineers participated:—The Somme, Sept. to Nov., 1916; Desire Trench, Nov. 17th and 18th, 1916; Vimy Ridge, April 9th to 13th, 1917; Arleux and Fresnoy, April 28th to 30th, 1917; Lens, begun June 11th, 1917; Hill 70, August 15th; Passchendaele, Oct. 25th to Nov. 10th, 1917; second battle of the Somme, March and April 1918; Arras, August 26th-28th; Queant-Drocourt Line, Sept. 3rd-5th; Canal du Nord, Sept. 27th-29th; Denain, Oct. 20th; Valenciennes, Oct. 25th-Nov. 2nd; advance towards Mons, Nov. 11th. The Battalion greatly distinguished itself at Canal du Nord.

The Institute extends to Colonel Trotter a very hearty welcome home.

*

Gordon L. Shanks, A.M.E.I.C., has returned to Canada on the *Royal George*, which arrived at Halifax on June 17th. Mr. Shanks enlisted with the Canadians in 1917, and was later transferred to the Royal Engineers, with which unit he took the road engineering cadet course at Newark and obtained his commission in November 1917. He went to France with G. H. Q. on the strength of the Inundation Section of the R. E., on water defence schemes. Until October 1918 he was attached to the Canadian Headquarters' Staff under

General Lindsay as laison officer on canal work, locks and floods on the Scarpe and Escaut Rivers. After the armistice was signed Mr. Shanks was on the staff engaged in canal reconstruction in British areas.

*

It is gratifying to note that so many of the younger engineers returning from overseas are losing no time in applying for admission to *The Institute*.

Among recent applications are those of Major Harvey W. L. Doane, son of Major F. W. W. Doane, M.E.I.C. Major Harvey Doane was one of the organizers of the famous 10th Siege Battery. He crossed with a draft to England and, unable to get to France, immediately transferred to the Imperial forces. His promotion was rapid and he was sent to Egypt as O. C. 420th Siege Battery. He is at present assistant to the City Engineer of Halifax.

Another applicant is Capt. F. H. Palmer, M.C. He also was one of the organizers of the 10th Siege Battery, and after accompanying his battery to England he reverted to the rank of Lieutenant in order to get to France, and was in the thick of the heavy fighting. He is at present connected with the Nova Scotia Highway Board.

*

Prof. H. E. T. Haultain, M.E.I.C., of Toronto University, was recently presented with a touring car by five hundred members of his vocational staff at the Armoury on the occasion of his retirement from the position of Vocational Officer for Ontario. The presentation was made the occasion of a striking tribute from those who had worked under the Professor and who expressed their keen regret that his active connection with the Ontario Vocational Branch of the Department of Soldiers' Civil Re-Establishment had terminated. It was pointed out that over 92 per cent of the male vocational staff in Ontario were returned officers and men, who had learned to look on the retiring chief as a personal friend.

In presenting the car on behalf of the members of the Ontario Vocational Branch, D. D. Eppes, head of the After-Care Department for Ontario, emphasized that Professor Haultain had earned the confidence of the disabled soldier and the respect and affection of his own subordinates. The speaker recalled that the retiring vocational officer had entered the retraining movement in its early days and had seen it grow to its present-day tremendous proportions. He paid tribute to the part the Professor had played in the development of the retraining movement and lauded his sympathetic handling of the returned men. The staff also presented a gold wrist watch to Professor Haultain's little daughter, and a bouquet of roses to Mrs. Haultain.

Professor Haultain, who was taken completely by surprise, accepted the presentation with a few suitable words.

Professor H. E. T. Haultain, M.E.I.C.

OBITUARY

Ernest Marceau, B.Ap.Sc. M.E.I.C., Past President of The Institute.

The engineering profession lost one of its noted members on May 24th in the death, at his home at Sault aux Recollets, of Ernest Marceau who for the past twenty-five years had occupied a prominent place in its activities.

Mr. Marceau was born at Danville, Que., on December 2nd, 1852, and graduated from the Ecole-

Late Ernest Marceau, B.Ap.Sc., M.E.I.C.
Past President,
The Engineering Institute of Canada.

Polytechnique of Montreal, with honors, in 1877. During his entire engineering career he has been associated with the canals of Eastern Canada, and for the greater portion of that time he has been Superintending Engineer of Canals in the Province of Quebec.

During the years 1897, 1898 and 1899, Mr. Marceau was a Member of Council, in 1901 he was elected Vice-President for three years, in 1905 he was elected President, and in 1909 was appointed Treasurer of *The Institute*, which office he held at the time of his death. The Gzowski Medal was awarded to Mr. Marceau in 1901 for his paper on the Carillon Canal, Dam and Slide.

Mr. Marceau was a member of La Société des Ingénieurs Civils de France. In 1904 he was appointed head of the Ecole Polytechnique of Montreal, and in 1909 went to Europe to engage professors for this institution, now associated with Laval University, in which institution Mr. Marceau was professor of industrial economy. Besides his professional and educational activities, he devoted some time to literature and was a contributor to foreign as well as home periodicals.

In 1879 Mr. Marceau married Miss Elzine Tassé, daughter of the late Dr. F. Z. Tassé, of St. Vincent de Paul, who died in 1909. He had been in weakened health for some years and his death will be regretted by a large circle of professional and personal friends by whom he was held in deserved respect.

The President and Council of *The Institute* sent a floral wreath, and *The Institute* was represented at the funeral by a large number of Members.

Employment Bureau

Situations Vacant

Civil Service

The Civil Service Commission of Canada hereby gives public notice that applications will be received from persons qualified to fill the following positions in the Civil Service of Canada:—

A Seismologist for Dominion Astronomical Observatory, Salary $2,000 per Annum.

1. A Seismologist for the Dominion Astronomical Observatory, Department of the Interior, at an initial salary of $2,000 per annum.

Duties: To perform research work in seismology under direction, in connection with the work of the Dominion Astronomical Observatory; to take readings of seismological instruments and maintain such instruments in efficient working condition; to record, compare, compute, and prepare such readings and the results of seismological research for publication; to correlate microseisms and weather conditions; to test seismological instruments; to carry on investigations with reference to the interior of the earth; and to perform other related work as required.

Qualifications: Graduation from a university of recognized standing with specialization in mathematics and physics; at least three years of experience with physical apparatus and instruments; a knowledge of modern languages is desirable.

Applications for this position will be received until July the 2nd.

An Assistant Astronomer for the Dominion Astronomical Observatory. Salary $1,800 per Annum.

2. An Assistant Astronomer for the Dominion Astronomical Observatory, Department of the Interior, at a salary of $1,800 per annum.

Duties: To assist, under direction of an Astronomer in making telescopic observations for the determination of time, latitude, longitude, and star positions; to assist in research work in solar physics, spectros-copy, and other astronomical and astrophysical work; to make necessary computations in connection with such observations; to assist in comparing and regulating primary clocks of the time service; and to perform other related astronomical and mathematical work as required.

Qualifications: Graduation from a university of recognized standing, with specialization in astronomy, mathematics and physics; at least three years of experience as an observer or as a post-graduate student in astronomical research; exactitude; steady nerves; good eyesight.

Application forms properly filled in. must be filed in the office of the Civil Service Commission not later than June 26th.

* * *

A Power Plant Superintendent, Salary **$200** *to* **$230** *per month.*

3. A Power Plant Superintendent for the power plant at the new Champlain Dry Dock at Lauzon, P.Q., Department of Public Works, at a salary of $200 to $230 per month; to have charge of a steam-electric generating plant; to supervise the employees engaged in operating the plant and the necessary maintenance and repair work; and to perform other related work as required; to supervise the operation, repair and maintenance of steam boilers of different types, automatic stokers, feed pumps, valves, steam turbines, alternating and D. C. generators and motors, electrical controlling apparatus, centrifugal pumps, automatic high pressure valves and other mechanical and electrical equipment found in such plants.

Qualifications: Education equivalent to high school graduation; either graduation in electrical or mechanical engineering from a school of Applied Science of recognized standing with three years of experience with large steam-electric power plants, two years of which shall have been in a position of professional responsibility; or five years of experience in large steam-electric power plants, two years of which shall have been in a position of professional responsibility; a thorough knowledge of the production of electricity by steam power and of the various equipment used in such work ; tact, good judgment and ability to manage men. Applicants must be residents of the Province of Quebec.

Application forms properly filled in, must be filed in the office of the Civil Service Commission not later than June 26th.

General Directions.

Selections for eligible lists of applicants qualified to fill similar vacancies which may occur in future may be made from applications for these positions.

According to law, preference is given to returned soldier applicants, possessing the minimum qualifications. Returned soldier applicants should furnish a certified copy of their discharge certificate, or, in the case of Commissioned Officers, a certified statement of their services.

Application forms may be obtained from the Dominion-Provincial Employment Officer, or the Secretary of the Civil Service Commission, Ottawa.

By order of the Commission,

WM. FORAN, Secretary.

Mechanical Draughtsman

Mechanical Draftsmen wanted, Box 44.

Drawing Instructor

Assistant instructor of engineering and architectural drawing wanted for the Ottawa Vocational School of the Soldiers' Civil Re-Establishment. Returned soldier preferred. Apply H. Etches, Architectural drawing instructor, Soldier' Aid Commission, 327 Wellington Street, Ottawa.

Teacher

Teacher of Physics and Chemistry wanted for Montreal Technical School, duties to commence in September next. Salary $1500 per year. Apply to Mr. McLeish, 1015 Decarie Blvd., N. D. G.

Railway Engineer snd Surveyor

J. C. Broderick, Engineer, 402 Transportation Bldg., Main 8773, requires an experienced engineer and surveyor for railway location work. The Rouge River Railway Co.

Locating Engineer

Engineer and surveyor experienced on railway location work required to locate a new line of railway near the Ottawa. Box 43.

Highway Supervisor

Returned soldier, preferably an engineering graduate, wanted for highway supervision. At present the position is temporary but may lead to permananence. Salary $125 per month. Box No. 42.

Designing Draftsman

Thoroughly competent draftsman for general civil engineering and construction work, capable of designing both steel and concrete to work under the chief draftsman of a large corporation. Address Box 41.

Situations Wanted

Mechanical Engineer

McGill graduate desires position with industrial firm. Good practical and technical knowledge of steam plants and ability for industrial organization. Box 6 P.

Municipal Engineer

Lieut. C. E. (Reserve), A.M.E.I.C., is desirous of securing a position as municipal engineer. Has had splendid contracting, railroad and general engineering experience. Apply Box 4 P.

Mechanical Engineer

Mechanical engineer as general or mechanical superintendent A-1 mechanic, technical graduate, twenty-five years in mechanical industries, steam and petrol marine engines, weaving machinery, reciprocating and centrifugal pumps, fundry practice; sixteen years in electrical machinery construction, good tool designer, and thoroughly up-to-date in every phase of manufacturing. Box 7 P.

Newfounland Railways

The Reid-Newfoundland Company which operates the Newfoundland Railway under contract with the Government, has had one of the most successful years in its history, both from the standpoint of freight and passenger traffic.

When in 1875 the idea of constructing a railway in Newfoundland first assumed shape, a survey was made from St. John's to St. George's Bay by the late Sir Sanford Fleming with the intention of building a railway system across Canada with St. John's, Nfld., as the eastern sea port terminal.

In those early days, even the most optimistic Newfoundlander did not think the railway would be anything more than a line of steel that would help to open the natural resources of the Colony; hence a narrow guage road was deemed adequate for all requirements.

In recent years, however, that narrow guage railway with its light rails, has been forced to carry more traffic than was ever dreamed of by the originators of the scheme. It is hard pressed with its present rolling stock to handle the increased volume of freight, for in the year 1918 it carried approximately 53,000 tons, as compared with 21,000 tons in 1914; that is, more than two and a half times the volume in 1918, as compared with 1914. The surplus not handled by the railway which amounted to 1325 car loads, which are twice as big as the Newfoundland car loads, had to be taken from Halifax and Sydney, Canada, by sea to Newfoundland. A daily railway express service has been run across Newfoundland, in order to cope with the passenger traffic. Thus it has been that freight and passenger records have more than doubled during the past four years and the indications are that a radical change will soon have to be made in the road-bed of the railway itself to accommodate the travelling public and the increasing trade of the Colony.

When the railway was built the contract called for 25 ton locomotives. The Reid-Newfoundland Company found several years ago that it was necessary to have 65 ton engines to do the work, yet this increased weight in rolling stock was imposed on a road-bed and a rail that were originally laid down to do not more than 20% of the traffic that has been done yearly during the past four years.

It is prophesied that the trade of Canada and Newfoundland, which in 1918 had a value to Canada of $11,000,000, will continue to grow in the future and that passenger traffic will also increase. These facts point to the necessity of improvement in the railway rolling stock and road-bed, in order to bring them up to modern requirements.

Judge F. J. Morris, of the Court of Inquiry, that investigated the railway accident that took place in September 23rd, 1918, in a written judgment just published, recommends to the Government of Newfoundland that they relay the railway.

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Preliminary Notice

of Application for Admission and for Transfer

20th June, 1919.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in July, 1919.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

AMIOT—ROMEO SADI, of Chicoutimi, P.Q. Born at New York, June 26th, 1894. Educ., 5 yrs. Rimouski Seminary, 1 yr. Poly. School. 1914, rodman, etc.; 1915, transitman and first asst., with Wm. Tremblay, P.L.S. and C.E.; 1916-17, asst. with ch. engr., Chicoutimi Pulp Co., on constrn. in connection with pulp mills; 1918-May 1919, first asst. with ch. engr., Roberval Saguenay Ry., also municipal engr., county of Chicoutimi; at present, engr. on constrn. of highway, Prov. Govt.

References: P. E. Amiot, J. F. Grenon, J. O. Lachance, J. A. Lefebvre, L. G. Trudeau.

AULT—HERBERT WILLIAM, of Ottawa, Ont. Born at Wrexham, N. Wales, March 17th, 1871. Educ., private tuition Grammar School, Wrexham. 1888-89, on air compressors and pneumatic pumps in eng. dept. of Hughes & Lancaster, Chester, Eng.; 1889-1902, with Shone & Ault, London, Eng., as follows:—1889-93, articled pupil; 1893-94, in office and field in connection with drainage of various towns in the Thames Valley; 1894-96, in chg. of carrying out town drainage and waterworks; 1897-1902, in office and field on drainage schemes; 1905-07, with H. B. Proudfoot, Saskatoon, on timber berths and town subdivs.; 1908-19, surveys examiner, Topographical Survey, at present ch. dftsman., Reclamation Service, Ottawa.

References: R. J. Burley, G. B. Dodge, J. S. Tempest, B. E. Norrish, W. C. Gillis, R. A. Davy.

BARNJUM—HAROLD FREDERICK GUILD, of Prince Rupert, B.C. Born at Montreal, Que. June 19th, 1880. Educ. Montreal High sch. and I.C.S. 1906-17 with G.T.P. Ry. as follows:—1906-08 dftsman on preliminary and location surveys; 1909 (6 mos.) dftsman on location; 1909-12 dftsman, div. engrs. office Mt. div.; 1912-14, ch. dftsman div. engrs office Mt. div.; 1914-16, dftsman. asst. engrs. office, Prince Rupert; 1917-18, in chg. of field party on location, etc., Narrow and Broad Gauge Army railways in France; 1908 (6 mos.) transitman on location; 1919 to date instr'man in chg. of res. engrs office, Prince Rupert.

References: W. H. Tobey, J. McGregor, A. L. Ford, M. A. Roby.

BARTRAM—VIVIAN TURNILL, of Toronto, Ont. Born at Ottawa, Ont., Aug. 2nd, 1878. Educ., Coll. Inst. 1895-1905, secy. and gen. mgr., Can. Atlantic Ry., Ottawa; 1905-06, ch. clerk, purchasing dept., C.P.R., Montreal; 1906-09, purchasing agent and gen. storekeeper, T. & N. O. Ry., North Bay; 1909, in constrn. business with Denis Murphy, later in same business alone, at present is vice-pres., National Shipbuilding Co. Ltd., Goderick, Ont.; pres., Bartram & Ball Lumber Co., Montreal; pres., Spardon Elec. Products Ltd., Ottawa.

References: G. A. Mountain, E. D. Lafleur, J. J. Collins, C. H. Keefer, C. O. Wood.

BOWEN—SYDNEY, of Morrisburg, Ont. Born at Llanelly, S. Wales, Dec. 2nd, 1882. Educ., associate, City & Guilds Inst., London Univ. 1904. 1904 (3 mos.) dftsman Nevills Eng. works; 1904-06, sectional engineer on Charing Cross, Euston & Hampstead Tubular Ry., in chg. of shafts, stations, etc.; 1907-08, parliamentary and constrn. surveys for motor roads and tramways, and ch. asst. engr. on railway in Ireland; 1909-11, on various eng. works, including direct chg. of constrn. surveys and plans for waterworks, etc.; 1912-14, inst'man and acting res. engr. on constrn., C.P.R.; 1914-18, res. engr., on Trent Valley Canal; 1918 (4 mos.) res. engr., C.N.R., on maintenance work; Aug. 1918 to date, first asst. engr. on St. Lawrence River survey for Hydro Elec. Power Comm.

References: A. J. Grant, J. B. McRea, J. H. McLaren, F. S. Lazier, M. C. Henderson.

BUCKLEY—REX ELMER, of Niagara Falls, Ont. Born at Niagara Falls, Nov. 17th, 1889. Educ., 2 yrs. eng. Valparaiso Univ. 1906-08, in city engr's office, Niagara Falls, as transitman, etc., on O.L.S.; 1908-09, transitman in city engr's office, St Petersburg, Florida; 1909 (7 mos.), 1910 (8 mos.), 1912 (6 mos.), in chg. of field work for J. C. Gardner, Niagara Falls, on municipal work; 1909-10 (5 mos.) in chg. of field party from city engr's office, Aberdeen, Wash.; 1911-14, instrument work and inspection of concrete, steel, etc., Ont. Power Co.; 1914-16, in chg. of field party on Welland Ship Canal; 1916-18, with Can. Niagara Power Co., in chg. of field work and estimates; Dec. 1918 to date, with Niagara Falls Power Co., eng. and inspection of substation at Echota, N.Y.

References: J. H. Jackson, J. C. Gardner, G. C. Hoshal, W. Jackson, J. L. Weller, W. H. Sullivan, F. N. Rutherford, T. H. Hogg.

CHAPMAN—EDWARD WILLARD GORDON, of Halifax, N.S. Born at Dartmouth, N.S. Sept. 17th, 1890. Educ. B.Sc. (C.E.) N.S. Tech. Coll. 1914. 1912-13, transitman ry. constr. C.N.O. Ry. Port Arthur dist.; 1914-16 transitman ry. constr. C.G.R. Halifax, to St. St. John, subdiv.; 1916-18 Quartermaster-Serg. of the 36th Battery; 1918 to date industrial surveyor with Dept. of Soldiers Civil Re-establishment, Halifax, N.S.

References: C. W. Archibald, C. E. W. Dodwell, F. R. Faulkner, O. S. Cox.

CRAIG—JOHN, of Nelson, B.C. Born at Toronto, Ont., Sept. 20th, 1877. Educ., B.A.Sc., Toronto Univ., 1901. 1899-1900, with Toronto street ry. shops; 1901-02, dftsman in switchboard dept., Westinghouse Co., Pittsburgh, Pa.; 1902-03, Fellow at School of Science; 1903-08, asst. engr., with Willis Chipman, on water, sewer and municipal work; 1908-14, contractor in municipal work; 1915-17, asst. engr. with Chipman & Power; 1917-18, with Jennings & Ross, Milwaukee, in chg. of sewer contract; 1918 to date, asst. engr. on B.C. hydrometric survey.

References: W. Chipman, G. Power, J. E. Underwood, J. B. Challies, R. G. Swan.

CRAM—HALDANE RODGER, of Ottawa, Ont Born at Ottawa, Ont. Sept. 22nd, 1888. Educ. B.Sc. McGill Univ. 1911. Summer 1909, eng. asst. on constrn. of grandstand, Ottawa Exhibition Grounds; 1911-12 various surveys and sewerage installation inspection for J. H. Moore; 1912 (6 mos.) eng. asst. in Topographical Surveys Br.; 1912 (6 mos.) hydrometric engr. Irrigation Br.; 1912-17, office engr. Irrigation Br.; 1917 to date, drainage engr. Reclamation Service, Ottawa.

References: J. S. Tempest, R. J. Burley, R. A. Davy, F. S. Drummond, A. L. Ford.

DUNBAR—WILLIAM PATTERSON, of Vancouver, B.C. Born at Broughty Ferry, Scotland, Feb. 11th, 1887. Educ., B.Sc. (distinction) Edinburgh Univ., 1911. A.M.I.C.E. B.C.L.S., 1914. 1913-14, asst. to J. A. Walker on B.C. survey; 4 yrs. in machine shop, 1 yr., drawing office, Urquhart, Lindsay & Co., Dundee, Scot.; 1 yr. with Col. T. H. Tracy, on gen. eng. work; 2 mos., road locator, municipality of N.Vancouver; 4 mos. field dftsman, C.P R.; at present, asst. in testing laboratory Forestry & Products Laboratory, Vancouver.

References: T. H. Tracy, J. A. Walker, E. A. Jamieson, C. Brakenridge, E. G. Matheson.

FAIRBANKS—ROGER LOUIS, of Port Arthur, Ont. Born at Marquette, Man., Dec. 13th, 1887. Educ., Ottawa, Univ. Am. S.C., 1906 (5 mos.) tapeman; 1906-08, timkeeper; 1909 (3 mos.) rodman; 1909-12, transitman; 1912-15, res. engr., T.C. Ry.; 1915-17, res. engr., H. B. Ry., since Jan. 1918, lieut., 11th Batt., C.R.T., recently returned from overseas.

References: A. E. Doucet, J. W. Porter, A. Timbrell, D. S. Scott, C. L. Hervey, J. E. Gibault.

FREEMAN—ROBERT PORTER, of Halifax, N.S. Born at Halifax, July 5th, 1888. Educ., B.Sc. (C.E.) N.S. Tech. Coll., 1915. 1906-09, dftsman, etc. on property surveys; 1908-09, rodman on location and constrn., T.C.Ry.; 1909-10, instr'man on constrn.. N.T.C. Ry.; 1911, instr'man and rodman on constrn., C.P. Ry.; 1912-13, res. engr. on constrn., I.C. Ry.; 1914, engr. and inspector on surveys, culvert and bridge constrn.; N.S. Prov. Highway Board; 1915, engr., on surveys, dsgning and reconstrn.; 1915-16, instructor in chg. of short course land surveying, N.S. Tech. Coll.; 1916, contracting in reinforced concrete constrn. etc., on a small scale; Oct. 1916, enlisted and has recently returned from overseas.

References: W. P. Morrison, J. W. Roland, C. O. Foss, J. R. Freeman, L. H. Wheaton, F. R. Faulkner, J. Lorne-Allan.

FROST—STANLEY RICHARD, of Niagara Falls, Ont. Born at Owen Sound, Ont., July 23rd, 1886. Educ., honor matric., Coll. Inst. 1904-05, ch. asst. to F. A. Wells, mech. engr.; 1906-14, with Portland Cement Co., as follows:—1906, on constrn. and operation, Babcock, Man.; 1907, night supt., Ironton, Ohio; 1908-10, asst. supt., Orangeville, Ont.; 1911-14, asst. supt., later supt., Kirkfield, Ont.; 1915, in chg. of mech. work on automobile assembling; 1916-18, supt., Portland Cement Co., at Hanover and Durham, Ont.; Sept. 1918, ch. dftsman., American Cyanimid Co.; Jan. 1919 to date, ch. mech. engr., in chg. of maintenance and constrn. in large chemical plant.

References: D. R. Thomas, A. C. D. Blanchard, D. T. Black, T. D. Kennedy.

GARDNER—DOUGLAS BANKIER, (Lieut)., of Toronto, Ont. Born at Peterboro, Ont. Nov. 30th, 1890. Educ. B.A.Sc. 1916. Summers:—1908, timekeeper with Hibbard & Pringle; 1909 with re-survey party for C.P.R.; 1910-11 ,clerk in Roadways office, City Hall, Toronto; 1913, asst. hydrographer and transitman on govt. irrigation survey party in Maple Creek dist.; 1914 inst'man in chg. of party, Roadways office, City Hall, Toronto; 1915, shift boss in Cyanide Gold Mill at Tough Oaks mine; 1916-19, Lieut. in Can. Engrs.; at present with Hydro-Elec. Power Comm. as dftsman under T.U. Fairlie.

References: J. M. R. Fairbairn, T. U. Fairlie, P. Gillespie, F. C. Krumm H. Wykes, F. B. Goedike, H. Robertson.

GISBORNE—LIONEL LEATHAM, of Niagara Falls, Ont. Born at Sydney, N.S., Feb. 12th, 1876. Educ., B.Sc. (mech. eng.) McGill Univ., 1899. 5 years, fitter, machinist, mech., draftsman and dsgning mech. dftsman, 1903, erecting engr., James Cooper Co., Montreal; in chg. of installation; 1905 sales dept., mech. engr, Allis-Chalmers-Bullock Ltd. who took over the Jas. Cooper Co.: 1908, on staff of International Marine Signal Co., Ottawa, as dsgning dftsman and erecting engr., later in chg. of experimental work; 1911, erecting engr , American Gas Accumulator Co., Philadelphia, Pa.; 1915, asst. water works engr., Ottawa; at present, dsgning mech. dftsman., Niagara Development, Hydro Elec. Power Comm.,

References: J. B. Goodwin, A. C. D. Blanchard, H. L. Bucke, J. B. McRae, H. Gisborne.

HARRIS—ATHOL CARR, of St. Catharines, Ont. Born at Kingston, Ont. Sept. 26th, 1883. Educ., B.Sc., 1906, M.E. 1912, Queen's Univ. 1903-05, transitman, chg. of party, G.T.P.; 1906-07, with Copper Queen Consolidated Mining Co., Bisbee, Ariz.; 4 mos. with mine eng. corps; 5 mos. underground miner; 1907 (6 mos.) with Greenidge & Lee, mine engrs. and assayers, Cananea, Mexico; 1907-13, with Cananea Consolid. Copper Co., on mine eng. force and asst. to ch. mine engr.; 1913 (2 mos.) made partial survey for Montezuma Arizpe Mining Co.; 2 mos., sampler with Can. Copper Co., Copper Cliff, Ont.; 3 mos. ch. mine engr., Morococha Mining Co., Morococha, Peru; 1914, sampler, Dome Mines Co., South Porcupine; 4 mos., supt. of mine for P. Tetreault; Oct. 1916 to date, with Coniagas Reduction Co. Ltd., Thorold, Ont., as follows: 1916, asst. supt.; 1918, works mgr.; 1919, supt.

References: R. W. Leonard, J. F. Pringle, J. C. Gwillim, E. H. Pense, R. O. Sweezey.

LIONAIS—JOSEPH EDOUARD, of Montreal, Que. Born at Montreal, Sept. 3rd, 1893. Educ. B.Sc. McGill Univ. 1915; summer vacations work with Canadian Allis Chalmers, Dominion Govt., Dominion Bridge; 1915 (6 mos.) asst. engr. with G. M. Gest, Ltd.; 1915 to date with Montreal Light Heat & Power Co., Elec. Dist. Dept.

References: H. E. Vautelet, R. M. Wilson, L. A. Kenyon, L. A. Herdt, E. Brown, J. M. Laforest.

LLOYD—FREDERICK LUTTLEY, (Lieut.) of Winnipeg, Man. Born at Bridgend, Wales, Aug. 1st, 1884. Educ., 4 yr. course, School of Eng., Swindon, Eng. 1904-08, junior asst., Welsh County roads and bridge dept.; 1908-09, topog'r, leveller, dftsman, H.B. Ry.; 1909 (6 mos.) dftsman., Man. Govt. telephone constrn., 3 mos., instr'man on constrn., C.P.R.; 1910-12, topog'r and dftsman on prelim. and location surveys, G.T.P. Ry.; 1912-13, inst'man and acting res. engr. on constrn., G.T.P.; 1913-15, res. constrn. engr., H.B. Ry.; Feb. 1916-May 1919 on active service, lieut., 6th Batt., C.R.T.

References: G. C. Dunn, J. Armstrong, F. P. Moffatt, J. V. Dillabough, W. J. D. Reed-Lewis, W. M. Wilkie, E. W. Reed-Lewis.

LYON—JOHN EDWARD, (Lieut.), of Ottawa, Ont. Born at Ottawa, Aug. 28th, 1895. Educ., War certificate, R.M.C., 1917. D.L.S., 1917. 1914 (6 mos.) and 1915 (5 mos.) asst. to G. C. Cowper on D.L.S. in Sask.; 1917, lieut., Royal Can. Engrs., Canada; 1917-Apr. 1919, on active service in England and France, 7th Batt.

References: J. B. Cochrane, G. C. Cowper, A. P. Deroche, T. E. Powers, D. Barry, M. Courtright.

MACKENZIE—HARRY, of Homer, Ont. Born at Beaverton, Ont. Aug. 7th, 1895. Educ. High School; 1913, 8 mos., on St. Lawrence canals, rodman, Welland Ship Canal, 1914-16; 1917, leveller; at present time instrumentman.

References: J. L. Weller, W. H. Sullivan, E. G. Cameron, H. M. Belfour, F. C. Jewett, A. J. Grant.

MACNEIL—WALTER RODERICK JAMES, of Montreal, Que. Born at Arichat, N.S. Feb. 25th, 1891. Educ. Richmond County Acad. N.S.; 1910-12, Rodman, etc. on ry. constr., N.T. Ry.; 1912 (8 mos.) drfts'man on ry. constr.; 1912-13, instr'man ry. constr. N.T. Ry.; 1913 (7 mos.) leveller on location North Ry.; 1913-14, asst. on land surveying, N.S.; 1914 instr'man bridge constr. Lennox Passage bridge, N.S.; 1914 (3 mos.) rodman municipal survey town of Mount Royal. Que.; 1914 (3 mos.) chg. of constr. work; 1914 to present time in chg. of party on municipal surveying and constr. work, town of Mount Royal.

References: L. E. Schlemm, W. D. Robertson, F. A. Snyder, W. E. Joyce.

McLELLAN—JOHN WILLIAM, of New Glasgow, N.S. Born at Sydney, N.S., July 20th, 1886. Educ., private study and I.C.S. 1905-08, with Dom. Coal Co., Glace Bay, as follows:—1905-06, rodman, etc. on ry. location and gen. constrn.; 1907, rodman and leveller; 3 mos. transitman on surveys, constrn., etc.; 1908, transitman on gen. surveys; 8 mos., surveyor, Kerr Lake Mining Co., Cobalt; 1909-10, assayer, etc.; 1911, ch. assayer; 1911 (6 mos.) engr. in chg. of exploration work, Temiskaming Mining Co.; 1912-13, ch. surveyor, Morococha Mining Co., Peru, in chg. of surface and underground eng.; 1915, private practice, P.L.S. in N.S.; 1916, engr., with Jones, Girard & Co., contractors; 1917, transitman, in chg. of bridge replacements Can. Govt. Rys ; 1918, transitman on maintenance of way; Nov. 1918 to date, surveyor, Acadia Coal Co., Stellarton, N.S.

References: C. M. Odell, D. S. Morrison, A. M. Jones, J. J. McDougall, C. Cooke, R. Montgomerie, R. F. Taylor.

MILLS—JOSEPH STARR, of New Glasgow, N.S. Born at Jordon Falls, N.S. Aug. 7th, 1881. 1903-04, H. & S. W. Ry. rodman, topographer, etc.; 1904-05, rodman N.T. Ry.; 1905-07, topo. and leveller on location, N.T. Ry.; 1907-08, transitman on location; 1908-09, asst. res. engr. on constr.; 1909-10, res. engr. on constr. N.T. Ry.; 1910-11 in chg. of location party; 1911-13, res. engr. on constr.; 1914, to date asst. engr. on maintenance, C.N.R.

References: J. R. Freeman, K. H. Smith, E. S. Fraser, C. Cooke, K. Weatherbee.

MUTCH—DOUGLAS A. S., of St. Catharines, Ont. Born at Toronto, Ont. 16th April, 1887. Educ. B.A.Sc. (mining) Toronto, 1913, two yrs. mill foreman, Dome Mines, Ltd. South Porcupine; one yr. examination, Temiskaming Silver Mine, Cobalt; three yrs. general engr. work and mining under R. A. Bryce, Toronto; 1916 (4 mos.) asst. mgr. Dome Lake Mines; 1916-18, mgr. Hudson Bay Mines; 1918-19, mgr. Coniagas Mines; 1919, (3 mos.) instructor in military Haileybury Sch. of Mines; at present time, works mgr. Coniagas Reduction Co. Thorold, Ont.

References: R. W. Leonard, H. E. T. Haultain, E. R. Gray, H. P. dePencier, H. W. Sutcliffe.

PALMER—FREDERICK HERBERT, (Lieut. M.C.), of Halifax, N.S. Born at Belfast, Ireland. June 3rd, 1892. Educ. S.B. Nova Scotia Tech. Coll. 1913, summers 1911-12, in car shops N.S. Car Works; 1913 (6 mos.) with Toronto Structural Steel Co. shops; 1915 on erection work for same company at Lindsay ; 1915 (6 mos. on erection work with Freeman Bros. Halifax; 1915-16 asst. engr. under J. W. Roland at Halifax O. T. for Foley Bros. Welsh Stewart & Fauquier; 1916-19, Capt. in Canada, later Lieut. overseas Heavy Artillery; at present with N.S. Highways Comm.

References: J. W. Roland, F. R. Faulkner, A. C. Brown, J. McGregor, O. S. Cox.

PATTERSON—JAMES FREEBAIRN, of Montreal, Que. Born at Montreal, Que. May 15th, 1894. Educ. B.Sc. (E.E.) McGill Univ. 1918, at present operator with Canadian National Rys.

References: L. A. Herdt, E. G. Burr, C. V. Christie, E. Brown, H. M. MacKay.

PEARSTON—GORDON McGREGOR (Lieut.) of Winnipeg, Man. Born at Broughty Ferry, Scotland, Sept. 8th, 1888. Educ., Gordons Coll., Aberdeen, Royal Tech. Coll., Glasgow, Scot. Apprentice with J. Donaldson, conslt. engr., Glasgow. 1908-09, rodman, dftsman, inst'man, on location, constrn., etc., C.N.R.; 1910-14, asst. engr., maintenance of way, in direct chg. of work covering trackage, drainage, surveying, etc.; 1914-19, on active service with Can. Engrs., 1918 in chg. of dfting office, Can. School of Mil. Eng., Seaford, Eng.; July 1919, will continue with C.N.R., as res. engr.

References: A. Macphail, H. A. Dixon, T. Turnbull, A. J. Taunton, W. Walkden, W. Burns.

PERRY—FRANK MORTIMER, (Capt.) of Sault Ste. Marie, Ont. Born at Toronto, Ont. Jan. 2nd, 1875. Educ. 3 yrs. C. E. course, Toronto Univ. Summer 1898, U. S. Govt.,Geodetic Survey; 1899-1900, with A. C. Ry., transit on location; 1901, dftsman. Lake Superior Power Co.; 1902-03, engr. in chg. of development and operation of limestone quarry, Sault Ste. Marie Pulp & Paper Co.; 1904-06, mine mgr. and res. engr., Superior Mine; 1907-09, operating independently in Cobalt mining dist.; 1912-14, contractor on mine development work; 1914-16, capt., 15th Batt.; Nov. 1916 to date, with Algoma Steel Corp., at present inspecting engr., on constrn. of a battery of coke ovens.

References: E. G. M. Cape, C. S. Gzowski, H. E. T. Haultain, R. A. Hazlewood, H. Holgate, A. F. Macallum, W. J. Stewart, E. A. Stone, R. S. McCormick, J. W. LeB. Ross, B. E. Barnhill, J. H. Ryckman, N. L. Somers, L. R. Brown, F. F. Griffin.

PICKRELL—WILLIAM J., of St. John, N.B. Born at London, Ont. Sept. 15th, 1880. Educ. 2 yrs. Woodstock Baptist Coll. 1899-12 round house and road engine service, C.P.R.; 1912-18, div. master mech. asst. supt. and dist. master mech. at Toronto, Woodstock, N.B. and Farnham, Que.; dist. master mech. N.B. dist. C.P.R. St. John, N.B.

References: H. H. Vaughan, J. M. R. Fairbairn, W. H. Winterrowd, J. A. Shaw, C. C. Kirby.

PLUMMER—WILLIAM ELFRIC, of St. Catharines, Ont. Born at Stratford, Ont. July 21st. 1889. Educ., 2 yrs. Coll. Inst. 1908-09, with Riter Connelly Constrn. Corp., as timekeeper and distributing clerk; 1909-12, rodman and instr'man, A.C. Ry.; 1913 to date with Welland Ship Canal; 1913 as instr'man; 1915-16, asst. engr.; 1916-18, with Can. Engrs. in France; at present, asst. engr., sec. No. 1, Welland Ship Canal.

References: J. L. Weller, W. H. Sullivan, F. C. Jewett, H. M. Belfour, E. G. Cameron.

POLET—MAURICE, of Edmonton, Alta. Born at Court St. Etienne, Prov. of Brabant, Belgium, Jan. 27th, 1877. Educ., 2 yrs. science course, Univ. of Louvain. Belgian Diploma of Surveyor. 1907-12, with G.T.P. Ry., on permanent bridge bldg., testing materials, drafting, etc.; 1913-14, asst. engr., on constrn. and operation, Edmonton Interurban Ry.; 1914-16, in eng. dept., of E. D. & B. C. Ry., in chg. of dsgning all trestle bridges and substructure of permanent bridges; July 1912 to date, supt. and engr., Edmonton Interurban Ry., studying and reporting on total relocation and reconstrn. of the line for future operation, also in chg. of disposal of steel, plant, bldg., etc.

References: R. J. Gibb, L. B. Elliot, C. Ewart, W. H. Hunt, W. R. V. Smith, J. A. Boyle, G. L. Law.

ROY—JOSEPH ERNEST, of Quebec, Que. Born at Quebec, 25th Sept. 1892. Educ. Engr. course McGill, 2 yrs. (1911-13) (I.C.S. 1915-19, C.E. diploma), 1910, 5 mos. notes on ry. location and lake surveying; 5 mos. with G.P. Roy, C.E.; Seasons 1911-13 inc. asst. to G. P. Roy on ry. location works; 1914 to date draftsman in geological surveying, plotting and mapping, Dept. of Colonization, Mines & Fisheries.

References: J. E. Gibault, I. E. Vallee, J. E. Girard, A. B. Normandin, E. S. T. Lavigne.

RYAN—JOSEPH HENRY, of Halifax, N.S. Born at St. Anne's, Barbadoes, B.W.I., Jan. 24th, 1895. Educ. B.Sc. (C.E.) N.S.T.C., 1918, 1916, (5 mos.) dfts'man with maritime Tel. & Tel. Co. Ltd.; 1917, (5 mos.) instr'man bridge dept. Halifax O. T. Ry.; 1918 (3 mos.) instr'man with Pickings & Roland, Halifax; instr'man and later ch. of party on general constr. work; 1918 to present date with Halifax Shipyards, Ltd.

References: F. R. Faulkner, J. W. Roland, J. N. Finlayson, W. Rodger, F. A. Bowman.

TROOP—STEWART (Lieut.) of Moncton, N.B. Born at Annapolis, N.S., Sept. 20th, 1886. Educ., eng. course, Acadia Univ., 1907 and private study. 1904, with contractor H. & S. W. Ry.; 1906, with N. T. C. Ry.; 1907-08, dftsman and inst'man, N.B. Southern Ry.; 1908 (3 mos.) with N. T. C. Ry.; 1908-09, div. office dftsman; 1909-12, inst'man on ry. work, 1912-14, res. engr., heavy railroad constrn., C.N.O. Ry.; 1914-18, in eng. and commercial business alone; 1918, lieut., Can. Engrs., later on supervision of mfr. of special equipment for American Electro Products Co. (munitions) in U.S.; 1918-19, purchasing engr., Kipawa Co., Ltd.

References: J. C. Smith, C. O. Foss, R. H. Cushing, L. H. Wheaton, H. MacNeil, C. Johnston, G. O. MacLaren, R. F. Davy, J. E. Openshaw.

YUILL—ALEXANDER CLAUDE ROY, of Vancouver, B.C. Born at White Lake, Ont., May 25th, 1880. Educ., self study. 1889-1900, power house operator, Valleyfield Elec. Co. and Montreal Cotton Co., Valleyfield, Que.; 1900-08, asst. erecting engr. at Montreal, Winnipeg and Niagara Falls, and elec. engr. in chg. of installation at Lac du Bonnet, Man., Can. Gen. Elec. Co.; 1908-15, practicing as consl, and contracting engr., under style Mather, Yuill & Co. Ltd., Vancouver, at present. conslt. engr.

References: W. M. Young, W. G. Chace, F. H. Latimer, R. F. Hayward.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

ROBB—CHARLES ALEXANDER, of New Glasgow, N.S. Born at Amherst, N.S., Jan. 28th, 1888. Educ., B.Sc. (Mech. eng.) McGill, 1909. S.M. (mech. eng.) Mass. Inst. of Tech., 1910. 1904-05, apprentice, Robb Eng. Works; 1910-11, eng student, Allis Chalmers Ltd.; 1911, dsgner. Robb Eng. Works; 1911-12, asst. in. mech. eng. dept., Mass. Inst. of Technology; 1912-14, lecturer, Univ. of Alta; 1914-16, asst. prof. and res. engr.; 1916-17, in chg. gauge production branch, Ministry of Munitions; 1917-19, tech. asst. to U.S. representative, Imperial Munitions Board (Canada) and mech. engr., Can. War Mission, Washington, D.C., at present, visiting industrial plants in England and Scotland.

References: R. J. Durley, H. H. Vaughan, H. O. Keay, G. R. MacLeod, J. Chalmers, D. W. Robb, S. J. Fisher.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

BLUE—WALTER EDWARD (Major) of Ottawa, Ont. Born at Toronto, Ont., Feb. 27th, 1889. Educ., grad. R.M.C., 1910. Summer 1908, concrete inspector on dam; 1910-13, in chg. of various surveys and river metering on Ottawa and St-Lawrence Rivers; 1913-14, res. engr. on Chaudiere dam, Lake Nipissing; 1914-19, with Can. Field Artillery in command of a field battery, bldg. dug outs, gun pits, shelters, etc.; at present, asst. engr., D. P. W., Ottawa.

References: S. J. Chapleau, C. R. Coutlee, R.A. Davy, E. H. Pense, W. J. Stewart. J. B. McRae.

GOODMAN—FLAVIUS IVO COBBETT, of Halifax, N.S. Born at Barbados, B. W. I. Nov. 14th, 1890. Educ. B.Sc. McGill Univ. 1914. Summer 1912-13, dfts'man with Dom. Bridge Co.; 1914 Forest products Lab. timber testing; 1915, engr. with Spring Water Co.; 1916-18 Res. engr. on constrn. of reinforced concrete bridges, Halifax O. T.; 1918, to date res. engr. in chg. of constrn. of car cleaning shop stores and ice house, also sewer and water system of Halifax O. T.

References: W. A. Duff, H. M. MacKay, A. C. Brown, J. N. Finlayson, F. A. Bowman.

GORDON—JAMES MACKENDRICK, of Toronto, Ont. Born at Toronto, May 19th, 1884. Educ., 2 yrs. course in mech. and elec. engr., S.P.S. 1903-10, plant, street, grade and surface foreman, Warren Bituminous Paving Co., Nelson Bros. Co., and Bitulithic & Contracting Co.; 1904 (6 mos.) mech. dftsman, Ruggles Cole Eng. Co., New York; 1910, to date, supt., Warren Bituminous Paving Co., in complete chg. of permanent pavement constrn., including grading, drainage, pipe laying, etc.

References: J. Edington, E. S. Fraser, L. Jones, M. Stewart, E. A. James, E. D. Gray, A. Kinghorn, E. G. Evans.

HOGARTH—BRUCE BOWERS, of Ottawa, Ont. Born at Whitby, Ont. Jan. 16th, 1892. Educ. B.A.Sc. Toronto Univ., 1914. 1909-10, Rodman, etc. C.N.R.; seasons 1911-12-13, asst. engr. on power investigations in Man. Alta, Sask. for Dominion Water Power Br.; 1914-15, asst. engr. on Alta. and Sask. power investigations for same firm; 1916-19 with C.E.F. (Overseas); at present insp. engr. Power Development on Winnipeg River for Dom. Water Power Br.

References: J. B. Challies, J. T. Johnston, C. H. Attwood, K. H. Smith, W. G. Swan.

HOGARTH—CLARENCE EARLE, of St. Catharines, Ont. Born at Hamilton, Ont. July 17th, 1890. Educ. B.A.Sc. Toronto Univ. 1915. 1908-10 rodman, timekeeper, etc. C.N.R.; 1910-11 instr'man on staff of City Engr. Hamilton; summer 1911 asst. to E. D. Bolton, Listowel, Ont.; summer 1912 in chg. of party City of Toronto: 1913 asst. in P. W. D.; 1914-15 on eng. staff of Welland Ship Canal; 1916-19 Lieut. in Can. Engineers (Overseas).

References: E. R. Gray, P. Gillespie, T. K. Thomson, C. R. Young, E. P. Johnson.

KOHL—GEORGE HUTTON (Major), of Hamilton, Ont. Born at Montreal, Que. Dec. 21st, 1889. Educ. B.Sc. (Elec.) McGill Univ. 1910. 1909, (4 mos.) elec. repair shop, Illinois Steel Co.; 1911-12 (6 mos.) test dept. Can. Westinghouse Co. Hamilton; 1912-14, water power surveys in B.C. for Prince Rupert Elec. Co., including run off storage, measurements of flow, etc. and preliminary designs; 1914 in Royal Engrs. as subaltern, later major commanding field coy., returned May 17th, 1919.

References: G. H. Duggan, L. Herdt, R. F. Hayward, C. V. Christie.

MORROW—HUGH MERVYN, (Lieut.) of Montreal. Born at Halifax, N.S., Apr. 25th, 1885. Educ., B.Sc., McGill Univ., 1908. 1909-10. mine supt., Jacobs Asbestos Mining Co.; 1911-12, ch. engr., Asbestos Corp. of Canada Ltd.; 1913-15, dept. mgr., Can. Fairbanks Morse; 1915-18, lieut., Can. Ry. Troops, France; at present, tech, salesman, Dom. Iron & Steel Co.

References: A. F. Byers, H. M. Jaquays, J. C. Kemp, G. K. McDougall, J. M. Oxley, J. B. Woodyatt.

NEHIN—FRANK O'BRIAN, of Montreal. Born at Buffalo, N.Y., Feb. 4th, 1893. Educ., B.Sc., McGill Univ. 1916. 2 yrs. in Arts. Summers 1913 to 1916, rodman, Inst'man, etc., on Montreal Harbour; 1916-17, inst'man, Mt. Royal Tunnel Co.; 1917-18, dftsman., Mich. State Highway; 1918 (4 mos.) dftsman, H. C. Frick Coke Co., Scottdale, Pa.; 1918, ch. of field party, Mt. Royal Tunnel & Terminal Co., nd from Dec. 1918 to date, asst. engr.

References: A. F. Stewart, W. E. Joyce, S. J. H. Waller, T. W. Harvie, A. F. Wall, E. H. Brietzcke.

WILSON—NORMAN, of Ottawa, Ont. Born at Chatham, N.B. June 17th, 1892. Educ. B.Sc. Univ. of N.B. 1913. summers 1910-11-12, Dept. of P. W.; 1913 Foundation Co. (Miramichi River Bridge); 1913-14-15 hydrographic survey, St. Lawrence River investigation; 1915 checking power consumption, St. Marys Rivers; 1916-19. Lieut. with Canadian Engineers, (overseas); at present asst. hydrographic survey, Dept. of Naval Service, Ottawa.

References: W. J. Stewart, H. D. Parizeau, C. F. Hannington, G. Stead, F. W. Fourneret, F. Anderson.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

DERY—THEODORE, of Rimouski, Que. Born at Rimouski, Que. July, 18th, 1895. Educ. 3 yrs. Rimouski coll., summer 1913-14, rodman, D.P.W. Rimouski; 1915 to date asst. engr. D.P.W. Rimouski.

References: J. C. Tache, L. G. Trudeau, P. E. Mercier, R. Blais, P. E. Amiot.

Monthly Engineering Index

In this department will be published from month to month the titles of current engineering papers with the authors and source and a brief extract of the more important. It is designed to give the members of The Institute a survey of all important articles relating to every branch of the engineering profession.

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MUNITIONS AND MILITARY ENGINEERING

Ammunition, Artillery. The Design of Artillery Ammunition and Some Recent Developments at Frankford Arsenal, J. Wallace Taylor. Jl. Engrs. Club, Philadelphia, vol. 36-4, no. 173, Apr. 1919, pp. 127-137, 8 figs. Pressure-velocity curves of a medium caliber gun; graphs showing travel of projectile against twist torque; table indicating atmospheric resistance to flight of projectile with ogival head or 2-caliber radius.

Artillery, Railway. Railway Artillery, E. D. Camphell. Jl. Engrs. Club of St. Louis, vol. 4, no. 2, Mar.-Apr. 1919, pp. 142-160, 9 figs. Historical sketch and forecast of future types.

Railway Mounted Artillery in the War. Ry. Age, vol. 66, no. 20, May 16, 1919, pp. 1205-1209. Development of mobile guns from 1863 to time of armistice with special reference to American types.

Automobile Service, French French Military Automobile Service (Le service automobile militaire française), Robert Altermann. Génie Civil, vol. 74, no. 15, Apr. 12, 1919, pp. 291-294, 3 figs. Account of its operation during the war.

Battle Cruisers. The Battle Cruiser, E. F. Eggert. U. S. Naval Inst. Proc., vol. 45, no. 5, May 1919, pp. 719-728. Suggests a type which is said to combine high speed of cruiser and fighting ability of battleship. It is to be 650 ft. long with 28 ft. draft, 20,000 tons displacement, 32 knots speed and have power of 100,000 i. hp.

Battleships. United States Battleship New Mexico, S. M. Robinson. Int. Mar. Eng., vol. 24, no. 5, May 1919, pp. 323-334, 26 figs. Description of propelling machinery; trial data.

Camouflage. A System of Camouflage for Railway Mounts, John M. Goodwin. Jl. U. S. Artillery, vol. 50, no. 3, May 1919, pp. 253-267, 14 figs. Two systems: (1) five-color system for concealment of heavy railway mounts in which great mass of solid surface must be broken up into several separate masses and shadow cast by mount must be hidden as well; (2) three-color system which consists principally in an endeavor to hide field piece by blending its form and shadow with landscape, this being accomplished by use of green, yellow and cream.

Camp Wastes. The Army's Utilization of Camp Wastes, F. C. Bamman. Mun. Jl. & Public Works, vol. 46, no. 18, May 3, 1919, pp. 322-325. Form of contract said to secure great economy in use of food, more material from which glycerine can be derived, and larger revenue.

Engineering, Italian. Notes on the Operations of the Italian Engineers, James H. England. Prof. Memoirs, Corps Engrs., U. S. Army & Engr. Dept., vol. 11, no. 5, Jan.-Feb. 1919, pp. 128-133, 5 figs. Deals with waterways and roads, the latter being designed and constructed with a view to accommodating 10-ton power trucks.

Fortifications. The Future of Permanent Fortifications, C. Beard. Prof. Memoirs, Corps of Engrs., U. S. Army & Eng. Dept., vol. 11, no. 55, Jan.-Feb. 1919, pp. 47-64. Author holds that by paying the price it will be possible in the future to construct fortifications capable of withstanding projectiles of large caliber, but remarks, quoting Napoleon, that "like cannon, fortresses are arms which alone cannot fulfill their missions."

Gas Masks. Gas Defense, Oscar E. Stevens. Stone & Webster Jl., vol. 24, no. 5, May 1919, pp. 365-371, 7 figs. Types of gas masks used by various beligerents during war.

Gun Emplacements. Notes on the Field Emplacement of a German Large Caliber Gun, G. P. Pillsbury. Professional Memoirs, Corp Engrs., U. S. Army & Engr. Dept., vol. 10, no. 54, Nov.-Dec. 1918, pp. 846-853, 3 figs. Foundation was wholly of structural steel and forged plates, no concrete being used. It had been prepared by excavating pit of required horizontal dimensions, about 7 ft. deep. No signs of overstrain were found in any part of foundation structure.

Guns, Location of. Listening for the Enemy. Sci. Am., vol. 120, no. 20, May 17, 1919, pp. 510-511, 8 figs. How a gun is located by timing its report as heard at three points.

Mining. The Work of the Miner on the Western Front, 1915-1918, H. Standish Ball. Bul. Instn. Min. & Metallurgy, no. 175, Apr. 1919, pp. 1-53, 32 figs., partly on 19 separate plates. Empirical formulæ by means of which fairly accurate calculations are said to have been made of the size and depth of the crater resulting from an explosion.

Mining in Chalk on the Western Front with Some Notes on the Explosion of Large Charges of High Explosives, L. B. Reynolds. Can. Min. Inst. bul. no. 85, May 1919, pp. 483-493, 1 fig. Diagrammatic illustration of manner in which enemy works were located.

Munitions, Canada. Canada Made a Remarkable Record in Production of Munitions, T. M. Fraser. Can. Machy., vol. 20, no. 26, Dec. 26, 1918, pp. 717-721. Imperial Munitions Board gives figures of total production in various plants.

Stokes Gun. The Stokes Gun and Shell and Their Development, Wilfred Stokes. Professional Memoirs, Corps Engrs., U. S. Army & Engrs. Dept., vol. 10, no. 54, Nov.-Dec., 1918, pp. 765-788, 24 figs. Setting-up mechanism modified by introducing modified leg of heavier design and with only half the traverse. Similar improvements made in mechanism and accessories.

MARINE ENGINEERING

AUXILIARY MACHINERY

Anchors. New Type of Anchor. Iron Age, vol. 103, no. 19, May 8, 1919, pp. 1225-1226, 4 figs. Allison cast-steel product with spoon-shaped flukes.

Compasses. The Gyro Compass. An Essential Navigation Instrument, M. R. Lott. Monthly Jl., Utah Soc. of Engrs., vol. 5, no. 2, Feb. 1919, pp. 28-41, 8 figs. Points of difference between a gyro-compass and a magnetic compass.

Electrical Auxiliaries. Merchant Marine Electrical Auxiliaries, Walter E. Thau. Jl. Am. Soc. Marine Draftsmen, vol. 5, no. 4, Jan. 1919, pp. 55-59, 5 figs. Advantages claimed for electrical appliances over steam appliances are economy, flexibility, lessening of noise and greater reliability.

Propellers. Propeller Patterns. Machy. (Lond.), vol. 14, no. 344, May 1, 1919, pp. 125-129, 8 figs. Methods of laying out propeller patterns, assembling different sections and working blades to required form.

Investigations into the Causes of Corrosion or Erosion of Propellers. Charles A. Parsons and Stanley S. Cook. Engineering, vol. 107, no. 2781, Apr. 18, 1919, pp. 515-519, 21 figs., also Shipbuilding & Shipping Rec., vol. 13, no. 16, April 17, 1919, pp. 494-495, and Engineer, vol. 127, no. 3301, Apr. 4, 1919, pp. 427-428. Result of investigation on nature of surface and state of initial stresses in blades under working conditions; impingement of water at high velocity; cavitation; water hammer produced by vortex cavities. Paper read before Instn. Naval Architects.

SHIPS

Boilers. The Work of the British Marine Engineering Design and Construction Committee, A. E. Seaton. Engineering, vol. 107, no. 2781, Apr. 18, 1919, pp. 519-522, and Shipbuilding & Shipping Rec., vol. 13, no. 16, Apr. 17, 1919, pp. 483-484. Object of committee was unification of all rules which govern design and construction of all marine machinery, especially of that pertaining to boilers. Papers read before Instn. Naval Architects.

Cast-Steel Ship. The Cast-Steel Ship Development, Myron E. Hill. Iron Age, vol. 103, no. 21, May 22, 1919, pp. 1351-1352, 2 figs. Standard units cast in sand, assembled in position and automatically welded.

Coastal Motor Boats. Coastal Motor Boats for the Navy. Engineer, vol. 127, no. 3303, Apr. 18, 1919, pp. 369-371, 3 figs. Design aimed at smallest possible dimensions consistent with carrying of torpedo, speed of at least 30 knots and full capacity for wide radius of action.

The Mysterious "C. M. B.'s" Motor Boat, vol. 16, no. 10, May 25, 1919, pp. 8-9, 4 figs. British 55-ft. coastal motor boat designed to run at high speed and to withstand hard sea work, carries two torpedoes which are discharged over stern.

Compartment Designs of Hull. Italian Two-Floodable Compartment Cargo Steamers, Salvatore Orlando. Engineering, vol. 107, no. 2782, Apr. 25, 1919, pp. 533-537, 9 figs. Design to permit keeping ship afloat after torpedo explosion, according to specifications proposed by engineers and technical men assembled in Genoa on August 18, 1917, to examine from a technical standpoint the urgent question of reconstruction of mercantile fleet and conservation of remaining vessels. Paper read before Instn. Naval Architects.

Protection of Freight Steamers (Per una maggiore difesa del naviglio de carico), Mario Taddei. Rivista Marittima, vol. 51, no. 11, Nov. 1918, pp. 187-206, 2 figs. Technical remarks on compartment designs of hull.

Electric Propulsion. Electric Drive on Merchant Ships, W. L. R. Emmet. Instn-Mar. Eng., vol. 24, no. 5, May 1919, pp. 335-337. Electric propulsion of single-screw cargo vessel proposed.

Electric Drive from a Military Point of View, S. M. Robinson. Mar. Eng. & Can. Merchant Service Guild Rev., vol. 9, no. 4, Apr. 1919, pp. 137-138. Based on technical considerations and performance of S. S. "New Mexico."

Merchant Shipbuilding. Some Recent Developments Towards a Simplification of Merchant Ship Construction, Eustace Tennyson d'Eycourt and Thomas Graham. Engineering, vol. 107, nos. 2781 & 2782, Apr. 18 & 25, 1919, pp. 503-505 and 554-556, 16 figs., also Shipbuilding & Shipping Rec., vol. 13, no. 16, Apr. 17, 1919, pp. 488-493, 17 figs. Design was intended to fulfill three conditions; (1) employment of labor unaccustomed to shipbuilding, (2) construction which would fully avail itself of such labor, and (3) process of obtaining parts of ship from various sources of supply and subsequently assembling such parts at the building berths. Paper read before Instn. Naval Architects.

MODEL EXPERIMENTS. Some Experiments on Full Cargo Ship Models, James Semple. Shipbuilding & Shipping Rec., vol. 13, no. 16, Apr. 17, 1919, pp. 495-497, 5 figs. Results of experiments made in order to determine effect on performance (1) of fullness, and (2) of longitudinal distribution of displacement. Paper read before Instn. Naval Architects.

Model Experiments on the Effect of Beam on the Resistance of Mercantile Ship Forms, J. L. Kent. Engineering, vol. 107, no. 2782, Apr. 25, 1919, pp. 550-553, 11 figs., also Shipbuilding and Shipping Rec., vol. 13, no. 16, Apr. 17, 1919, pp. 501-503. Research on effect upon resistance of change in maximum beam, carried out at William Froude National Tank. Paper read before Instn. Naval Architects.

SPEED, COST OF. On the Great Cost of High Speed, Sidney Graves Koon. Int. Mar. Eng., vol. 24, no. 5, May 1919, pp. 357-359, 1 fig. Analysis of relative costs in power for moderate increases in speed in slow- and high-speed vessels.

STABILITY OF SHIPS. Stability of Ships, George Nicol. Shipbuilding & Shipping Rec., vol. 13, no. 18, May 1, 1919, pp. 562-564, 7 figs. Method of obtaining cross curves of stability by employment of longitudinal sections. Paper read before Instn. Engrs. & Shipbuilders in Scotland.

SUBMARINE CHASERS. The 110-Foot Submarine Chasers and Eagle Boats. J. A. Furer, U. S. Naval Instn. Proc., vol. 45, no. 5, May 1919. pp. 753-767. How British Admiralty solved problem of providing effective patrol boats for war zone and for combating activity of submarine.

United States 110-Foot Submarine Chasers, R. P. Sanborn. Int. Mar. Eng., vol. 24, no. 5, May 1919, pp. 337-343, 10 figs. Construction, equipment and engineering data, also part this type of naval vessel played in the war.

SUBMARINES. Below Deck on a U-Boat, Warren O. Rogers. Power, vol. 49, no. 20, May 20. 1919, pp. 784-787, 5 figs. Notes on engine room and torpedo room.

TANKERS. The World's Largest Oil Tanker. Petroleum Times, vol. 1, no. 14, Apr. 12, 1919, pp. 289-292, 5 figs. Vessel has d.w. carrying capacity of over 18,000 tons.

TONNAGE. The Tonnage of Modern Steamships, A. T. Wall. Engineering, vol. 107, no. 2782, Apr. 25, 1919, pp. 549-550, also Shipbuilding & Shipping Rec., vol. 13, no. 16. Apr. 17, 1919, pp. 479-481. Effect of recent legislation on modern machinery on tonnage measurement. Paper read before Instn. Naval Architects.

TURBINE MACHINERY. Turbine Machinery for Standard Ships. Engineer, vol. 127, no. 3303, Apr. 18, 1919, pp. 371-373, 11 figs., partly on supp. plate. Two Turbines driving one screw propeller through toothed reduction gearing considered as most economical design because it is said that by splitting up power between two units, turbines can be designed to utilize high vacuum without making machines unduly large or adopting inconveniently high speed.

Marine Geared Turbines Have Shown Great Economy and Efficiency, William H. Easton. Marine News, vol. 5, no. 12, May 1919, pp. 110-111, 5 figs. Discussion of relative advantages of turbines and reciprocating engines.

MODERN SHIPS. 3500-Ton D. W. Auxiliary Schooners Built for France. Rudder, vol. 35, no. 5, May 1919, pp. 244-247, 5 figs Built of Oregon fir in long lengths. Machinery consists of two triple-expansion steam engines and two Roberts water-tube boilers with 1800 sq. ft. heating surface.

The Uses of Wood, Hu Maxwell. Am. Forestry, vol. 25, no. 304, Apr. 1919, pp. 973-983, 21 figs. Wooden boats and their manufacture. Twentieth article.

TERMINALS

COALING. Coaling Ships Mechanically—II, Wilbur M. Stone. Coal Trade Jl., vol. 50, no. 19, May 7, 1919, pp. 527-529, 4 figs. Trimming mechanism. driving motor and reduction gearing. Concluding article.

SHANGHAI. The Port of Shanghai, Paul Page Whitman. Pac. Mar. Rev., vol. 16, no. 5, May 1919, pp. 71-77, 17 figs. General description. Maritime customs report for 1917 shows foreign trade of this port to be a little over one-half billion dollars.

WHARF EQUIPMENT. Wharf Equipment, Roy S. MacElwee. Professional Memoirs, Corps Engrs., U. S. Army & Engr. Dept., vol. 10, no. 54, Nov.-Dec. 1918, pp. 820-840, 12 figs. Determining size of transit shed. Reference is made to conditions in several of principal ports in the world.

YARDS

BRITISH COLUMBIA. British Columbia's Part in Ship Programme A. F. Menzies. Can. Machy., vol. 20, no. 26, Dec. 26, 1918, pp. 722-729, 15 figs. Program undertaken by Imperial Munitions Board Wooden Shipbuilding Dept. report completed and to have resulted in addition of 27 wooden steamers of total d.w. capacity of over 75,000 tons.

CASTINGS. Steel Foundry to Cast Ships. E. C. Kreutzberg. Mar. Rev., vol. 49, no. 6, June 1919, pp. 269-271, 4 figs. Methods of Cast Steel Ship Corp., New York, for casting component parts of ships. Parts are afterwards permanently joined by welding.

CONCRETE CAR FLOATS. New Concrete Shipyard on Lake Erie. Int. Mar. Eng., vol. 24, no. 5, May 1919, pp. 352-356, 14 figs. Method of constructing concrete car floats.

CONCRETE SHIPYARDS, BRITISH. British Concrete Shipyards, W. Noble Twelvetrees. Engineering, vol. 107, no. 2776, Mar. 14, 1919, pp. 334-338. 21 figs. partly on separate plates. Two yards are dealt with, (1) Brentford, of limited capacity, as only one vessel not exceeding 150 ft. can be built there at a time; and (2) Rochford, equipment of which provides for simultaneous construction of three vessels up to nearly 200 ft. in length.

HOG ISLAND SHIPYARD. The Electrical Features of Hog Island Shipyard, H. W. Osgood. Jl. Engrs. Club, Philadelphia, vol. 36-5, no. 174, May 1919, pp. 165-173, 8 figs. Problem was to anticipate where and in what amount electric service would be required in yard which was expected to grow up in a few months, at a time when only partial plans were known. Paper read before Assn. Iron & Steel Elec. Engrs.

The Hog Island of Today. Pac. Mar. Rev., vol. 16, no. 5, May 1919, pp. 83-94, 21 figs. and supp. chart. Technical data of engineering features connected with design and construction of ships being built and construction and management of yard.

WELDING. Some Experiences with Electric Welding in Warships, W. H. Gard. Shipbuilding & Shipping Rec., vol. 13, no. 16, Apr. 17, 1919, pp. 485-486. Repairing cast-steel stern post of battleship and similar work carried out during the war. Paper read before Instn. Naval Architects.

Electric Welding in Ship Construction. Elec. Eng., vol. 52, no. 5, Nov. 1918, pp. 14-15. Projects and some experimental results obtained by British Admiralty.

Electric Welding, Thomas T. Heaton. Steamship, vol. 30, no. 359, May 1919, pp. 252-253. Systems applied to welding of mild steel. Paper read before Instn. Mech. Engrs.

GENERAL SCIENCE

CHEMISTRY

ABSORPTION. Absorption of Precipitates, Harry B. Weiser and J. L. Sherrick. Jl. Physical Chemistry, vol. 23, no. 4, Apr. 1919, pp. 205-252, 2 figs. Absorption of following anions by precipitated barium sulphate said to have been determined; Chloride, bromide, iodide, chlorate, permanganate, nitrate, nitrite, cyanide, sulphocyanate, ferrocyanide and ferricyanide. Order of absorption was not in accord with Schulze's law.

ANALYSIS, COKE. Precautions Necessary in Grinding Samples of Coke for Analysis, A. E. Findley. Jl. Soc. Chem. Indus., vol. 38, no. 7, Apr. 15, 1919, pp. 93T-94T. Reports that samples of coke ground in an iron mill were found to be magnetic; consequently recommends placing coke in strong linen bag and grinding it to fine powder in agate mortar.

ANALYSIS, GAS. An apparatus for the Automatic Estimation of Small Amounts of Oxygen in Combustible Gas Mixtures or of Combustible Gases in Air, H. C. Greenwood and A. T. S. Zealley. Jl. Soc. Chem. Indus., vol. 38, no. 7, Apr. 15, 1919, pp. 87T-90T. 3 figs. Principle involved is that of combustion of oxygen or impurity by means of intermittently heated platinum wire.

The Determination of Sulphites, and of Sulphur Dioxide in Gaseous Mixtures, Percy Heller. Jl. Soc. Chem. Indus., vol. 38, no. 5, Mar. 15, 1919, pp. 52T-56T. It is concluded from experimental research that the addition of 5 per cent glycerin to solutions or sulphites, or to caustic soda solutions used in absorbing sulphur dioxide, prevents any loss by spontaneous oxidation to sulphate.

ANALYSIS, PHOSPHORUS. The Estimation of Phosphorus in the Presence of Tungsten, G. Watson Gray and James Smith. Iron & Steel Inst., Ann. Meeting, May 8, & 9, 1919, no. 5, 4 pp. Method devised by writers.

ANALYSIS, STEEL. Determination of Uranium, Zirconium, Chromium, Vanadium and Aluminum in Steel—I, Charles Morris Johnson. Chem. & Metallurgical Eng., vol. 20, no. 10, May 15, 1919, pp. 523-524, 1 fig. Method based on fact that when ammonia is added to iron in the ferrous state the unoxidized iron is first converted to double sulphate of ferrous iron and ammonium and remains in solution. Addition of ammonia forms precipitate.

COLLOIDS. The Colors of Colloids—III & IV, Wilder D. Bancroft. Jl. Physical Chemistry, vol. 23, nos. 3 & 4, Mar. & Apr. 1919, pp. 154-185 and 253-282. Rayleigh's discussion of visibility of polished surfaces; phenomena exhibiting invisibility due to uniform illumination; soap bubbles, oil or tar upon water, tempered steel, the brilliant colors of lead skimmings, Nobili's metallochrome, insects' wings, and other objects exhibiting colors of thin plates. Survey and analysis of various theories.

RUBBER. Rubber as a Colloid, D. F. Twiss. Jl. Soc. Chem. Indus., vol. 38, no. 5, Mar. 15, 1919, pp. 47T-49T and (discussion), pp. 49T-50T. Suspensoid character of rubber is deduced from its behavior in electrolytic process of separating it from latex.

SOLUBILITY. Theory of Solubility (Théorie de la solubilité), Albert Colson. Comptes rendus des séances de l'Academie des Sciences, vol. 168, no. 13, Mar. 31, 1919, pp. 681-684. Thermo-dynamic interpretation of sense of phenomenon, eutectic concentrations, angular points, etc. A formula of solubility is developed from the chemical principle established by Chesneau that the concentration of a solution varies in the same sense as the osmotic pressure.

SOLUTIONS. Sulphur as a Cryoscopic Solvent (Schwefel als kryoskopisches Losungsmittel), E. Beckmann and C. Platzmann. Zeitschrift fur anorganische & allgemeine Chemie, vol. 102, no. 3, Apr. 9, 1918, pp. 201-214. Describes results of series of tests. Adjustment of "natural" melting point; determination of cryoscopic constant; catalytic influences; some applications of cryoscopic constant to anorganic substances.

On the Determination of Boiling Points of Solutions, F. G. Cottrell. Jl. Am. Chem. Soc., vol. 41, no. 5, May 1919, pp. 721-729, 1 fig. Particulars of method described consists in placing thermometed bulb in gas phase as in the case of pure liquid and making the boiling of the liquid itself pump some of the latter mechanically in a thin film over it, thus duplicating as far as possible the same relations of gas, liquid and thermometer which ordinarily obtain in boiling-point determinations of pure substances.

ULTRA-VIOLET RAYS. Use of Ultra-Violet Rays—XXIV. Chem. Engr., vol. 27, no. 4, Apr. 1919, pp. 102 and 20 (adv.). Description of absorption spectra apparatus and ultra-violet light filters.

MATHEMATICS

BESSEL-CLIFFORD FUNCTION. The Bessel-Clifford Function, G. Greenhill. Engineering, vol. 107, no. 2776, Mar. 14, 1919, p. 334. Claims to simplify formula relating to stability, statistical and dynamical of a beam, strut or whirling shaft.

EQUATIONS. Linear Equations with Unsymmetric Systems of Coefficients, A. J. Pell. Trans. Am. Mathematical Soc., vol. 20, no. 1, Jan. 1919, pp. 23-29. Theory for linear equations in infinitely many unknowns. Method followed consists in reduction, by means of biorthogonal system, to system of linear equations with limited symmetric matrix of coefficients.

Solution of Simultaneous Linear Differential Equations and Certain Problems in Mechanics by means of D Symbol (Applications du calcul symbolique à l'intégration des équations différentielles linéaires simultanées et à la résolution de certains problèmes de mécanique), H. Vogt. Revue Générale de l'Electricité, vol. 5, no. 16, Apr. 1919, pp. 581-589. In R. G. E., vol. 2 Sept. 20 and Oct. 13, 1917, pp. 483 and 533, writer applied this system of solution to single differential equations occurring in electrotechnics; in present note application is extended to simultaneous equations and exemplified in various cases of vibratory motion and gyroscopic action.

The General Solution of the Indeterminate Equation: $Ax+By+Cz+\ldots r$, D. N. Lehmer. Proc. Nat. Acad. Sciences, vol. 5, no. 4, Apr. 1919, pp. 111-114. Treats equation in same non-tentative way that is found in continued fraction solution for two variables.

ISOMORPH. A Partial Isomorph of Trigonometry, E. T. Bell. Bul. Am. Mathematical Soc., vol. 25, no. 7, Apr. 1919, pp. 311-321. Isomorph considered as the algebra of sets and parities, and the related properties of functions.

ORTHOGONAL PROJECTION, MODEL. A New Geometrical Model for the Orthogonal Projection of the Cosines and Sines of Complex Angles, A. E. Kennelly. Proc. Am. Academy of Arts & Sciences, vol. 54, no. 5, Apr. 1919, pp. 371-378, 4 figs. on separate plates. Three-dimensional structure constructed to permit verification of sines and cosines of complex angles by two successive orthogonal projections on to X-Y plane, one projection being made from a rectangular hyperbola, and the other from a circle selected among a theoretically infinite number of non-coplanar circles, all concentric at origin.

TRIAD SYSTEM TRAINS. The Trains for the 36 Groupless Triad Systems on 15 Elements, Louise D. Cummings. Bul. Am. Mathematical Soc., vol. 25, no. 7, April 1919, pp. 321-324. Triad system being regarded as an operator, covariants of that operator are deduced. These covariants are called trains or systems.

PHYSICS

ALCOHOL-WATER MIXTURES. The Determination of the Freezing-Point Curves and Densities of Denatured Alcohol-Water Mixtures, Clarke E. Davis and Mortimer T. Harvey. Jl. Indus. & Eng. Chem., vol. 11, no. 5, May 1919, pp. 443-448, 10 figs. A "zone of safety" is proclaimed for several concentrations. Tests were conducted at Chem. Eng. Lab., Columbia Univ., for the purpose of determining means of protecting radiator and cooling system of automobiles, airplanes and trucks from freezing.

DIFFRACTION FIGURES. On the Diffraction-Figures Due to an Elliptic Aperture, C. V. Raman. Physical Rev., vol. 13, no. 4, Apr. 1919, pp. 259-260, 2 figs. on supp. page. Transition from Fresnel to Fraunhofer class of diffraction figure is traced and attention drawn to geometric law to which pattern conforms.

DIAMOND, DISPERSION OF. On the Dispersion of Diamond, L. Silberstein. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 220, Apr. 1919, pp. 396-406, 2 figs. Applies concept of electrical intersection of atoms (see Refractive and Atomic Interaction, Phil. Mag., vol. 33 (1017), p. 521, especially general formulæ (2), (3) on p. 522) to refractive properties of diamond considered as assemblage of fixed "atomic centers," each containing a single dispersive electron and becoming a doublet in presence of an external electric field.

ELECTRICAL ACTION, LAWS OF. On the Fundamental Law of Electrical Action, Megh Nad Saha. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 220, Apr. 1919, pp. 347-371, 1 fig. Theoretical study based on electro-dynamic principles as modified by Lorents, Einstein and Minkowski according to the principle of relativity. Method followed is that of four-dimensional analysis as initiated by Minkowski in Mathematische Annalen, vol. 68, p. 472, et seq.

GYROSCOPIC FORCE OF FLUIDS. Gyroscopic Force of Fluids (Sur la force gyroscopique des fluides), E. Faure. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 8, Feb. 24, 1919, pp. 395-398. Forces in system of pipes containing a fluid when subjected to gyroscopic motion.

INOIC MOVEMENT IN ELECTRILYSIS. Movement of Ions in Electrolysis (Sul Movimento degli joni nell'elettrolisi), Carlo Del Lungo. Il nuovo cimento, Series 6, vol. 16, nos. 3-4, Sept.-Oct. 1918, pp. 173-181. Formula for velocity.

LUMINOSITY, ELECTROLYTICALLY PRODUCED. An Application of Electrolytically Produced Luminosity. Forming a Step Towards Telectroscopy, L. H. Walter. English Mechanic, vol. 109, no. 2822, Apr. 25, 1919, pp. 160-161, 1 fig. Attempting to reproduce Johnstone's experiments, writer claims to have succeeded in constructing various luminous devices out of aluminum alloys. Paper read before Roy. Soc.

MATHEMATICAL PHYSICS. Examples of Operational Methods in Mathematical Physics, T. J. I'a. Bromwich. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 220, Apr. 1919, pp. 407-419, 1 fig. Heaviside's methods (Proc. Lond. Math. Soc., vol. 15, 1916, p. 401, particularly paragraph 3 and 4) to examine whether assumption of uniform rate of descent and unfirom temperature-gradient are sufficient to explain various observations recorded on thermometers carried in aeroplanes.

MATTER AND LIGHT. Matter and Light (Matière et lumière), Jean Perrin. Annales de Physique, vol. 11, Jan.-Feb. 1919, pp. 5-108. Dissociations and combinations, phosphorescence, radioactivity and changes of physical state explained by theory which represents light as immediate cause of chemical reactions and establishes fundamental law governing many physical and chemical phenomena.

PENDULUM, FOUCAULT. On the Irregularities of Motion of the Foucault Pendulum, A. C. Longden. Physical Rev., vol. 13, no. 4, Apr. 1919, pp. 241-258, 20 figs. In brief historical statement emphasis is put on current opinion that Foucault pendulum must be very long and very heavy in order to be successful. It is shown then that the elliptical motion so common in Foucault pendulum experiments is not due to insufficient length or weight, or atmospheric disturbances, but to unequal freedom of motion in different directions.

PIEZO ELECTRICITY. Piezo-Electricity and its Applications. Engineering, vol. 107, no. 2782, Apr. 25, 1919, pp. 543-544, 6 figs. Experiments exhibiting formation of electricity by pressure acting on tourmaline crystals and similar substances. Paper read before Roy. Instn.

RADIOACTIVE LEAD. The Problem of Radioactive Lead—II. Nature, vol. 103, no. 2579, Apr. 30, 1919, pp. 93-96. Comparison of two kinds of lead—the ordinary metal, in non-uraniferous ores, and that apparently produced by decomposition of uranium, radium being one of the intermediate products.

VAPOR TENSIONS OF METALS. The Vapor Tensions of the Metals, J. W. Richards. Jl., Franklin Inst., vol. 187, no. 5, May 1919, pp. 581-598, 4 figs. Vapor-tension curves, straightline equation, Trouton's rule and Richards' rule discussed in their application to physical phenomena taking place in sheardardizing and calorizing.

X-RAY SPECTRA. Researches on the X-Ray Spectra (Recherches sur les spectres des Rayons X), Alex Muller. Archives des Sciences physiques et naturelles, vol. 1, 5th period, Mar.-Apr. 1919, pp. 127-132, 2 figs. Experimental verification of law of Einstein.

RAILROAD ENGINEERING

FOREIGN

EUROPEAN TRAIN SPEEDS. European Train Speeds. Ry. Gaz., vol. 30, no. 16, Apr. 18, 1919, pp. 685-687, 2 figs. Survey of highest, longest and fastest non-stop runs, speed of trains between two places and geographical distribution of important services, Balkan States, Roumania, Germany. (Continuation of serial.)

FOREIGN DEVELOPMENTS. Railway Developments in Foreign Countries. Ry. Age, vol. 66, no. 19, May 9, 1919, pp. 1163-1164. Proposed extension in Peru; suggestions for trading with Greece; South African news.

NORWAY. Transport Conditions on Norwegian Railways During the War (Vore jaernbaners transport forhold under Krigen), Chr. Platon. Teknisk Ukeblad, vol. 66, no. 11, Mar. 14, 1919, pp. 147-156, 15 figs. Development and present conditions. Railways are state-owned. Figures indicating traffic during the war.

CONSTRUCTION

WELDING OUTFITS. Local Building of Railway Special Work with the Aid of an Oxygen-Acetylene Cutting and Welding Outfit, Montelle C. Smith. Stone & Webster Jl., vol. 24, no. 5, May 1919, pp. 402-409, 4 figs. Experience in building frogs, switchmates and switches.

ELECTRIC RAILROADS

BATTERY LOCOMOTIVES. Electric Battery Locomotives. Quarry, vol. 24, no. 267, May 1919, pp. 125-126, 1 fig. Consideration given to Brush type by Ministry of Munitions. These locomotives haul loads of three to four tons on level track.

LOCOMOTIVE DESIGN. The Progess of Electric Locomotive Design, W. B. Potter and S. T. Dodd. Ry. Age, vol. 66, no. 19, May 9, 1919, pp. 1157-1158. States that geared motors mounted directly on the axle will probably be continued for freight and slow-speed passenger work, while locomotives for high-speed passenger work, while locomotives for high-speed passenger service will be preferably of gearless design.

REGENERATIVE BRAKING. The Economics of Electric Operation of Railways, W. G. Gordon. Jl. Eng. Inst. Can., vol. 2, no. 5, May 1919, pp. 398-401. Costs of maintenance of electric locomotive for an average of five years for three railroads, an average of four years for two roads, an average of 2 years for C., M. & St. P. R.R., with figures of saving effected by regenerative braking obtained by this road.

SUBSTATIONS, RAILWAY CONVERTER. Railway Converter Substations, C. E. Lloyd. Elec. Eng., vol. 53, no. 3, Mar. 1919, pp. 108-112, 3 figs. Plan of Taggart Street substation, Pittsburgh Railways Co.

WESTINGHOUSE PNEUMATIC CONTROLLER. Westinghouse Pneumatic Controller of French Suburban Locomotives (Equipment Westinghouse pour la commande electro-pneumatique des automotrices de banlieue des chemins de fer de l'Etat), Lucien Pahin. Industrie Electrique, vol. 28, no. 644, Apr. 25, 1919, pp. 145-148, 1 fig. Scheme of connections and description of operation. (Concluded.)

ELECTRIFICATION

ELECTRIFICATION AND POLICIES. Some Possibilities of Steam Railroad Electrification as Affecting Future Policies, Calvert Townley. RR. Herald, vol. 23, no. 6, May 1919, pp. 133-135. Fundamental difference between electrification and steam propulsion. Emphasizes, among other features, practically unlimited power electricity can furnish as compared to strictly limited motive power of locomotives.

FRANCE. Partial Electrification of French Railways; Experiences Acquired in France and in Other Countries Concerning Electrification of Main Line Roads (Programme d'électrification partielle des chemins de fer français: expérience actuellement acquise en France et à l'étranger dans l'électrification des grandes lignes), A. Mauduit. Bulletin de la Société Française des Electriciens, vol. 9, no. 78, Mar. 1919, pp. 127-160, 8 figs. Figures indicating fuel economy; types of locomotives, particularly three-phase designs used in Simplon tunnel; operating practice.

IOWA. Electrification of Steam Road Results in Service and Success. Elec. Traction, vol. 15, no. 5, May 1919, pp. 290-293, 9 figs. Iowa Southern Utilities Co.'s experience.

LIMITING FACTORS. Main Line Railway Electrification. Times Eng. Supp., vol. 15, no. 534, Apr. 1919, p. 127. Some limiting factors.

LOCOMOTIVE CHARACTERISTICS. Railroad Electrification, F. H. Shepard. Jl. Eng. Inst. Can., vol. 2, no. 5, May 1919, pp. 402-406 and (discussion), pp. 406-409, 10 figs. Examples of track arrangement and details of locomotive design. Graphs indicating comparative steam- and electric-locomotive characteristics.

PANTAGRAPH SHOE DESIGN. Railroad Electrification Facts and Factors, A. J. Manson. Ry. Elec. Engr., vol. 10, no. 5, May 1919, pp. 147-149, 4 figs. Pantagraph shoe design is governed by class of service in which the locomotive operates.

PROGRESS. Steam Railroad Electrification. Calvert Townley. Elec. Eng., vol. 53, no. 4, Apr. 1919, pp. 170-172. Blames electrical men for slow progress during last 20 years.

SWISS RAILWAYS. Electrification of Swiss Railways (Die Elektrifizierung der Schweiz. Bundesbahnen), E. Huber-Stockar. Schweizerische Bauzeitung. vol. 73, no. 15, Apr. 12, 1919, pp. 174-178, 4 figs. Difficulties encountered concerning supply of labor and material. Idea of electrification was suggested and work hastened by steadily increasing shortage of coal. Description of various power stations and single-phase a. c. 15,000/60,000-volt transformer for Riton power station. (To be concluded.) Paper read before Zurcher Ingenieur & Architekten Verein.

LOCOMOTIVES

COMPARATIVE EFFICIENCIES, COMPOUND AND SIMPLE LOCOMOTIVES. Comparative Efficiency of a Compound and a Simple Locomotive Both Using Superheated Steam, C. J. Mellin. Loco. vol. 10, no. 1, May 1919, pp. 3-11, 4 figs. Diagrams worked out from investigation as to ranges in temperatures and expansion of superheated steam.

FEED WATER HEATERS. Feed Water Heaters and Their Development, J. Snowden Bell. RR. Herald, vol. 23, no. 6, May 1919, pp. 143-148, 5 figs. Forms of feed water heaters being applied in the U. S. A. by various locomotive works. (Continuation of serial.)

PULVERIZED COAL. Utilization of Pulverized Coal in Locomotives (L'emploi du charbon pulvérisé sur les locomotives), E. Lasseur. Génie Civil, vol. 74, no. 18, May 3, 1919, pp. 345-349, 7 figs. Present development of this application, notably as practiced by the Locomotive Pulverized Fuel Co., N. Y.

Pulverized Fuel Locomotive. Engineer, vol. 127, no. 330A, Apr. 25, 1919, pp. 400-402, 8 figs. on supp. plate. In order to make fire-box suitable for use of pulverized fuel, grate and ashpan were removed and two openings, each 7½ in. in diameter, were made through the water space; through these openings pulverized fuel with a certain proportion of air is injected. Apparatus located on tender and steam-driven throughout.

STANDARD LOCOMOTIVES. Standard 4-6-2 Type Locomotives. Ry. Mech. Engr., vol. 93, no. 5, May 1919, pp. 230-235, 14 figs. Locomotive is somewhat similar in its proportions to M., K. & T. locomotive, which however, has more heating surface, but a considerably smaller grate and a smaller ratio of firebox heating surface to total heating surface.

The Administration Standard Light Mountain Type. Ry. Age, vol. 66, no. 20, May 16, 1919, pp. 1193-1196, 5 figs. Weight 327,000 lb., tractive effort 53,000 lb. with factor of adhesion of 4.2.

SWISS LOCOMOTIVES. Brown-Boveri Locomotives for the Swiss Federal Railways, J. Buchli. Engineering, vol. 107, no. 2783, May 2, 1919, pp. 562-565, 12 figs. partly on supp. plate. Spur gearing and coupling rods transmit power from motor to driving axles. (To be continued.)

TANK ENGINES. 2-6-4- Tank Engine, Class K. South Eastern and Chatham Railway. Ry. Engr., vol. 40, no. 472, May 1919 pp. 102-103, 2 figs. Design drawings with dimensions.

TESTS. Locomotive Performance—IV, E. G. Young. Loco, vol. 10, no. 1, May 1919, pp. 12-17, 4 figs. Curves obtained in tests made on a Pacific-type locomotive at Pennsylvania laboratory, Altoona.

UNIFLOW. New Express Locomotive with "Uniflow" Cylinders. North Eastern Railway. Ry. Gaz., vol. 30, no. 19, May 9, 1919, pp. 801-803, 5 figs. Boiler has length of 15 ft. 10½ in. and diameter of 5 ft. 6 in.; cylinders, 16½ in. diameter by 26 in. stroke.

MAINTENANCE

CAR TRUCKS. Problems in Design and Maintenance of Car Trucks in Relation to Maintenance of Roadway, W. J. Hyman. Official Proc. Can. Ry. Club., vol. 18, no. 4, Apr. 1919, pp. 15-22 and (discussion), pp. 23-35, 3 figs. Wheel-base trucks in relation to tracks and flat spots from viewpoint of Car Department.

PROGRESS. Progress in Railroad Engineering and Maintenance, as Developed in the Annual Convention of the American Railway Engineering Association, Chicago, March, 1919, J. C. Irwin. New England RR. Club, Apr. 8. 1919, pp. 65-104. Following subjects are touched upon: Flat spots on wheels; economics of railway labor; war emergency yard improvements; umbrella vs. butterfly sheds and screw spikes.

OPERATION AND MANAGEMENT

ACCIDENT PREVENTION. The Prevention of Accidents at Railroad Grade Crossings. Proc. Pac. Ry. Club, vol. 2, no. 12, Mar. 1919, pp. 12-22. Present methods for preventing accidents were discussed as practiced in various parts of the country by different members of the club.

FUEL CONSERVATION. Reduction of Fuel Consumption on the Northern Pacific Railroad, M. A. Daly. Official Proc., N. Y. R. R. Club, vol. 29, no. 6, Apr. 18, 1919, pp. 5632-5636, also Ry. Mech. Engr., vol. 93, no. 5, May 1919, pp. 237-240, 21 figs. Fuel-instruction car employs laboratory demonstrations and moving pictures.

OIL FUEL TRIALS. Oil Fuel Trials: North Western State Railway, India. Ry. Engr., vol. 40, no. 472, May 1919, pp. 90-92, 4 figs. Reports of trials which have been in progress since 1913. Result is said to be that locomotives are to be fitted to burn 60,000 tons of oil per annum Technical paper no 193, Govt. Printing Dept., Calcutta.

PERMANENT WAY AND BUILDINGS

ABUTMENTS. Reinforced Concrete Framed Railway Abutments, Albert M. Wolf. Eng. World, vol. 14, no. 9, May 1, 1919, pp. 23-24, 3 figs. C., M. & St. P. R. R. abutments carry tracks over ends of high embankments, and instead of retaining the embankment, allow it to slope out between and around the abutment posts or piers.

GRADE CROSSINGS. Engineering Treatment of Necessary Railroad Grade Crossings, Rodman Wiley. Mun. & County Eng., vol. 56, no. 5, May 1919, pp. 191-193, 1 fig. Recommend that important crossing be well paved, paving to be level with top of rails, so as to prevent man killing his engine on track.

General Aspects of Grade Separation. Contract Rec., vol. 33, no. 19, May 7, 1919, pp. 440-443. Report issued by Division of Grade Separation and Bridges of city of Detroit. Question is viewed in its relation to city planning and cost of elevating railroads.

RAILS

WEIGHT OF RAIL AND AXLE LOAD. Relation of Weight of Rail to Axle-Load, G. Richards. Ry. Gaz., vol. 30, no. 17, Apr. 25, 1919, pp. 715-716 Reasons for scales of axle loads prescribed in "Schedules of Maximum. Minimum and Recommended Dimensions to be observed on all 5-ft. 6-in., 2-ft. 6-in. and 1-metre gauge railways in India," for 1913 and limitations for spacing of sleepers. From Roy. Engrs. Jl.

ROLLING STOCK

DRAFT GEAR. Freight Car Draft Gear Test Demonstrations. Ry. Age, vol. 66, no. 18, May 2, 1919, pp. 1097-1100, 6 figs., also Ry. Mech. Engr., vol. 93, no. 5, May 1919, pp. 249-252, 6 figs. Method of recording action under impact between cars devised by Inspection and Test Section of Division of Operation, U. S. R. R. Administration.

PERISHABLE-FOOD CARS. On the Design of Railway Wagons for the Carriage of Perishable Foods. Dept. Sci. & Indus. Research. Food Investigation Board, special report no. 1, 1919, 8 pp. Among other suggestions it is advised that doors be laid in two portions, being divided horizontally.

REFRIGERATOR CARS. Report on English Refrigerator Cars. Cold Storage & Produce Rev., vol. 22, no. 253. Apr. 17, 1919, pp. 87-90. Document from Government Research Sub-Committee. Urges among other things, that special attention be directed to airtightness, especially as regards fitting of doors.

SAFETY AND SIGNALING SYSTEMS

BLOCK SIGNALING PRACTICE. Block Signaling Practice on a British Railway. F. B. Holt and A. B. Wallis. Ry. Signal Engr., vol. 12, no. 5, May 1919, pp. 159-161, 3 figs. Electrical equipment used in signal tower on the Midland. First of series of three articles.

LOW FREQUENCY SYSTEM. Supply and Transmission for Modern Railway Signaling, A. E. Tattersall. Ry. Engr., vol. 40, no. 472, May 1919, pp. 92-95, 2 figs. Advantages of low frequency are claimed to be possibility of using standard d. c. apparatus, economy in installation, improvement of power factor and greater variation in operating values of apparatus.

REINFORCED CONCRETE APPLIANCES. Reinforced Concrete for Signal Work in England, A. C. Rose. Ry. Signal Engr., vol. 12. no. 5, May 1919, pp. 152-154, 6 figs. Types of reinforced-concrete signal and telegraph poles, stakes and other appliances.

SHOPS

DIPPING AND BAKING. Insuring Electrical Equipment by Efficient Dipping and Baking, W. G. Lamb. Elec. Traction, vol. 15, no. 5, May 1919, pp. 307-309, 5 figs. Experience with dipping and baking process of Waterloo, Cedar Falls & Northern Railway.

HALIFAX CAR REPAIR SHOPS. Car Repair Building for C. N. R. at Halifax. J. J. MacDonald. Contract Rec., vol. 33, no. 19, May 7, 1919, pp. 427-429, 5 figs. Shell of building consists of plain concrete base wall rising to level of window sills, a series of narrow wall piers between windows and reinforced-concrete entablature and parapet wall above window openings.

OMAHA CAR BARNS. New and Modern Car Barn in Omaha. Elec. Traction, vol. 15, no. 5, May 1919, pp. 293-296, 5 figs. Structure of 100 cars capacity, including single line of columns, giving maximum unobstructed floor space.

ROUNDHOUSE DESIGN. Some Modern Tendencies in Roundhouse Design, Exum M. Haas. Ry. Age., vol. 66, no. 20, May 16, 1919, pp. 1199-1201. Economy in permanent construction. Paper read before Western Soc. of Engrs.

WELDING. Welding Locomotive Drive Wheel. Welding Engr., vol. 4, no. 5, May 1919, p. 29, 3 figs. Pin was broken of flush with wheel, which was performed without removing wheel or preheating.

SPECIAL LINES

NARROW-GAGE REPAIR SHOP TRAINS. Repair Shop Train Used on Narrow Gage in Flanders. F. C. Coleman. Ry. Age, vol. 66, no. 19, May 9, 1919, pp. 1139-1140, 3 figs. Portable machine shop equipped with electric-motor-driven tools and gasoline generator sets.

STREET RAILWAYS

NEW ORLEANS. Suggested Changes in the Operation of the Street Railway System of New Orleans, W. T. Hogg. Proc. Louisiana Eng. Soc., vol. 5, no. 1, Feb. 1919, pp. 25-78, 22 figs. Analysis of present routes from viewpoint of principles said to be scientifically based on geographic relations of commercial, industrial, residential and recreative centers. Present system found inadequate and modifications are suggested.

New York. Six Years of Rapid-Transit Progress in New York, D. L. Turner. Eng. News-Rec., vol. 82, no. 18, May 1, 1919, pp. 865-869, 8 figs. Graphs showing cost of labor, comparison and work accomplished on old and new subway lines.

Rehabilitation Track Standards. Chicago Rehabilitation Track Standards Prove Successful. Elec. Ry. Jl., vol. 53, no. 18, May 3, 1919, pp. 865-869, 5 figs. Five standard types adopted in 1907 and 1909. Study made of rail corrugation as influenced by several types of construction.

Wheels and Axles. Steel-Tired Wheels and Axles, H. Vernon. Elec. Ry. Jl., vol. 53, no. 20, May 17, 1919, pp. 961-963, 7 figs. Practice at tramway sheds of Belfast, Ireland.

TERMINALS

Coaling Station, Lehigh Valley R.R. Modern Railroad Coaling Station, M. V. Bailliere. Coal Trade Jl., vol. 50, no. 19, May 17, 1919, pp. 519-520, 2 figs. Facilities provided for coaling on six different tracks in station built for Lehigh Valley R. R. at Manchester, N. Y.

D. & R. G. Freight Terminal. Novel Features in New D. & R. G. Freight Terminal. Ry. Age, vol. 66, no. 18, May 2, 1919, pp. 1083-1085, 7 figs. Facilities at Salt Lake City include two freight houses, transfer platforms and a team yard.

N. Y. C. Engine Terminal. New York Central R. R. Engine Terminal, Gardenville, N. Y. Ry. Rev., vol. 64, no. 19, May 10, 1919, pp. 677-681, 10 figs. Engine house is equipped with boiler-washing and filling apparatus, portable electric-welding equipment, hoists and trolleys for handling heavy locomotive parts, etc.

AERONAUTICS

AIRCRAFT

Lift of Airships. Lighter-than-Air Craft, T. R. Cave-Browne-Cave. Aeronautics, vol. 16, no. 285, Apr. 3, 1919, pp. 365-371, 4 figs. Technical study of factors governing variation of lift of an airship and its significance in design of envelope. Paper read before Roy. Aeronautical Soc.

Non-Rigid Airships. The Development of Airship Construction, C. I. R. Campbell. Engineer, vol. 127, no. 3303, Apr. 18, 1919, pp. 384-386, 3 figs. General dimensions and dates of three typical non-rigid airships, Zodiac, Parseval and Astra types. Paper read before Instn. Naval Architects.

Rigid Airships. Rigid Airship Design: The Tension in the Diagonal Bracing Wires, E. H. Lewitt. Aeronautics, vol. 16, no. 287, Apr. 17, 1919, pp. 402-403, 2 figs. Formula based on assumption that ship bends about a neutral axis, that longitudinal girders take the bending stresses only, while diagonal bracing wires take all the shear, and that all loads are concentrated at transverse frames.

APPLICATIONS

Air Navigation Regulations. Air Navigation, H. E. Wimperis. Flight, vol. 11, no. 19, May 8, 1919, pp. 600-604, 10 figs. Technical problems in air navigation, similar to those presented by sea navigation and manner of solving same. Paper read before Roy. Aeronautical Soc.
Air Navigation Regulations. Flight, vol. 11, no. 19, May 8, 1919, pp. 608-615, 2 figs. Legislation concerning conditions of flying, aerodromes, safety provisions, licensing of personnel, lights and signals, registration and nationality marks.

Commercial Transportation. Commercial Transportation and High-Speed Services by Air, G. Holt Thomas. Aeronautics, vol. 16, no. 287, Apr. 17, 1919, pp. 404-405. Visualizes trade conditions when "there will be no place on the earth's surface more than four days' journey from London by air."
Air Transports (Aéro-Transports), Ernest Archdeacon. L'Aérophile, vol. 27, nos. 3-4, Feb. 1-15, 1919, pp. 33-37, 3 figs. Analysis of types developed during war which indicate possibilities of commercial utilization for air service.

Latin American Republics. Aviation as a Solution of the Ecnomic and Sociological Problems of Latin American Republics (Lo que puede hacer la aviacion en pro de la solucion de los problemas economicos y sociologicos de las republicas latino-americanas), Henry Woodhouse. Flying, vol. 8, no. 4, May 1919, pp. 350-351 & 374. Argues that lack of adequate means of transportation has prevented growth of Latin America, its development by establishing air routes will solve problem.

AUXILIARY SERVICE

Air Fans. Air Fans for Driving Generators on Airplanes, G. Francis Gray, John W. Reed and P. N. Elderkin. Mech. Eng., vol. 41, no. 6, June 1919, pp. 527-530, 11 figs. Difficulty of problem in designing is represented as having been the production of fan which was turned at constant speed in air streams of widely varying speeds set up by airplane in flight. Paper for June meeting of A.S.M.E.

Navigation Apparatus. Determining True Course in Aerial Navigation (Indicateur-palonneur de route pour la navigation aérienne à l'estime), L. Dunoyer. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 14, Apr. 7, 1919, pp. 728-729. To simplify composition of triangle of velocities a system is suggested which involves placing on pilot's chart at place of departure an indicator having concentric circles whose radii are proportional to distances made under wind of 2, 4, 6 .... miles per sec., and at place terminus of voyage a similar indicator in which the radii of concentric circles are proportional to distances travelled by airplane in calm weather. Their operation is illustrated by examples.

Telephone Apparatus, Radio. Aeroplane Radio Telephone Apparatus, Edgar H. Felix. Aerial Age, vol. 9, no. 8, May 5, 1919, pp. 397-399, 10 figs. Types of microphones, headgear and generators developed by Signal Corps.

DESIGN

Aerofoil Design. Some Future Possibilities of Aerofoil Design, W. E. Astin. Flight, vol. 11, no. 16, Apr. 17, 1919, pp 506-509, 7 figs. Considers possible that rigid wings will not persist, but will in time be replaced by wings which may be of variable area, of variable angle of incidence, variable camber, or again of any suitable combination of these variables.

Commercial Engines. Machines for Commerce and Pleasure. Aeronautics, vol. 16, no. 286, Apr. 10, 1919, pp. 380-381, 3 figs. Graham White Co., Ltd., has decided on seven types: instructional machine, Bantam sporting single-seater, express air-mail machine, four-seater aero-limousine, five seater aero-limousine, 24-seater passenger machine, and Dominions-type machine.

Radius of Action. Air Mileage of Aeroplanes Intended for Long Distances and for Transport, J. Dennis Coales. Engineering, vol. 107, no. 2783, May 2, 1919, pp. 557-560, 6 figs. Technical study of limitations with reference to problem of transatlantic flight. (To be continued.)

ENGINES

Cooling. The Cooling of Aero Engines. Autocar, vol. 42, no. 1227, Apr. 26, 1919, pp. 609-612, 9 figs. Physical conditions of the atmosphere to which engine must adapt itself. Discusses means being adopted for preventing over-cooling of front valves.

Design. The Design of Airplane Engines—V. John Wallace. Automotive Eng., vol. 4, no. 4, Apr. 1919, pp. 166-168, 11 figs. Crank-effort diagram; calculation of inertia forces of reciprocating mass. (To be continued.)

Hispano-Suiza. Hispano-Suiza Motors (Les moteurs Hispano-Suiza). L'Aérophile, vol. 27, nos. 5-6, Mar. 1-15, 1919, pp. 78-81, 8 figs. Five types considered are: 150 hp., 180 hp., 200 hp., 220 hp., and 300 hp. (To be continued.)

King-Bugatti Engine. King-Bugatti 16-Cylinder Aero Engine—II. Automotive Industries, vol. 11, no. 18, May 1, 1919, pp. 956-959, and 986, 7 figs. Consists virtually of two 8-cyl. all-in-line engines mounted on common crankcase and geared to common propeller shaft; designed to permit a 37-mm. cannon to shoot through hollow propeller shaft.

Liberty Engine. Mechanical Details of the Liberty Engine—III. Automotive Eng., vol. 4, no. 4, Apr. 1919, pp. 178-179 and 102. Specifications of both the cast-iron cylinder forms for tank use and the steel cylinder type with sheet-metal water jackets for airplane power plants.

Maybach Engine. Details of the 300-Horsepower Maybach Airplane Engine. Automotive Eng., vol. 4, no. 4, Apr. 1919, pp. 169-173, 10 figs. Mechanical construction and design features. Cylinders, crankcase and shaft pistons and wrist pins. (To be continued.)

Puma Engine. The Siddeley-Deasy "Puma" Aero Engine. Aerial Age, vol. 9, no. 9, May 12, 1919, pp. 441-442 and 453, 4 figs. Engine has 6 cylinders; outstanding features claimed are special construction of cylinders and arrangement of mechanism actuating valves, these features being designed to facilitate dismantling and erection for repairs.

Superchargers. Maintaining Constant Pressure Before the Carburettors of Aero Engines Regardless of the Altitude, Leslie V. Spencer. Aerial Age, vol. 9, no. 8, May 5, 1919, pp. 387-389, 7 figs. Mechanical features of Moss and Sherbondy turbo-superchargers (Concluded.)

Zeitlin Engine. The Zeitlin Aero-Engine. Engineer, vol. 127, no. 3304, Apr. 25, 1919, pp. 408-410, 10 figs. Nine-cylinder rotary 220 hp. engine. Fundamental differs from other motors in that piston stroke is not of uniform length in each of the four movements constituting a complete cycle.

INSTRUMENTS

Anemometers. Design of Pressure Plate Anemometers, C. H. Powell. Aviation, vol. 6, no. 7, May 1, 1919, pp. 374-375, 3 figs. Technical points of design Writer takes up case of constructing instrument to give direct readings without making it necessary to have recourse to trial and error methods.

MATERIALS OF CONSTRUCTION

Glues. The Manufacture and Use of Glues in Aeroplane Construction, B. C. Boulton. Aerial Age, vol. 9, nos. 8 & 9, May 5 & 12, 1919, pp. 390 and 395-396, and 451-453, 2 figs. Based upon technical reports prepared for Bur. Aircraft Production. Factors affecting quality of casein; Bur. of Aircraft Production, specification for glues.

Veneers. Veneer Body Construction. Aviation, vol. 6, no. 3, May 15, 1919, pp. 434-436, 3 figs. Results of investigations conducted at McCook Field in endeavor to develop satisfactory veneer bodies of USC-2 and USXB-1 combat planes. (To be continued.)

METEOROLOGY

Cyclone Compression. Examples of "Cyclone Compression," (Sur quelques exemples de "compression de cyclone"), Gabriel Guilbert. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 13, Mar. 31, 1919, pp. 691-693. Cases quoted in substantiation of rule: Depressed region surrounded with converging strong winds shows maximum barometric compression in center.

MODELS

Aeroplanes. Model Aeroplanes—XXIII, F. J. Camm. Aeronautics, vol. 16, no. 285, Apr. 3, 1919, p. 363, 6 figs. Built-up plane; covered with proofed transparent silk. Illustrations indicate construction details.
Elementary Aeronautics and Model Notes, John F. McMahon. Aerial Age, vol. 9, no. 9, May 12, 1919, p. 457, 1 fig. Model in which regular tested wing curve is used.

Air Screws. Model Aeroplanes—XXIV, F. J. Camm. Aeronautics, vol. 16, no. 287, Apr. 17, 1919, p. 409, 4 figs. Carving model airscrews.

Speed Models. Elementary Aeronautics and Model Notes, John F. McMahon. Aerial Age, vol. 9, no. 8, May 5, 1919, p. 403, 2 figs. Speed model said to have developed speed of 55 miles per hour.

PLANES

B. A. T. The B. A. T. Four-Seater Biplane. Flight, vol. 11, no. 16, Apr. 17, 1919, pp. 494-498, 11 figs. Designed for commercial work—either passengers or carrying mail; provides accommodation for four passengers besides pilot.

Curtis M-F Flying Boat. Curtiss M-F Flying Boat. Aerial Age, vol. 9, no. 8, May 5, 1919, pp. 384-385, 5 figs. Equipped with 8-cyl., 4-stroke cycle water cooled V-type engine, rated at 100 hp. at 1400 r.p.m.; bore and stroke 4½ in. by 5 in.

Halberstadt. The Halberstadt Two-Seater Fighter. Aviation, vol. 6, no. 7, May 1, 1919, pp. 384-386, 11 figs. Constructional features.

Lepere. The Lepere Two-Seater Fighter. Aviation, vol. 6, no. 3, May 15, 1919, pp. 426-429, 8 figs. Belongs to class of DeH.-4 and Bristol type. One peculiarity of design is that there are no incidence or stagger wires in the plane, these being replaced by a system of portal-framed struts.

Pfalz. The Pfalz (D XII) Single-Seater Fighter. Flight, vol. 11, no. 17, Apr. 24, 1919, pp. 528-533, 16 figs. This airplane was brought down near Dury on Sept. 15, 1918. Report covering design and details issued by Technical Dept. (Aircraft Production), Ministry of Munitions.

Tarrant Triplane. The Tarrant Giant Triplane. Flight, vol. 11, no. 19, May 8, 1919, pp. 592-593, 2 figs. Power plant consists of Napier "Lion" engines, four of which are mounted on bottom plane, the other two being placed between the middle and the top plane and driving tractor screws. Warren type of girder has been adapted in regard to wood construction.

Torpedoplane. The Torpedoplane, the New Weapon which Promises to Revolutionize Naval Tactics, Henry Woodhouse. U. S. Naval Inst., Proc., vol. 45, no. 5, May 1919, pp. 743-752. Constructed for dropping torpedoes from airplanes.

PROPELLERS

Variable Pitch Propeller. Pilot Motor Variable Pitch Propeller, Alfred Vischer, Jr. Aviation, vol. 6, no. 7, May 1, 1919, pp. 380-381, 3 figs. SCR-73 synchronous rotary-gap transmitter designed and developed to be adjustable to nine wave lengths supplemented by five notes obtained from interchangeable-gap rotors to prevent interference and to aid in identification.

PRODUCTION

Fire Hazard. Features of Fire Hazard in Airplane Manufacture, W. D. Milne. Quarterly of the Nat. Fire Protection Assn., vol. 12, no. 4, Apr. 1919, pp. 345-352. Notes on prominent fire hazards as observed by writer in various airplane factories; he advocates incorporating in plans for these plants measures necessary for their protection against fire.

National Aeroplane Factory, England. National Aeroplane Factory Near Manchester. Engineer, vol. 127, no. 3301, Apr. 4, 1919, pp. 422-424, 10 figs. on supp. plate. Factory covers area of 15 acres and comprises assembling and erection shop, woodworking shop, timber drying shed for spruce conditioning and two ash-drying plants.

Naval Aircraft Factory, Philadelphia. Aeroplane Construction, F. G. Coburn. Jl. Engrs. Club, Philadelphia, vol. 36-4, no. 173, Apr. 1919, pp. 121-126, 6 figs. Brief account of construction and development of Naval Aircraft Factory at Philadelphia Navy Yard.

TESTING

Engine Trials. The Analysis of Engine Trials. Automobile Engr., vol. 9, no. 126, May 1919, pp. 134-136, 9 figs. Empirical methods of calculation for analyzing results of aero-engine trials, particularly where tests have obviously been faulty or incomplete.

Full-Scale Experiments. Full Scale Aeroplane Experiments, W. S. Farren. Aeronautical Jl., vol. 23, no. 98, Feb. 1919, pp. 34-63, 14 figs. Formulæ derived from model experiments cannot be employed in designing calculations, it is stated, without first testing their validity in full-scale experiments.

TRANSATLANTIC FLIGHT

Navy (U. S.) Fliers. The Navy's Trans-Atlantic Fliers. Motor Boat, vol. 16, no. 10 May 25, 1919, pp. 5-7, 5 figs. Weights and principal dimensions.

Winds. Trans-Atlantic Flight and Meteorology, Willis Ray Gregg. Aviation, vol, 6, no. 7, May 1, 1919, pp. 370-372, 1 fig. Wind velocity and direction as affecting Newfoundland-Ireland and Newfoundland-Labrador-Greenland Scotland routes. Paper read before Phil. Soc. of Washington.

VARIA

Aviators, Physiology. The Physiology of the Aviator, Yandell Henderson. Science vol. 49, no. 1271, May 9, 1919, pp. 431-441. Development of this branch of science during the war and account of the principles laid down from experience.

Aviators. Tests of. Psycho-Physical Tests of Aviators, George M. Stratton. Sci. Monthly, vol. 8, no. 5, May 1919, pp. 421-426. Stress is laid upon two qualifications, viz.: coolness and power to make rapid decisions.

Camera Aero. A New Aero Camera. Aeronautics, vol. 16, no. 286, Apr. 10, 1919, p. 389, 2 figs. Taking photograph, moving exposed plate out of position, resetting camera shutter and moving up of fresh plate into position performed by one movement.

Mapping, Aero. Methods Used in Aero-Photographic Mapping. Eng. News-Rec., vol. 82, no. 21. May 22, 1919, pp. 1000-1004, 8 figs. Outgrowth of experience in use of panoramic camera in Alaska with exposition of principles on transforming camera. From Geographical Rev.

Present Status of Photographic Mapping from the Air, J. B. Mertie. Jr. Eng. News-Rec., vol. 82, no. 21, May 22, 1919, pp. 996-999. Airplane mapping is considered possible and practicable, but it is observed that two great problems horizontalization of camera and effects of surface relief, must be solved.

METALLURGY

ALUMINUM

Alloys. Aluminum and Its Light Alloys. Dept. of Commerce, Circular of the Bur. of Standards, no. 76, Apr. 21, 1919, 120 pp., 27 figs. Deals primarily with physical properties of metal or alloy. Other features, except a few statistics of production and such as methods of manufacture, presence of impurities, etc., are discussed only in their relation to these physical properties.

Aluminum and Magnesium. The Metallurgy of Aluminum and Magnesium, H. B. Pulsifer. Salt Lake Min. Rev., vol. 21, no. 2, Apr. 30, 1919, pp. 21-25, 4 figs. Principles of electrolytic cell for producing magnesium: methods of manufacture.

Micrography. The Micrography of Aluminum and Its Alloys, Hanson and S. L. Archbutt. Metal Industry, vol. 14, no. 14, Apr. 4, 1919, pp. 277-283, 13 figs. Preparation of etchings, especially when metal has been cold-worked, when material is said to exhibit great readiness to become tarnished by formation of adhering coating of oxide of aluminum.

COPPER AND NICKEL

Alloys. The Properties of Some Copper Alloys, W. Rosenhain and D. Hanson. Metal Industry, vol. 14, no. 14, Apr. 4, 1919, pp. 269-272 and (discussion), pp. 272-274, 4 figs. Series prepared by Metallurgy Dept. of Nat. Physical Laboratory. Combination of high tensile strength with great ductility was aimed at in every case.

Brass and Silicon. Some Principles Involved in Melting Metals—V. Charles Vickers. Brass World, vol. 15, no. 5, May 1919, pp. 145-147, 2 figs. Adding silicon to yellow brass in order to increase fluidity of alloy so that it can be poured into thin castings.

Brass for Rolling. Notes on Alloys Used in British Brass-Rolling Mills, A. J. Franklin. Metal Indus., vol. 17, no. 5, May 1919, pp. 225-228, 1 fig. Effects of impurities, casting difficulties, hints on annealing and composition of some of the alloys.

Copper Rolling. The Metallurgy of Copper, Thomas H. A. Eastdick. Sci. Am. Supp., vol. 87, no. 2264, May 24, 1919, pp. 332-333 and pp. 335-336, 5 figs. Graphs showing effect of rolling on tensile strength and elongation under a given stress.

Slag. Copper-Smeltery Slag from the Microscopic and Chemical Point of View, C. G. Maier and G. D. Van Arsdale. Eng. and Min. Jl., vol. 107, no. 19, May 10, 1919, pp. 815-824, 40 figs. Combined miscroscopical and chemical method pursued in investigations indicated that, in slags examined copper existed in two physical forms chemically similar, (1) dissolved copper sulphide, in blast furnace and reverberatory slags and in converter or mixed slags and (2) mechanically suspended particles of sulphide copper varying in composition from matte to Cu_2+X Cu and in amount equal to total copper less dissolved copper.

FERROUS ALLOYS

Ferro-Manganese. Manganese Alloys in Open-Hearth Practice. Iron Age, vol. 103, no. 21, May 22, 1919, pp. 1363-1365. Use of silico-manganese recommended.

FLOTATION

Gold. Notes on Cyaniding, W. B. Blyth. Min. Mag., vol. 20, no. 4, Apr. 1919, pp. 224-226. Effect of arsenic and antimony and position of flotation as regards gold metallurgy.

FURNACES

Heating and Annealing Furnaces. Heating Furnaces and Annealing Furnaces—W. W. Trinks. Blast Furnace & Steel Plant, vol. 7, no. 5, May 1919, pp. 215-217, 6 figs. Heat losses from tongue-hold, from openings around ingots, through roofs partly burned and through incomplete combustion. Examples derived from large furnaces.

IRON AND STEEL

Cast Iron. The Solubility and Stability of Iron Carbide in Cast Iron J. A. Holden. Iron & Coal Trades Rev., vol. 98, no. 2668, Apr. 18, 1919, p. 479, 3 figs. Results of various experimenters compiled and compared.

Duplexing. Metallurgical Considerations of Duplexing—I, Richard S. McCaffery. Blast Furnace & Steel Plant, vol. 7, no. 5, May 1919, pp. 209-212. Operation of large and small Bessemer converters from viewpoint of metallurgical and physical chemistry.

Electric Furnace Steel. Electric Furnace Steel, William K. Booth. Jl. Am. Steel Treaters Soc., vol. 1, no. 6, Mar. 1919, pp. 207-214, 6 figs. Characteristics of Booth-Hall electric furnace. General principle of design is hearth which becomes conductive of electricity when hot, and use of auxiliary electrode which acts as a return for the electric current until the hearth becomes heated and conductive.

Making Electric Steel for Roller Bearings. Machy. (Lond.), vol. 14, no. 344, May 1, 1919, pp. 131-137, 11 figs. Practice of Timken Roller Bearing Co., Canton, Ohio, in operating Héroult electric furnaces forging ingots, rolling billets and cold-drawing steel into solid bars and seamless tubing.

Flaky Fractures. Flaky Fractures and Their Possible Elimination, Haakon Styri. Chem. & Metallurgical Eng., vol. 20, no. 9, May 1, 1919, pp. 478-483, 1 fig. Review of literature bearing upon oxides and other inclusions in steel, together with application of principles of physical chemistry to conditions in a steel melt.

Graphitization. Graphitization in Iron-Carbon Alloys, Kuniichi Tawara and Genshichi Asahara. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 14, 16 pp., 4 figs., also abstracted in Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 578-579, 2 figs. View is held that in fluid alloys there exist atoms of free carbon; these free-carbon items may serve as nuclei for the graphitization when conditions are favorable.

Hardening. The Hardening of Steel, H. C. H. Carpenter. Engineering, vol. 107, nos. 2776 and 2777, Mar. 14 & 21, 1919, pp. 340-341 and 386-390, 18 figs. Exposition of various views as to scientific explanation of this property. Discourse delivered at Roy. Instn.

The Experimental Investigation of the Influence of the Rate of Cooling on the Hardening of Carbon Steels, A. M. Portevin and M. Garvin. Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 599-607, 25 figs. (Abridged.) Paper read before Iron & Steel Inst.

High-Speed Steel. The Manufacture and Working of High-Speed Steel, J. H. Andrew and G. W. Green. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 1, 32 pp., 40 figs. Also abstracted in Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 588-590, 2 figs. Investigation of various forging operations of cogging, rolling, etc., disclosed, in opinion of writers, that for efficient forging temperatures must be used which are appreciably higher than those which are generally accepted as correct. Also photo-micrographs are interpreted as showing that whether reduction is effected by rolling or hammering, or a combination of both, no difference is produced in microstructure of steel.

The Molecular Constitutions of High-Speed Tool Steels and Their Correlations with Lathe Efficiencies, John Oliver Arnold. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 2, 24 pp., 5 figs. Experiments to ascertain compositions of the carbides of chromium, vanadium, tungsten, and molybdenum and to examine electrolytic differential analyses of carbides and tungstide.

Ingot Production. Safeguarding Steel Ingot Production. Raw Material, vol. 1, no. 2, Apr. 1919, pp. 138-143, 6 figs. Indicates how some of methods of ingot production can be improved wherever steel price justifies expense of changing established practice. (To be continued.)

Lime in Open Hearth. Deoxidation, and the Influence of Lime on Equilibrium in the Acid Open-Hearth Furnace, B. Yaneske. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 17, 16 pp. Also in Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 576-578. While writer admits that for certain classes of steel such as that required for ship and similar plates it is unnecessary to obtain a very highly deoxidized bath, yet he considers that for special steel, particularly nickel-chrome, which has to undergo severe mechanical tests, forging and machinery operations, it is essential that such a condition of the bath be obtained before the finishing alloyes are added.

Liquidus. Note on the Liquidus in the Iron-Carbon Diagram, G. Cesaro. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no 4, 9 pp., 1 fig. Based on deduction from experiments by Carpenter and Keeling, writer endeavors to ascertain cause of curve joining points at which molten iron-carbon alloys commence to solidify.

Malleable Cast Iron. Effects of Phosphorus on Malleable Cast Iron, J. H. Teng. Foundry, vol. 47, no. 320, Apr. 1, 1919, pp. 151-156, 9 figs. Curves indicating effect of increasing phosphorus on tensile properties of both the pure-iron series and the common-iron series. From paper presented before Iron & Steel Inst.

Manganese in Open Hearth. The Use of Manganese Alloys in Open-Hearth Steel Practice, Samuel L. Hoyt. Metal Trades, vol. 10, no. 5, May 1919, pp. 227-230, 1 fig. Investigation to determine (1) condition in open-hearth practice that lead to conservation of manganese both during working of heat and in making final addition; (2) satisfactory metallurgical conditions for use of manganese in form of low-grade or special alloys, and (3) effect of finished steel, both as to quality and " condition " of various methods and processes studied. From Bul. no. 11 of War Minerals Investigation Series, U. S. Bur. Mines

Metallurgy. Modern Stool Metallurgy, Chas. H. F. Bagley. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 3, 49 pp. Also Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 565-571. Method of calculating consumption of materials and technical results in manufacture of steel from any kind of pig iron by any standard process.

Quenching. The formation of Troostite at Low Temperature in Carbon-Steels and the Influence of the Emersion Temperature in Double Quenching (La formation de la troostite à bassee température dans les aciers au carbone et l'influence de la température d'émersion dans les trempes interrompues), M. Portevin and M. Garvin. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 14, Apr. 7, 1919, pp. 731-733. Concluded from experimental investigations that in vicinity of critical quenching velocity. troostite will form even after cooling to 450 deg. cent., such formation being always accompanied with a pronounced characteristic recalescence.

Slag. The Acid Hearth and Slag, J. H. Whiteley and A. F. Hallimond. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 16, 44 pp., 29 figs. Also abstracted in Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 579-583, 3 figs. Microstructure of slags, structure of slowly coled acid slags and reactions occurring in molten slag during process from observations and experiments.

Transformations in Iron. On the Non-Allotropic Nature of the A2 Transformation in Iron, Kôtarô Honda. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 9, 8 pp., 3 figs. Also abstracted in Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 575-576. Reported experiments evidenced three transformations, A_2, A_3 and A_4, in the case of pure iron; last two are said to be alltropic transformations, while the first cannot properly be so called.

MICROPHOTOGRAPHS

Macro-Etching and Printing. Macro-Etching and Macro-Printing, J. C. W Humfrey. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 10, 14 pp., 12 figs. Also abstracted in Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 607-609, 4 figs. Writer's etching reagent used in course of investigation into flow of steel during process of punching and drawing a shell blank, was prepared by addition of hydrochloric acid to Heyn's reagent.

NON-FERROUS ALLOYS

Metallography. Metallography Applied to Non ferrous Metals—IV, Ernest J. Davis. Foundry, vol. 47, nos. 6 & 7, May 1 & 15, 1919, pp. 263-266 & 304-307, 15 figs. Equilibrium diagram of copper-aluminum, aluminum-Zinc and aluminum-magnesium series, and photomicrographs of various alloys.

OCCLUDED GASES

Hydrogen. The Occlusion of Hydrogen by the Metallic Elements and Its Relation to Magnetic Properties, Donald P. Smith. Jl. Physical Chemistry, vol. 23, no. 3, Mar. 1919, pp. 186-200, 1 fig. From review of literature it is deduced that resulting alloys are to be distinguished from other types of binary hydrogen compounds and that metals which form the alloys probably occupy a definite region in the periodic table of Werner.

INDUSTRIAL TECHNOLOGY

Ammonia Oxidation. The Oxidation of Ammonia, W. S. Landis. Chem. & Metallurgical Eng., vol. 20, no. 9, May 1, 1919, pp. 476-477, 5 figs. Review of early investigations beginning in 1839 with Kuhlman: Ostwald process and apparatus; improvements made in catalyst screens platinum activation to foreign gases such as acetylene and phosphine; cyanamide process at Muscle Shoals. Paper read before Am. Electrochemical Soc.

Boron. The Production of Amorphous Boron (Ueber die Darstellung des amorphen Bors), Wilhelm Kroll. Zeitschrift für anorganiche & allgemeine Chemie, vol. 102, no. 1, Jan. 4, 1918, pp. 1-33, 4 figs. Writer describes experiments made and results obtained by reduction with aluminum, magnesium, calcium, natrium, and by electrolysis. Apparatus for quick distillation of boric acid with methylene alcohol is described.

Cements, Rubber. Notes on Cemented Seams and Rubber Cements, Junius David Edwards and Irwin L. Moore. India-Rubber Jl., vol. 57, no. 15, Apr. 12, 1919, pp. 1-6, 8 figs. Tests and examination of micro-sections. It is concluded that a good seam requires a good cement, smoothing and cleaning of surface.

Dust Elimination. Removal of Dust, Gases and Fumes in Metal-Working Plants, J. J. Rosedale. Metal Trades, vol. 10, no. 5, May 1919, pp. 223-226, 6 figs. Recommended specifications for design, construction and operation of exhaust systems. From Cal. Safety News.

Electrical Precipitation of Solids from Flue Gases, J. M. Wauchope. Elec. Rev., vol. 74, no. 19, May 10, 1919, pp. 744-747, 7 figs. Application of Cottrell process to waste gases of smelters. Article dwells particularly on apparatus used, operating conditions, and troubles.

Explosives. Modern Explosives, J. Young. Soc. Engrs., vol. 10, no. 3, 1919, pp. 109-136. Historical sketch of development during last 50 years leads writer to assert that no epoch-making discovery has been made during this time, but he examines the work which has been accomplished in inventing mixtures of old materials and grading them in order to make them suitable for various purposes.

Fertilizers. Sodammonium Sulphate. A New Fertilizer. The Utilization of Nitre Cake in the Fixation of Ammonia, H. M. Dawson. Jl. Soc. Chem. Indus., vol. 38, no. 8, Apr. 30, 1919. Trans. pp. 98T-101T, 1 fig. Diagram illustrating crystallization of solutions containing sodium and ammonium sulphate.

Gas Masks. Effect of Exposure to Weather on Rubber Gas Mask Fabrics, G. St. J. Perrot and A. E. Plumb. Jl. Indus & Eng. Chem., vol. 11, no. 5, May 1919, pp. 439-443, 6 figs. Investigation by Research Division, Chem. Warfare Service.

Gas Mask Absorbents, Arthur B. Lamb, Robert E. Wilson and N. K. Chaney. Jl. Indus. & Eng. Chem., vol 11, no. 5, May 1919, pp. 420-438, 10 figs. Reasons underlying choice of mixtures used by Chemical Warfare Service. Mixture used in canisters contained 60 per cent 6 to 14 mesh coconut-shell charcoal and 40 per cent 8 to 14 mest soda-lime pomanganate granites. Other combination selected was 75 per cent specially impregnated coconut charcoal and 25 per cent of soda-lime containing no permanganate.

Nitrogen Fixation. The Present Status of Nitrogen Fixation, Alfred H. White. Sci. Am. Supp., vol. 87, no. 2264, May 24, 1919, pp. 330-331, 1 fig. Several processes contrasted on basis of recent experience. Address delivered at meeting of Am. Inst. of Chem. Engrs.

How the Nitrogen Problem Has Been solved—III, Henry Jermain Maude Creighton. Jl. Franklin Inst., vol. 187, no. 5, May 1919, pp. 599-610, 2 figs. Outline of principles underlying formation of calcium cyanide from calcium carbide and atmospheric nitrogen. (To be concluded.)

Paints. The White Pigments, S. J. Cook. Can. Chem. Jl, vol. 3, no. 5, May 1919, pp. 145-147. Survey of present practice and magnitude of these paint industries. Address delivered before Ottawa Branch, Soc. Chem. Indus.

Salt. The Salt Industry and the Possibilities for the Future Development in Canada. L. Heber Cole. Can. Min. Jl., vol. 40, no. 19, May 14, 1919, pp. 346-366. 1 fig. Flow sheet indicating method employed in recovery of commercial salt from nature; deposits of British Columbian, Albertan, Manitoban, Ontario and Maritime provinces.

Seaweed Products. Industrial Uses of Seaweed (Sjotang som raastof for Sorindustri). Teknisk Ukehlad, vol. 66, no. 12, Mar. 21, 1919, pp. 172-174, 4 figs. "Norgiu" manufactured from seaweed is used as dressing for cotton and linen fabrics and by painters for the preparation of insde walls and ceilings.

Soda Ash. Huge Industrial Development by Brunner Mond Co. at Amherstburg Ont. Contract Rec., vol. 33, no. 18, Apr. 30, 1919, pp. 403-406, 5 figs. Process to be employed in manufacture of soda ash utilizes as two of prncipal raw materials limestone and salt.

Thallium. Note on Extraction of Thallium from Pyrites Flue Dust, George Sisson and J. S. Edmondson. Chem. News, vol. 118, no. 3078. Apr. 11, 1919, p. 75. Method depends upon solubility of chloride and sulphate, operation being to treat the dust with boiling water acidified with sulphuric acid.

WOOD PULP. The Chemistry of Wood Pulp Production, Arthur Klein. Paper, vol. 24, no. 10, May 14, 1919, pp. 15-19. Theories concerning constitution of cellulose. Paper read before German Assn. of Cellulose and Paper Chemists. (To be continued.)

MINING ENGINEERING

BASE MATERIALS

CLAYS. Ball Clays of West Tennessee, Rolf A. Schroeder. Resources of Tennessee, State Geol. Survey, vol. 9, no. 2, Apr. 1919, pp. 81-180, 13 figs. Investigation covered location, geological relations and economic importance. Laboratory tests were made at Ceramic Laboratory, University of Illinois.

GARNET. Garnet in North Carolina and the Market for Abrasive Garnet, Frank J. Katz. Eng. & Min. Jl., vol. 107, no. 21, May 24, 1919, pp. 903-906. Report of examination of deposits and of canvass of producers and consumers.

COAL AND COKE

ALASKA. The Nenana Coal Field, Alaska, G. C. Martin. Dept. of the Interior, U. S. Geol. Survey, bul. 664, 1919, 54 pp., 12 figs. Geology, geography and general features. Coal is classified as lignite of good grade.

BELGIUM. The Coal Beds of Belgium (Les gisements houillers de la Belgique), Armand Renier, Annales des Mines de Belgique, vol. 20, first issue, 1919, pp. 227-258. Stratigraphy. (Continuation of serial).

CANADA. Coal Resources of Western Canada—II, James White. Coal Age, vol. 15, no. 19, May 8, 1919, pp. 858-862, 1 fig. Government is reported to favor plan to carbonize low-grade coals of Saskatchewan for the purpose of saving freight and by-products.

CARBONIZATION. Some Features of Carbonization and By-Product Recovery J. Thorp. Colliery-Guardian, vol. 117, no. 3044, May 2, 1919, pp. 1015-1016, Beehive vs. patent coke for steel smelting. Paper read before Coke Oven Managers' Assn. (Midland Section).

CARBONIZING PROCESS, LOW TEMPERATURE. G-L Low-Temperature Carbonizing Process. Coal Age, vol. 15, no. 18, May 1, 1919, pp. 810-812, 5 figs. Gases, oil and tars are liberated from coal at maximum temperature within retort not exceeding 1200 deg. fahr.; oils are thus expelled as vapors without being broken down by heat into gases; after removal from retorts they are condensed into liquid oils.

COAL-CUTTING MACHINERY. Comparative Working Costs of Electrical and Compressed-Air Coal-Cutting Machines (Longwall) with Increased Outputs over Hand Hewing. F. A. Hale. Iron & Coal Trades. Rev., vol. 98, no. 2668, Apr. 18, 1919, p. 478. Series of tests is presented in substantiation of writer's objections to installation of longwall coal-cutting machines in collieries. Paper read before North of England Branch Assn. Min. Elec. Engrs.

COAL GAS. Coal; Its Value as a Raw Material for Distillation Products—IV, Coal Gas, J. A. Wilkinson. South African Jl. Industries, vol. 2, no. 3, Mar. 1919, pp. 239-246, 1 fig. Methods of producing coal gas. (Concluded).

COKE OVENS. New Coke Ovens at the Providence Gas Works, Edward H. Bauer. Gas Age, vol. 43, nos. 9 & 10, May 1 & 15, 1919, pp. 461-465 & 516-520, 17 figs. Plant has nominal capacity of 7,500,000 cu. ft. of gas per day and consists of one battery of 40 by-product coke ovens equipped coal-handling conveyors, crushing and mixing apparatus and bins for preparing coal, 750-ton coal-storage bin, quenching station, coke-handling conveyors and both metallurgical and domestic coke-screening stations. Three reversing machines—one damper and air-valve reversing machine and two gas-coke machines (one for coke side and one for crusher side gas coke).

Modern Coke Oven and By-Product Plant, Drummond Paton. Iron & Coal Trades Rev., vol. 98, no. 2668, Apr. 18, 1919, pp. 470-471. In discussing schemes suitable for Lancashire coal, writer remarks on features of low temperature, high temperature or gasification as factors determining successful operation. Paper read before Manchester Geol. & Min. Soc.

COKING LOW-GRADE FUEL. Utilization of Mine Waste and Low-Grade Fuels (Utilisation des déchets de mines et des mauvais combustibles), F. Blache. Bulletin et comptes rendus mensuels de la Société de l'Industrie Minérale, séries 5, vol. 15, first issue of 1919, pp. 5-28, 2 figs. Scheme for coking fuel with recuperation of by-products and purifying coke.

COKING OUTPUT OF COALS. Coking Output of Coals (Quelques notes sur le pouvoir cokéfiant des charbons), annales des mines de Belgique, vol. 19, third issue, 1914, pp. 625-651. Experiments with English, Belgium and German samples to determine agglutinant power as index of quality.

COSTS. Coal-Mining Costs and Output. Times Eng. Supp., vol. 15, no. 554, Apr. 1919, p. 129. Comparison with America.

KENT, ENGLAND. The Evolution and Development of the Kent Coalfield, A. E. Ritchie. Iron & Coal Trades Rev., vol. 98, nos. 2662, 2668, 2669 and 2670, Mar. 7, Apr. 18 & 25, May 2, 1919, pp. 289-290, 476-477, 508-509, and 537-538, 6 figs. From 1901 to 1905; operations in the latter part of 1906 and during 1907; from 1909-1910; comparative sections of pits at Dover and Tilmanstone to show strata between Gault and coal measures are illustrated; from 1911 to 1912; diagramatic section showing general position of Tilmanstone pits. (Continuation of serial.)

METHANE ACCUMULATIONS. Methane Accumulations from Interrupted Ventilation, H. I. Smith and R. J. Hamon. Colliery Guardian, vol. 117, no. 3042, Apr. 17, 1919, pp. 895-896, 2 figs. Tests conducted in three mines—two in Southern Illinois and one in Indiana—showed that Methane may accumulate from (1) sudden liberation from seams, cracks or other feeders, (2) emission from inaccessible and abandoned workings, as a result of either an increase or decrease in pressure of ventilating current and, (3) local accumulations resulting from any interruption of normal ventilating current.

PYRITES. Pyrite Deposits in Ohio Coal, W. M. Tucker. Economic Geolog., vol. 14, no. 3, May 1919, pp. 198-219, 3 figs. Total possible production of pyrite estimated at 250,000 tons yearly.

Recovery of Pyrite from Washery Refuse, E. A. Holbrook. Coal Age, vol. 15, no. 19, May 8, 1919, pp. 848-851, 4 figs. Efficiency of recovery of about 70 per cent is said to be realized by installation and operation of crushing, screening, jigging and sometimes tabling apparatus.

SCREENING PLANT. Thurcroft Main Colliery. Iron & Coal Trades Rev., vol. 98, no. 2662, Mar. 7, 1919, pp. 279-280, 2 figs. & supp. plates. Equipment for an output of 4000 tons daily. Screening plant comprises several units each capable of dealing with 120 tons per hour.

STRIPPING. Coal Stripping in the United States—V, Wilbur Greeley Burroughs. Coal Indus., vol. 2, no. 5, May 1919, pp. 177-182, 2 figs. Differences between systems followed in bituminous and anthracite fields.

RUSSIA. At the Anthracite Mines, South Russia, in the Early Days of the War. A. L. Simon. Min. Mag., vol. 20, no. 4, Apr. 1919, pp. 203-211, 2 figs. Area over which mining rights extend approximates 10,000 acres. Mine water, boiler house, winding engines and labor conditions are discussed from viewpoint of adaptability to special requirements and susceptibility to improvements.

TIPPLE AND WASHERIES. New Tipple of the Granby Consolidated Mining, Smelting & Power Co., F. E. Mueller. Coal Age, nol. 15, no. 18, May 1, 1919, pp. 804-805, 3 figs. General layout of tracks, tipple and proposed washery, and details of solid-body mine car.

COPPER

LEACHING ORES. Leaching of Oxidized Copper Ores with Ferric Chloride, R. W. Perry. Min. & Sci. Press, vol. 118, no. 20, May 17, 1919, pp. 669-674, 2 figs. Patented process based on: $3\,CuO + 2\,FeCl_3 + 3\,H_2O = 3\,CuCl_2 + 2\,Fe(OH)_3$: $3\,CuCl_3 + 3\,Fe = 3\,Cu + 3\,FeCl_2$; and $3\,FeCl_2$ + Electricity = Fe $+ 2\,FeCl_2$.

GEOLOGY AND MINERALOGY

AUSTRALIA. A Geological Reconnaissance of the Country Between Laverton and the South Australian Border (near South Latitude 26 deg.), Including part of the Mount Margaret Goldfield, H. W. B. Talbot and E. de C. Clarke. Geol. Survey, Western Australia, bul. no. 75, 1917, 207 pp. 72, figs.

BRAZIL. Notes on the Geology of the Diamond Region of Bahia, Brazil Roderic Crandall. Economic Geology, vol. 14, no. 3, May 1919, pp. 220-244, 14 figs. Opinions expressed by various explorers.

CHISONE VALLEY. Contribution to the Study of Minerals in the Chisone Valley (Contributo allo studio dei minerali della Valle del Chisone), E. Grill. Atti della Società Toscana di Scienze Naturali, Memorie, vol. 31, 1917, pp. 140-167, 6 figs. Pyrite, albite magnetite, dolomite, apatite, tremolite, actimolite, tourmaline andilmenite.

CRYSTALLOGRAPHY. Crystallography of some Canadian Minerals; 9, Cerussite, Eugine Poitevin. Am. Minerologist, vol. 4, no. 5, May 1919, pp. 56-58, 3 figs. Crystals show three habits: Tabular crystals with large brachypinacoid, pyramidal crystals with well-developed prisms and pyramids and limited domes, and pyramidal crystals having *r* (130) as twinning plane.

Artificial Coloration of Helicoid Spherolites as Means to Determine Polymorphous Modifications (Coloration artificielle des sphérolites à enroulement hélicoidal et distinction des modifications polymorphes par la couleur acquise), P. Gaubert. Bulletin de la Société Française de Minéralogie, vol. 41, no. 7-8, July-Dec. 1918, pp. 198-224, 6 figs. Account of experiments. Coloring matter and colorless substance group themselves so as to form mixed crystals. Asparagine, tartrates and bimalates considered.

GEORGIA. Report on the State Deposits of Georgia, H. K. Shearer. Geol. Survey of Ga., bul. 34, 1918, 192 pp., 24 figs. Geological formations of Appalachian Valley and Cumberland Plateau areas. Only along eastern border, near, Cartersville, are shaly beds considered as commercially valuable slates.

NEW MINERALS. Review of New Mineral Species (Revue des espèces minérales nouvelles), P. Gaubert. Bulletin de la Société Française de Minéralogie, vol. 41, nos. 718, July-Dec. 1918, pp. 224-226, Colerainite, collbranite and gilpinite.

OREGON. The Salient Features of the Geology of Oregon, Warren Dupre Smith and Earl L. Packard. Jl. of Geology, vol. 27, no. 2, Feb.-Mar. 1919, pp. 79-120, 3 figs. Including bibliography of important articles.

TASMANIA. The North Picman and Huskisson and Sherling Valley Mining Fields. A. McIntosh Reid. Tasmania Dept. Mines, Geol. Survey bul. 28, no. B-82381,1918, 132 pp., 13 figs. Geological data, location and area, and typographical details.

TONOPAH DIVIDE. The Divide District, Frank L. Sozer, Min. & Sci. Press, vol. 118, no. 19, May 10, 1919, pp. 631-633, 4 figs. Important geological features of the Tonopah Divide are the pronounced fissuring and the volcanic uplift.

WATER IN ROCK FORMATIONS. Water Expectancy in Tunnels. Mines and Deep Wells in Homogeneous Rocks, Robert F. Horton. Jl. Am. Water Works Assn., vol. 6, no. 2, June 1919, pp. 183-186. Proposes method and formulæ by which data obtained from surface wells can be applied. Method is limited to cases where bedrock is somewhat uniform in character throughout all depths from rock floor down to bottom of tunnel or other structure.

LEAD, ZINC, TIN

LEAD FROM VANADINITE. A Proposed Metallurgical Process for the Treatment of Vanadinite for the Recovery of Lead and Vanadium, J. E. Conley. Chem. & Metallurgical Eng., vol. 20, no. 10, May 15, 1919, pp. 514-518, 2 figs. Vanadinite concentrate is fluxed and reduced with soda ash, caustic and carbon, giving metallic lead; slag is elutriated Si and Mo precipitated with lime; vanadium pentoxide precipitated by boiling in acid solution.

Sintering Zinc Residues. Sintering Zinc Residues, K. Stock. Chem. & Metallurgical Eng., vol. 20, no. 10, May 15, 1919, pp. 525-537, 16 figs. Methods used by Bartlesville Zinc Co. After roasting and retorting, all residues are subjected to additional treatment depending upon amount and nature of metals to be recovered.

MAJOR INDUSTRIAL MATERIALS

Nickel. Canada Controls Nickel Output of the World, W. F. Sutherland. Can. Machy., vol. 20, no. 26, Dec. 26, 1918, pp. 730-736, 13 figs. Plant of International Nickel Co. of Canada at Port Colborne. Reference is made to laboratory and refineries.

MINES AND MINING

Bore-Hole, Diamond. Some Difficulties met with in Putting Down a Diamond Bore-Hole Underground, J. Walker Steele. Iron & Coal Trades Rev., vol. 98, no. 2662, Mar. 7, 1919, p. 292, 1 fig. Account of difficulties met and dealt with in putting down a 2-in. diamond borehole for the proving of underlying seams in faulty and difficult ground.

Cartridges, Safety. Safety Cartridge (Etude d'une Cartouche de Sûreté). Emmanuel Lemaire. Annales des Mines de Belgique, vol. 19, third issue, 1914, pp. 587-590. Mixture of calcium fluoride, sodium chloride, iron sulphate and sand reported found from experimental research to insure safety and permit minimum cartridge diameter. First article.

Concentrate Treatment. New Process for the Mechanical Preparation of Minerals (Nouveaux procédés de préparation mécanique des minérais). Echo des Mines et de la Métallurgie, vol. 47, no. 2620, Apr. 6, 1919, pp. 217-218. Wolfram and cassiterite mixed concentrates treated in Rapid apparatus.

Concentration. Economics of Concentration, A. P. Watt. Eng. & Min. Jl., vol. 107, no. 18, May 3, 1919, pp. 775-779, 3 figs. Evidence offered in substantiation of suggested advisability for operating a separate heat-treatment plant.

Deep Mines, Cooling and Drying. Cooling and Drying in Deep Mines, Sidney F. Walker. Refrig. World, vol. 54, no. 5, May 1919, pp. 23-24. Recommends refrigeration and cold-storage methods to make coal more accessible.

Explosives, Storage. Storage of Powder and Explosives at Coal Mines, E. M. Kimball. Coal Age, vol. 15, no. 18, May 1, 1919, pp. 794-795, 1 fig. Example of magazine built on brick foundation.

Geophone. The Geophone. Eng. & Min. Jl., vol. 107, no. 20, May 17, 1919, pp. 872-873, 2 figs. Invented by French to detect enemy sapping and underground mining operations and for ascertaining position of enemy artillery.

Hoisting. Hoisting in Coal Mines, W. J. Heeley. Can. Min. Inst. bul. no. 85, May 1919, pp. 498-503, 1 fig. Lines which writer believes to be close approximation to economy, from viewpoint of rope, for relative position of drum and pulley, for shafts from 100 to 600 yards winding depth.

Lamp, Safety. The Chance Acetylene Safety-Lamp, William Maurice. Trans. Instn. Min. Engrs., vol. 56, part 4, Apr. 1919, pp. 273-280 and (discussion) pp. 280-284, 9 figs. Combines American type of Wolf lamp with Mueseler principle. It is provided with roof reflector which distributes illlumination sidewise, thus making it unnecessary to tilt lamp.

Safety Lamp Gauzes—V T. J. Thomas. Colliery Guardian, vol. 117, no. 3042, Apr. 17, 1919, pp. 898-899. Compilation of data on uses of nonferrous metals as recorded by various experimenters.

Loading Machinery, Underground. Underground Coal-Loading Machinery, E. N. Zern. Coal Age, vol. 15, no. 18, May 1, 1919, pp. 784-791, 10 figs. Remarks in reference to results obtained in some mines that it is manifestly unfair to put any coal-loading machinery work unless mining haulage and other conditions are made favorable to its operation.

Power Plants. Economies in a Mine Power Plant, J. A. Carruthers. Power, vol. 49, no. 19, May 13, 1919, pp. 720-722, 3 figs. Example is quoted where it is said that power plant effected reduction of 13 to 15 tons of coal per day as result of several changes in equipment.

Queensland Mining Industry. Queensland Mining Industry. Queensland Gov. Min. Jl., vol. 20, no. 226, Mar. 15, 1919, pp. 97-114, 1 fig. Annual report of Under Secretary for Mines for 1918. It includes inspection of mines, state mining and boring operations, geological survey and methods—of mining gold, copper, tin, silver lead, wolfram, bismuth, molybdenite and scheeltie.

Rescue Apparatus. Digest of the First Report of the Mine Rescue-Apparatus Research Committee, David Penman. Trans. Instn. Min. Engrs., vol. 56, part 4, Apr. 1919, pp. 236-260 & (discussion) pp. 260-272, 7 figs. Committee was appointed by Advisory Council to Committee of Privy Council for Scientific and Industrial Research, to inquire into types of breathing apparatus used in coal mines and by experiment to determine the advantages, limitations and defects of the several types of apparatus, their possible improvements and the advisability to standardizing.

Respirator. The Use of the Gas Mask as a Respirator, A. C. Fieldner and S. H. Katz. Chem. Engrs., vol. 27, no. 4, Apr. 1919, pp. 79-83, 3 figs. Directions of uses in chemical and metallurgical industries. Warning is issued against indiscriminate use of gas masks for any and all purposes; it is observed that poisonous gases used in warfare are chemically active and therefore combine readily with absorbents of gas mask; some of the gases, however, immediately penetrate the mask when present in quantities of one or two per cent.

Ties, Steel. Steel Mine Ties, R. B. Woodworth. Coal Age, vol. 15, no. 18, May 1, 1919, pp. 814-816, 6 figs. Gain in headroom, endurance, fire-proofness, scrap value, and simplicity are quoted as some of the advantages of steel tie over wood rest.

Timbering. Safe and Efficient Mine Timbering—V. R. Z. Virgin. Coal Indus., vol. 2, no. 5, May 1919, pp. 175-177, 3 figs. Removing timber from pillar workings, banging canvas and timbering with wire rope.

MINOR INDUSTRIAL MATERIALS

Antimony. Pure Antimony (Reines Antimon), E. Groschuff. Zeitschrift für anorganische & Allgemeine Chemie, vol. 103, no. 3, Jlne 21, 1918, pp. 164-188. Technical refining of metallic antimony; electrolytic refining of antimony; crystallization of metallic antimony; precipitation and purification of antimony sulfide; crystallization of antimony as tartar emetic; analytical examination of antimony; examination of commercial antimony as to impurities; analytica and physical characterization of nominally pure antimony.

Chrome. Maryland Sand Chrome Ore, Joseph T. Singewald, Jr. Economic Geology, vol. 14, no. 3, May 1919, pp. 189-197, 5 figs. Account of Chrome industry in Maryland State. Paper presented before Geological Soc. of America.

Quicksilver. The Anticlinal Theory and Some Quicksilver Deposits, William H. Emmons. Eng. & Min. Jl., vol. 107, no. 21, May 24, 1919, pp. 916-917, 2 figs. Considers theory as applicable to prospecting of areas where structure conditions are favourable.

Vanadium. Treatment of Cuprodescloizite for Extraction and Recovery of Vanadium, Lead and Copper, J. E. Conley. Chem. & Metallurgical Eng., vol. 20, no. 9, May 1, 1919, pp. 465-469. It is held that the inter cake-sulphuric acid extraction is most economical.

OIL AND GAS

Holbrook Area. Study of Oil and Gas Possibilities of the Holbrook Area, Doresy Hager. Salt Lake Min. Rev., vol. 21, no. 3, May 15, 1919, pp. 21-25, 6 figs Determined from examination of general stratigraphic conditions structural characteristics, notably presence or absence of folding or intrusions that might create adverse conditions for oil or gas accumulations. No positive indications of petroleum were found in this Arizona area.

Movement of Oil Through Gas. Movement of Oil and Gas Through Rocks, Victor Ziegler. Petroleum Times, vol. 1, no. 13, Apr. 5, 1919, pp. 275-277. Surface tension of water being greater than that of oil affords explanation for passage of water through smaller openings while oil occupied larger ones. (Concluded from p. 38.)

Natural Gas. Utilization and Conservation of Natural Gas, L. L. Graham. Gas Age, vol. 43, no. 9, May 1, 1919, pp. 477-478. How public-service commissions can control situation. Paper read at conference called by Public Service Commission of Pa.

Domestic and Industrial Use of Natural Gas, John Gates. Gas Age, vol. 43, no. 9, May 1, 1919, pp. 470-471. Conditions in Pittsburgh district.

Texas. The Oil Fields of Northwestern Texas, W. L. Watts. Min. & Oil Bul., vol. 5, no. 5, Apr. 1919, pp. 255-258, and 269. 7 figs. Types of structures and petroleum geology in general. Third and concluding article. Second article appeared in Dec. 1918 issue.

PRECIOUS MINERALS

Gold Situation. Report of a Joint Committee Appointed from the Bureau of Mines and the United States Geological Survey by the Secretary of the Interior to Study the Gold Situation. Dept. of the Interior, Bur. of Mines, bul. 144, Oct. 30, 1918, 84 pp., 4 figs. Decline in gold mining is believed to be due to labor shortage and higher wages, lower efficiency of available labor and higher cost of power.

Santiago River. Gold Deposits of the Santiago River and its Zone (La riqueza aurifera del rio Santiago y de su zoma), Luis Ulboa. Boletin de la Sociedad Geografica de Lima, vol. 34, Dec. 1918, pp. 94-106. Geographical history.

South Africa. Labor and Gold Mining in South Africa, Evelyn A. Wallers. Eng. & Min. Jl., vol. 107, no. 21, May 24, 1919, pp. 918-922. Remedy for labor unrest lies, writer holds, in building, piece by piece, with persistence and patience, upon basis of steadily developing mutual understanding and desire to mutual good will between employer and employees.

TRANSPORTATION

India. The Carriage of Coal by Rail in India, H. Kelway-Bamber. Ry. Gaz., vol. 30, no. 16, Apr. 18, 1919, pp. 689-691, 3 figs. Gross earnings of train weighing 1400 tons and carrying coal a distance of 250 miles. (Continuation of serial). Paper read before Indian Section Roy. Soc. Arts.

Mine Haulage. Efficiency in Mine Haulage Construction, George L. Yaste. Coal Indus., vol. 2, no. 5, May 1919, pp. 199-200. In choice of rails for roadway writer prefers to have them rather heavy than so light that it should become difficult to maintain track on account of low places between ties and at junction of rails.

ORGANIZATION AND MANAGEMENT

ACCOUNTING

Army, U. S. The Cost Accounting System of Construction Division, U. S. Army, C. W. Pinkerton. Eng. & Contracting, vol. 51, no. 21, May 21, 1919, pp. 548-551, 5 figs. Basis is foreman's daily report blank.

Factory Costs. New System Computes Factory Costs, W. A. Rutz. Iron Trade Rev., vol. 64, no. 16, Apr. 17, 1919, pp. 1023-1024. Method used by Am. Multigraph Co., Cleveland. System is based on principle that stock room is a bank.

Production Charges, Indirect. Fixing Indirect Production Charges, M. H. Potter. Iron Trade Rev., vol. 64, no. 18, May 1, 1919, pp. 1148-1149, 1 fig. Chart showing connection between various items offered as preliminary step in classifying indirect charges.

EDUCATION

Apprentices. Theoretical Training for Apprentices—Outline of the Educational Facilities Provided at the British Government Arsenal, E. G. Timbrell. Can. Engr., vol. 36, no. 18, May 1, 1919, pp. 423-425. Apprentices must be between 14-16 years of age. Course of four years covering mathematics, experimental mechanics, chemistry and engineering drawing, given three evenings per week, with addition of one-half day.

Home of the Canadian Ingersoll-Rand Co. Can. Machy., vol. 21, no. 19, May 8, 1919, pp. 451-455, 8 figs. Particular reference is made to apprenticeship systems and practices followed in forging department.

Women, Wireless Workers. Telephone and Wireless Transmission. Elec. Eng., vol. 53, no. 1, Jan. 1919, pp. 15-17. Training given women workers in Westinghouse plant.

FACTORY MANAGEMENT

Boiler Manufacturing. Modern Management in Boiler Manufacturing, Chas. M. Horton. Boiler Maker, vol. 19, no. 5, May 1919, pp. 122-123. Advises systematic continuity in turning out product.

Fornson Assembly Methods. Fordson Assembly Wholly on Progressive Plan—II, J. Edward Schipper. Automotive Industries, vol. 11, no. 18, May 1, 1919, pp. 960-966, 11 figs. Cylinder block and transmission housing assemblies travel along paralel lines until complete.

Haulage, Inter-Shop. Saving $200 a Day in Inter-Shop Haulage, R. M. Kinny. Factory, vol. 22, no. 5, May 1919, pp. 926-929, 9 figs. Minneapolis Steel & Machinery Co. have added a railroad despatching system to the use of ordinary industrial trucks with trailers.

Human Element. The Human Element in the Factory, Hugh K. Moore. Eng. & Indus. Management, vol. 1, no. 2, Apr. 24, 1919, pp. 327-331, 3 figs. Boiler performance curves for various forms are examined and conclusions are derived concerning influence of personal touch between employer and employee in creating research initiative in the latter.

Layout. Continental Plant Layout Facilities Production. Automotive Industries, vol. 40, no. 21, May 22, 1919, pp. 1122-1126. 10 figs. on supp. plate. Engine shipments go out on same tracks on which raw parts enter. (To be continued.)

The Designing of Factory Layouts for the Clay Industries, T. W. Garve. Jl., Am. Ceramic Soc , vol. 2, no. 3, Mar. 1919, pp. 195-207, 4 figs. Interior and selection of machinery as affected by kind and quantity of ware to be made, physical conditions of clay and local conditions and requirements.

Pattern Control. A Simple Pattern Control and Routing System. Foundry, vol. 47, no. 7, May 15, 1919, pp. 292-296, 11 figs. Method worked out at Canton Steel Foundry Co. It is based on five standard forms operated from central office.

Payroll Systems. Installing Accurate Payroll System, Clifford E. Lynn. Iron Trade Rev., vol. 64, no. 20, May 15, 1919, pp. 1289-1292, 9 figs. Maintenance of timekeeping and distribution method by co-operation of superintendent, foremen and workmen.

Production Control. Controlling Production in a Motor Plant, Charles Lundberg. Iron Age, vol. 103, no. 20, May 15, 1919, pp. 1279-1284, 10 figs. Obtainable from methods used by Mechanical Appliance Co., Milwaukee, are determination of comparative production, of labor costs, stage of manufacture each lot has reached at any time, quantity of each piece on hand or in process and deduction of faulty work.

Purchasing. Handling Orders in Steel Plants, Clifford E. Lynn. Iron Trade Rev., vol. 64, no. 15, Apr. 10, 1919, pp. 956-958, 3 figs. General forms by which purchase requirements are received, recorded and executed.

Repair Shop, Automobile. The Scientific Management of the Automobile Repair Shop (Application des principes de l'organisation scientifique à l'atelier central de réparations du service automobile), J. Compagnon. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 2, Mar.-Apr. 1919, pp. 299-328, 29 figs. Based on the Taylor system.

Weighing and Packing. Weighing and Packing by Machinery, Gilbert Balkan. Commercial America, vol. 15, no. 11, May 1919, pp. 41-45, 4 figs. Automatic weighing and packing illustrated by continuous operation applied to flour.

FINANCE AND COST

Appraisal. Advantages of the Engineering Appraisal, Charles W. McKay. Textile World Jl., vol. 55, no. 20, May 17, 1919, pp. 43-45. Discussion of federal tax problems of textile executives.

Appraising and Cost Finding, William F. Worcester. Concrete Age, vol. 30, no. 1, Apr. 1919, pp. 14-16. Address delivered before Am. Concrete Pipe Assn.

Costkeeping System. Manufacturing Non-Ferrous Metal Articles. Iron Age, vol. 103, no. 19, May 8, 1919, pp. 1209-1214, 10 figs. Annealing and pickling machinery and automatic safety devices in plant of Bridgeport Metal Goods Mfg. Co. also costkeeping system.

Costing as Applied to General Engineering, Chas. E. Lewton. Eng. & Indus. Management, vol. 1, no. 10, Apr. 17, 1919, pp. 310-317, 15 figs. Scheme in vogue at general engineering establishment is laid out with considerations on procedure adopted in commercial inspection, labor cost and allocation of predetermined establishment expenses to job; iron foundry costs; material costs and determining establishment expenses.

INSPECTION

Equipment, Inspection and Record. Demobilizing Equipment of Spruce Production Division. Eng. News-Rec., vol. 82, no. 20, May 15, 1919, pp. 967-968, 4 figs. System of inspecting and recording which is said to keep order among 4800 classifications.

Materials Before Acceptance. Inspection of Materials Before Acceptance, Emmanuel Mayaut. Contract Rec., vol. 33, no. 18, Apr. 30, 1919, pp. 417-419. Instances of failures caused by neglect to have concrete, sand and stone properly tested for quality before use.

LABOR

Convict Labor. Convict Labor on Highway Work; Organization, Administration, Camps and Cost Data, Good Roads, vol. 17, no. 18, May 3, 1919, pp. 189-190, 2 figs. Committee report presented at Convention of Am. Road Builders' Assn.

Fatigue, Industrial. Industrial Efficiency from the Psychological Standpoint—II, Chas. S. Myers. Eng. & Indus. Management, vol. 1, no. 12, May 1, 1919, pp. 359-360, 5 figs. Experiments with Krapelin's ergograph. Distinction is established between muscular fatique arising from excessive activity, producing clogging of physiological mechanism with products of that activity, and fatigue due to exhaustion of living substance of the muscles. Lecture delivered before Imperial College of Science & Technology.

Industrial Disputes. Organization in the Settlement of Industrial Disputes, V. Everit Macy. Eng. & Min. Jl., vol. 107, no. 19, May 10, 1919, pp. 825-828. Emphasizes that labor problem is merely a human problem and unless similar methods are employed in dealing with it as have been found effective with other human problems, maximum production and industrial peace cannot be realized.

Industrial Relations. The Status of Industrial Relations, L. P. Alford. Mech. Eng., vol. 41, no. 6, June 1919, pp. 513-516 & 556. Present aspect of labor and employment problems is held to be similar to that presented by these problems immediatcly afger civil war; situation, however, is considered as greatly amplified now. Suggestions to meet present emergency are made.

Industrial Efficiency from the Psychological Standpoint—I, Charles E. Myers. Eng. & Indus. Management, vol. 1, no. 2, Apr. 24, 1919, pp. 332-336, 6 figs. Improving mechanical conditions and sympathetic understanding of standpoint of others are considered far more important factors in determining industrial efficiency than capital or labor.

Industrial Co-operation, Charles P. Steinmetz. Am. Machy., vol. 50, no. 19, May 8, 1919, pp. 893-894. Merging capital and labor interests in one advocated as only way to meet present industrial requirements.

Labor Turnover. Reducing the Labor Turnover, W. C. Nisbet. Ry. Mech. Engr., vol. 93, no. 5, May 1919, pp. 265-268. Discusses advantages of applying employment department idea to railroad shops.

Modern Industrial Plants—VI-b, George C. Nimmons. Architectural Rec., vol. 45, no. 5, May 1919, pp. 450-470, 20 figs. Excessive turnover of labor and influence of employees' welfare work on reducing it. Conditions in various plants are quoted.

Night Work. Medical Argument Against Night Work, Especially for Women Employees, Emery R. Hayhurst. Am. Jl. of Public Health, vol. 9, no. 5, May 1919, pp. 367-368. How night work emphasizes intrinsic factors which bring about chronic fatigue.

Profit Sharing. Willys Profit-Sharing Plan on 50-50 Basis. J. Edward Schipper. Automotive Industries, vol. 11, no. 18, May 1, 1919, pp. 942-944. Provides for division of profits over and above amounts reserved for interest upon capital on a 50-50 basis between workers and employers.

How to Compass Industrial Cooperation, Charles P. Steinmetz. Coal Age, vol. 15, no. 20, May 15, 1919, pp. 904-906. Proposes to give labor dividends based on wages paid and on the amount of excess profits above a certain percentage, the gross returns to labor being made equal to the excess profits allotted capital.

Wages. Uniform Wages for Workmen. Contract Rec., vol. 33, no. 18, Apr. 30, 1919, pp. 403-406, 5 figs. Assn. of Montreal Building and Construction Industries reporting attempting to secure fixed wages and eliminate sub-contract abuses.

Welfare Work. Welfare Work for Employees in Industrial Establishments in the United States. U. S. Dept. Labor, Bur. Labor Statistics, Bul. no. 250, Feb. 1919, 139 pp., 40 figs. Fieldwork of investigation extended over period of twelve months in 1916 and 1917 and 31 states were visited in connection with study.

Women. Female Labour on Line Construction Work, J. B. Taylor. Post Office Elec. Engrs. Jl., vol. 12, part 1, Apr. 1919, pp. 26-31, 6 figs. Although work was hard, and meant exposure to all kinds of weather, experiment is reported as successful.

Women in Electrical Work. Elec. Eng., vol. 53, no. 1, Jan. 1919, pp. 11-13. British methods for training workers in war industries. From bul. issued by U. S. Dept. Labor.

Women as Factory Inspectors. Eng. & Indus. Management, vol. 1, no. 12, May 1, 1919, pp. 368-369. Duties of women in the capacity of assistant factory inspectors in several German states, notably Bavaria and Baden. From Technik & Wirtschaft.

LEGAL

Compensation. Compensation for Occupational Diseases, Riley M. Little. U. S. Dept. Labor, Bur. Labor Statistics, bul. 248, Mar. 1919, pp. 251-257 and (discussion), pp. 258-268. Contends that hazards of industry ought to be borne by society as a whole and not by individual workingman.

LIGHTING

Shop Lighting. Improved Methods of Shop Lighting. Power Plant Engr., vol. 23, no. 10, May 15, 1919, pp. 457-459, 5 figs. Comparison of general and localized system of illumination.

Wall Box Illumination. Lighting Without Hanging Ceiling Fixtures, J. L. Stair. Elec. Jl., vol. 16, no. 5, May 1919, pp. 183-187, 14 figs. Examples of wall box or wall pocket method of illumination.

RECONSTRUCTION

Financial Conditions. Some of Our Post-War Problems, Francis B. Sisson. Am. Mach., vol. 50, no. 20, May 15, 1919, pp. 935-937. Concerning particularly financial conditions resulting from war. Address before Indus. Conference of N. Y. Business Publishers' Assn.

Foreign Trade. Reconstruction Days. Metal Indus., vol. 17, no. 5, May 1919, pp. 207-210. Analysis of present business conditions and forecast of future of foreign trade.
Problems of Our Foreign Trade, G. A. O'Reilly. Am. Mach., vol. 50, no. 19, May 8, 1919, pp. 891-893. Address before Editorial Conference of N. Y. Business Publishers' Assn.

Foreign Trade Policy. The Stabilizing Effect on American Industry of a Definite Foreign-Trade Policy, James W. Hook. Am. Mach., vol. 50, no. 20, May 15, 1919, pp. 938-939. Address delivered before Sixth Nat. Foreign Trade Convention.

Industrial Democracy. Industrial Democracy, Charles A Eaton. Am. Mach., vol. 50, no. 20, May 15, 1919, pp. 933-935. Address before Indus. Conference of N. Y. Business Publishers' Assn.

Wage Problems. After-War Problems. W. L. Hitchens. Machy. Market, nos. 964 & 965, Apr. 25 & May 2, 1919, pp. 19-20 and 19-20. Wage problem in industry. Paper read before Roy. Soc. Arts.

SAFETY ENGINEERING

Accident Prevention. Safety from the Standpoint of Industrial Efficiency, C. W. Price. Official Proc. Ry. Club of Pittsburgh, vol. 18, no. 3. Feb. 27, 1919, pp. 58-71 and (discussion), pp. 71-79. Accident prevention as common ground on which employers and employees can meet, with mutual benefit as result.

Accidents. Comparison of Industrial with Military Casualties, I. M. Rubinow. U. S. Dept. Labour, Bur. Labor Statistics, bul. 248, Mar. 1919, pp. 217-225. Concludes that in peaceful times industrial life creates as many handicapped persons as would an army of 1,000,000 soldiers fighting on the battlefields of Europe.
Some Showing from Accident Records, Lucian W. Chancy. U. S. Dept. Labor, Bur. Statistics, bul. 248, Mar. 1919, pp. 30-37. Statistics of Bur. of Labor including causes of accidents and nature of injuries described as indicating that 58 per cent of accidents could have been prevented by adequate engineering provisions.
Shipbuilding Accidents. Eng. & Indus. Management, vol. 1, no. 12, May 1, 1919, pp. 379-381. Dangers to which workmen are subjected in a shipyard and how these may be minimized or eliminated.

Fire Fighting. Fire Engines and Effective Fire Fighting, Charles H Fox. Mech Eng., vol. 41, no. 6, June 1919, pp. 503-505. Essentials of effective fire fighting and their relation to fire engines as viewed by writer who believes that importance of methods employed in fire fighting is often underestimated by both laymen and engineers.

Fire Prevention. Fire Prevention in the Metal Trades—I. R. E. Swearingen. Metal Trades, vol. 10, no. 5, May 1919, pp. 213-216. A clean, well-managed plant is considered not only a safer risk, but a healthier and more satisfactory place to work in and of wholesome effect on the working force.
The Saskatchewan Fire Prevention Act and the Methods of Its Administration, Arthur E. Fisher. Quarterly of the Nat. Fire Protection Assn., vol. 12, no. 4, Apr. 1919, pp. 334-342. One section appoints local assistants to Fire Commissioner in every place, with practically all powers granted to Commission.

Mechanical Safeguards. Mechanical Safeguards, David S. Beyer. U. S. Dept. Labor, Bur. Labor Statistics, bul. 248, Mar. 1919, pp. 16-26. Emphasizes importance of mechanical guarding in addition to safety education for prevention of accidents. Desirability of standardizing mechanical guards is advocated and an account of work done in this direction by Standardization Committee of Nat. Safety Organization is mentioned.

TRANSPORTATION

Electric Trucks and Tractors. The Field for Industrial Electric Trucks and Tractors. Elec. Rev., vol. 74, no. 20, May 17, 1919, pp. 791-795, 7 figs. Examples of their application in various industries. (First article.)
Electric Vehicles, C. Tunstill Opperman. Surveyor, vol. 55, no. 1421, Apr. 11, 1919, pp. 271-272. Their reliability and economy on short journeys.

Truck Delivery Costs. Cost of Highway Concrete Delivered Wet by Trucks. Eng. News-Rec., vol. 82, no. 18, May 1, 1919, pp. 870-872, 3 figs. Delivery of wet concrete from central crushing and mixing plant to road surface, by motor trucks, over hauls ranging from ¼ mile to 4 miles reported as being satisfactorily accomplished by Maryland State Road Commission.

CIVIL ENGINEERING

BRIDGES

Culverts and Small Bridges. Culverts and Small Bridges, Charles D. Snead. Better Roads & Streets, vol. 9, no. 3, Mar. 1919, pp. 86-88. Examines mixing practice throughout State of Kentucky and lists what he terms faults in procedure.

Maintenance. *See Painting and Maintenance below.*

Military. Military Bridges Built by the English Army (Les ponts-routes militaires de l'armée anglaise), R. Meehin. Génie Civil, vol. 74, no. 15, Apr. 12, 1919, pp. 285-291, 18 figs. and 2 extra plates. Construction, and erection of Inglis, Portal, Dawit and Hopkins types. Organization of engineering corps.

Painting and Maintenance. Recommended Procedure in the Painting and Maintenance of Highway Bridges, Charles D. Snead. Mun. & County Eng., vol. 56, no. 5, May 1919, pp. 171-172. Periodical inspection of structures, particularly of small culverts after very hard rain, is recommended as advisable practice.

A Survey of Electric Railway Bridge Maintenance, R. C. Cram. Elec. Ry. Jl., vol. 53, no. 20, May 17, 1919, pp. 952-959, 11 figs. Specifications of Massachusetts Public Service Commission.

Raising Bridge. Raising Allegheny River Bridge 13 Feet by Jacking. Eng. News-Rec., vol. 82, no. 18, May 1, 1919, pp. 850-854, 9 figs. Increasing by 12.6 ft. the underclearance of a four-track, two-level steel structure at Pittsburgh without interruption of traffic.

Reinforcement. Reinforcement of Bridge by Means of an Eccentric Chord. Eng. News-Rec., vol. 82, no. 19, May 8, 1919, pp. 912-914, 4 figs. Strengthening steel bridge span in Chicago without infringing on underclearing and without using falsework.

Repairs. Repairs to Bridge at Kampen. Holland (Herstellingswerken aan de brug over den Djssel te Kampen), J. C. Pannekoel. De Ingenieur, vol. 34, no. 12, Mar. 22, 1919, pp. 204-205, 8 figs. Collision of steamer with one of the girders damaged bottom flange, plates and angles being torn away. Damaged parts were removed and actual tension on girder determined by calculation and checked by spring balance temporarily inserted.

Small Bridges. *See Culverts and Small Bridges above.*

Superstructure. Design of New Superstructure of Louisville Bridge with 644-Foot Riveted Span. Eng. News-Rec., vol. 82, no. 21, May 22, 1919, pp. 1007-1011, 10 figs., partly on separate plate. Replacement of Pennsylvania's historic Fink-truss bridge over Ohio River at Louisville, Ky., said to have involved design and erection under exceptional conditions.

Wilson Bridge. Wilson Bridge Combines Stone and Concrete. Contract Rec., vol. 33, no. 20, May 14, 1919, pp. 451-453, 4 figs. Six-span arch structure over river Rhone has masonry arches, cutstone trimmings and Hennebique type concrete deck.

BUILDING AND CONSTRUCTION

Army Construction Division. The World's Biggest Building Project, Arthur J. Widmer. Jl. Engrs. Club of St. Louis, vol. 4, no. 2, Mar.-Apr. 1919, pp. 125-141. Work of the Construction Division of the army said to have involved expenditure of $1,200,000,000 for period of 18 months.

Concrete Houses. Housing Project Construction Costs, Charles F. Willis. Concrete, vol. 14, no. 5, May 1919, pp. 185-190, 14 figs. Concrete houses in groups at Tyrone, N. M.

Cottage. The Perfect Double-Flatted Cottage Dwelling, Robert Thomson. Building News, vol. 116, no. 3353, Apr. 9, 1919, pp. 212-213, 1 fig. Structural arrangement of offices housing water-using appliances and their combination with entrance lobby makes each of them independently accessible therefrom.
Stucco-Coated English Type of House. Building Age, vol. 41, no. 5, May 1919, pp. 162-163, 4 figs. Plans, elevations and cross-sections of three-story 35-ft. x 31-ft. design.

Dams. *See Earthwork, Rock Excavation, etc.*

Factory Production of Building Parts. Reducing Construction Costs—II, Theodore F. Laist. Am. Contractor, vol. 40, no. 19, May 10, 1919, pp. 21-22 and 35. Suggests factory production of essential structural parts of dwellings as way to offset high cost of materials.

Floors. Reducing Construction Costs, Theodore F. Laist. Am. Contractor, vol. 40, no. 18, May 3, 1919, pp. 32-34, 10 figs. Reinforced-concrete floors in apartment buildings are suggested as means of decreasing depreciation charges and eliminating loss through obsolescence.

Halifax Ocean Terminals. Reinforced Concrete Building, J. J. Macdonald. Can. Engr., vol. 36, no. 18, May 1, 1919, pp. 427-429, 1 fig. General plan of part of Halifax ocean terminals showing coach-cleaning and storage yard.

Housing Projects. Notes on Grading and Planting Plans for Government Housing Projects, H. V. Hubbard. Landscape Architecture, vol. 9, no. 3, Apr. 1919, pp. 131-140. Concerning projects executed by U. S. Housing Corporation.

Competition for the Design of a Housing Scheme at Bözingen, near Biel (Wettbeewerb für eine Wohnkolonie im Fuchsenried in Bözingen bei Biel), Schweizerische Bauzeitung, vol. 73, no. 7, Feb. 15, 1919, pp. 67-72, 8 figs. Specifications required 60 per cent of dwellings should have 2 bedrooms, living room, kitchen, cellar and attic; 30 per cent 3 bedrooms instead of 2; and 10 per cent 4 bedrooms and in addition a separate kitchen. Schemes of six competitors and report of assessors are given with criticisms and comments.

Industrial Housing. Industrial Housing, C. W. Ruth, Stone & Webster Jl., vol. 24, no. 5, May 1919, pp. 388-392, 2 figs. Believes that the most economical structure is the five- to six-room house, because it allows family to take one or two roomers and boarders.

Reservoirs. Circular Concrete Reservoirs at Leamington, Ont., Edward M. Proctor. Can. Engr., vol. 36, no. 19, May 8, 1919, pp. 433-435, 8 figs. Provide storage of 1,000,000 imp. gal. Low unit stress has been used for steel and walls are entirely separate from floor.
Oil Fuel Reservoir of Rosyth. Engineer, vol. 127, no. 3301, Apr. 4, 1919, pp. 324-325, 2 figs. Concrete structure on rock foundation; walls built in form of retaining walls with average height of 35 ft., and reinforced with steel rods laid in direction of length of wall in layers 3 ft. apart in vertical direction, and spaced from 1 ft. to 4 ft. apart in horizontal direction.

Roofs. Erecting Long-Span Roof over Steel Mill by Rolling Trusses to Place. Eng. News-Rec., vol. 82, no. 19, May 8, 1919, pp. 898-902, 8 figs. Trusses rolled along craneway in groups weighing 800 tons.

School House. Standard School House Equipment and Details. Am. Architect, vol. 115, no. 2263, May 7, 1919, pp. 657-663, 11 figs. N. Y. City practice of forming folding partitions.

Vibrations. Vibrations in Buildings Due to Electrical Machinery, A. B. Eason. Post Office Elec. Engrs. Jl., vol. 12, part 1, Apr. 1919, pp. 32-40, 3 figs. Noise and vibration dealt with is that being due to telephone charging sets and ringing machines. Various reports dealing with conditions in post-office telephone exchanges are mentioned.

Warehouse. Eaton Mail Order Building, Moncton, N. B. Contract Rec., vol. 33, no. 20, May 14, 1919, pp. 449-450, 2 figs. Six-story flat-slab reinforced-concrete warehouse.

CEMENT AND CONCRETE

Car Floats. Construction of Concrete Car Floats for the Government. Concrete, vol. 14, no. 5, May 1919, pp. 181-183, 8 figs. Concrete is pourced in three units: (1) bottom skin, keelsons and frames, and outside skin and frames; (2) bulkheads; (3) stanchions, deck beams, girders and deck slabs.

Concrete Mixes. Correct Proportioning of Concrete Mixes, Duff A. Abrahms. Am. Architect, vol. 115, no. 2265, May 21, 1919, pp. 721-733, 9 figs. Report of investigations covering consistency (quantity of mixing water), size and grading of aggregates, and mix (proportion of cement, conducted during past three years at Structural Materials Research Laboratory, Lewis Institute, Chicago, with co-operation of Am. Inst. of Architects and Portland Cement Assn.

Design of Concrete Mixtures. Duff A Abrams. Concrete, vol. 14, no. 5, May 1919, pp. 191-195, 4 figs. Results of investigations conducted at Lewis Institute, Chicago, covering relation between consistency, size and grading of aggregates and mix.

Iron Portland Cement. Iron Portland Cement in Reinforced Concrete, Edwin H. Lewis. Iron & Coal Trades Rev., vol. 98, no. 2669, Apr. 25, 1919, p. 510. Claims that in properly made iron portland cement there should be no difficulty in keeping sulphur percentage below requirements of British standard specification. Paper before West of Scotland Iron & Steel Inst.

Mortars and Concrete, Physical Properties of. Physical Properties of Mortars and Concretes, H. M. Thompson. Can. Eng., vol. 36, no. 18, May 1, 1919, pp. 415-422 and 429, 18 figs. Tests show that 1:2 mortar without addition of chemicals and cured in a moist closet resists attack by alkali solution, but is disintegrated when steam-cured; addition of soap and aluminum sulphate decreases strength of mortars and renders them more liable to disintegration.

Pneumatic Concreting. Pneumatic Method of Concreting, H. B. Kirkland. Cement & Eng. News, vol. 31, no. 5, May 1919, pp. 23-25, 3 figs. Consist in blowing batches of concrete through pipe from central point of supply to their place into concrete form.

Retaining Wall. New Type of Sectional Concrete Retaining Wall. Ry. Rev., vol. 64, no. 19, May 10, 1919, pp. 690-691, 4 figs. Material in form of 8-in. reinforced-concrete I-beams was secured and laid in form of cribbing or retaining wall.

Rodding. Improving Concrete by Rodding, F. E. Giesecke. Eng. News-Rec., vol. 82, no. 20, May 15, 1919, pp. 957-958, 2 figs. Tests are said to have shown that strength is increased materially by continuous agitation of wet concrete with rods.

Setting Time of Portland Cement. Notes on the Setting Time of Portland Cement, F. Esling. Jl. Soc. Chem. Indus., vol. 38, no. 7, Apr. 15, 1919, pp. 81T-82T. Advocates further revision of standard specification of cement testing in respect to water that should be used in gaging cement-setting-time tests, and for this purpose distilled water is suggested as most readily obtainable standard.

Slag Production. Largest Slag Producer in America. Cement Mill & Quarry, vol. 14, no. 9, May 5, 1919, pp. 11-13, 14 figs. Plant at Ensley designed to produce 4000 tons of basic slag, crushed and screened in seven standard sizes.

Trunking, Concrete. Construction and Use of Concrete Trunking, B. A. Lundy. Ry. Signal Engr., vol. 12, no. 5, May 1919, pp. 169-170, 2 figs. Scarcity of cypress and high cost of sizes required led to development of this type.

EARTHWORK, ROCK EXCAVATION, ETC.

Dams. Sweetwater Dam Enlarged for the Third Time, H. N. Savage. Eng. News-Rec., vol. 82, no. 20, May 15, 1919, pp. 948-952, 6 figs. Construction of siphon spillways and enlargement of weir spillways to take care of maximum flood.

Dredging. Embankments of the Zuider Zee (De dijken in de Zuiderzee), K. dem Tex. De Ingenieur, vol. 34, no. 13, Mar. 29, 1919, pp. 227-228. Advantage claimed for suction dredges with pressure pipes is great output independent of wind and weather.

Filling. Computation of Time Required to Fill a Graving Dock, Eugene E. Halmos Eng. News-Rec., vol. 82, no. 19, May 8, 1919, pp. 920-921, 1 fig. Based on method of filling from upper orifice or from usual gate openings at bottom of dock.

Inspection of Dredging. Inspection of Drainage Ditch Cross-Sections After Contract Dredging, E. S. Blaine. Eng. News-Rec., vol. 82, no. 21, May 22, 1919, pp. 1019-1022, 7 figs. Soundings made by level rod gave way to lead and line following along tape.

Sinking. Sinking a Concrete Pumping Station in a River, Keith O. Guthrie. Eng. News-Rec., vol. 82, no. 21, May 22, 1919, pp. 1013-1016, 6 figs. House consisting of concrete cylinder 30 ft. in diameter lowered while being built from frame controlled by ratchet wrenches tied together for simultaneous movement.

Steam Shovel. A Review of Modern Steam Shovel Practice, with Recommended Procedure, Llewellyn, N. Edwards. Mun. & County Eng., vol. 56, no. 5, May 1919, pp. 176-179, 3 figs. Economy and efficiency of shovel operation believed to be mainly dependent on properly proportioned combination of latent power of machine with skill and experience of operator.

Tunneling. Tunnel Between Denmark and Sweden (Om tunnelbanen Kobenhavn-Malm), Heinrich Ohrt. Ingeniren, vol. 28, no. 15, Feb. 19, 1919, pp. 94-95. Project contemplates connection across harbor dam with Amagar Island. It is proposed to sink shafts at Saltohlm Island from which tunneling will be carried in two directions. Total length to be 31¼ miles of which 11 miles will be below sea level.

HARBORS

Philadelphia. Harbor Developments of the Port of Philadelphia in Progress and Contemplated, W. B. Ladue. Jl. Engrs. Club Philadelphia, vol. 36-5, no. 174, May 1919, pp. 188-193. Forecasts great future for this port, and suggests advertising its present possibilities.

MATERIALS OF CONSTRUCTION

Liquid Air. Liquid Air as an Explosive (Het schieten met vloeibare lucht in de Uederlandsche Kolenmijnen), W. H. D. de longh. De Ingenieur, vol. 34, no. 10, Mar. 8, 1919, pp. 176-179, 2 figs. Experiments with cartridges containing finely powdered soot, charcoal, bituminous coal, paper, cork, reed and sawdust saturated with liquid air. This explosive is said to have been found equal to dynamite.

Roofing Materials. Bituminous Roofing Materials and Construction—II, George Landis Wilson. Chem. & Metallurgical Eng., vol. 20, no. 9, May 1, 1919, pp. 484-486, 4 figs. Comparative tests of thickness, tensile strength, absorption of moisture, pliability, volatility and fillers.

ROADS AND PAVEMENTS

Asphalt. Hot Mix Asphalt Pavements. Francis P. Smith. Can. Engr., vol. 36, no. 21, May 22, 1919, pp. 472-474 & 482. Determining character of drainage and on manner of utilizing existing pavements. Paper read before Sixth Can. Good Roads Congress.

Bituminous Pavements. Defects in Surface of Bituminous Pavement Due to Concrete Base, H. W. Skidmore. Eng. News-Rec., vol. 82, no. 18, May 1, 1919, pp. 878-880. Data collected at Oak Park, Ill., intepreted as indicating that cracks and other objectionable features are a minimum where flexible foundations are used.

Efficiency of Bituminous Surfaces and Pavements Under Motor Truck Traffic, Prevost Hubbard. Am. City, City Edition, vol. 20, no. 5, May 1919, pp. 455-458. Views general opinion as rating increasing efficiency of bituminous types in the order; bituminous surfaces, bituminous macadam, bituminous concrete, sheet asphalt and asphalt block.

Brick. Design and Construction of the Monolithic Brick Road South of Seneca, Ill., A. H. Hunter. Mun. & County Engr., vol. 56, no. 5, May 1919, pp. 161-163, 6 figs. Plans call for alteration of grade by reduction to maximum of 7 per cent, a specification which required heavy excavation on hill.

Brick Pavements in the Middle West, A. T. Goldbeck and F. H. Jackson. Public Roads, U. S. Dept. Agriculture. Bur. Public Roads, vol. 1, no. 10, Feb. 1919, pp. 3-18, 14 figs. Writers conclude from their survey that type and thickness of base should depend upon maximum load or weight to be carried and the bearing value, under all weather conditions, of the underlying soil. Further conclusions applying to special cases were also formed.

General Features of Brick Pavement Construction, A. T. Goldbeck and F. H. Jackson. Eng. & Contracting, vol. 51, no. 19, May 7, 1919, pp. 479-481. From observations made during inspection trip of large number of brick roads in the Middle West. See Note to preceding item.

Present Status of Brick Pavements Constructed with Sand Cushions, Cement Mortar Beds, and Green Concrete Foundation, Wm. M. Acheson. Better Roads & Streets, vol. 9, no. 3, Mar. 1919, pp. 83-84. Paper before Am. Road Builders' Assn.

Concrete Highway Standards. Concrete Highway Construction Standards Raised. Eng. News-Rec., vol. 82, no. 20, May 15, 1919, pp. 955-956. Mississippi Valley State Road Officials recommend tamped concrete and heavier sections.

Concrete Sidewalks. Design of Concrete Sidewalks and Concrete Curb and Gutter at Street Intersections, W. Robert Paige. Mun. & County Eng., vol. 56, no. 5, May 1919, pp. 188-189, 3 figs. Examples of lines of walks and curves, intersected at angle of 78 deg. 14 min. on one side and 101 deg. 46 min. on other side.

Cost Charts. The Cost of a Mile of Road, George A. Duren. Eng. & Contracting, vol. 51, no. 19, May 7, 1919, pp. 485-486, 3 figs. Charts based on prices assumed as averages. Paper presented before Eng. & Road Builders' Congress.

Dixie Highway. Design and Construction of the Dixie Highway from Rockwood to Monroe, Mich., Leroy C. Smith. Mun. & County Eng., vol. 56, no. 5, May 1919, pp. 163-165, 2 figs. Metal top is 18 ft. wide with uniform thickness of 7 in. and 5-ft. shoulders. Grade is uniform, with no heavy cuts or fills, country being low and level and soil a heavy clay the entire length.

Easements and Superelevations. Superelevations and Easements, George Alden Curtis. Good Roads, vol. 17, no. 19, May 10, 1919, pp. 199-201, 5 figs. Field methods of constructing pavements with banked and easement curves.

Guarantees. Pavement Guarantees. Mun. Jl. & Public Works, vol. 46, no. 20, May 17, 1919, pp. 355-356. Practice of counties throughout U. S. A. as to requiring them and opinions of county officials as to their desirability.

Finishing Concrete Roads. The Finishing of Concrete Roads by Machine, E. G. Carr. Am. City, Town & County Edition, vol. 20, no. 5, May 1919, pp. 429-431, 2 figs. Illustrating how entrapped air is removed from concrete by alternating pressure.

Illinois. Illinois Adopts a Uniform Basis of Design for all Types of Rigid Pavement, Clifford Older. Eng. News-Rec., vol. 82, no. 19, May 8, 1919, pp. 905-907. State bond issue of $60,000,000 together with about $24,000,000 of Federal aid appropriation is to be expended for road building. It has been decided to use concrete or brick base or bituminous concrete base for main roads.

Macadam. Bituminous Macadam, A. W. Dean. Can. Engr., vol. 36, no. 21, May 22, 1919, pp. 469-470. Various rules are given for preventing unsatisfactory results with bituminous macadam.

Marker, Standardization. Uniform Markers for Our Highways, Roy E. Berg. Motor Age, vol. 35, no. 20, May 15, 1919, pp. 30-32, 14 figs. Road signs recommended for standardization.

PAVINGS FOR ELECTRIC-RAILWAY TRACKS. Investigation of Pavings for Electric Railway Tracks, H. S. Cooper. Elec. Traction, vol. 15, no. 5, May 1919, pp. 318-328. Advises that in comparing various types and kinds of paving it is well to consider that each has the type of base or foundation best suited to its stability as a whole and that such base or foundation is of ample strength of itself to relieve paving of any stresses or strains other than those which crush, roll or otherwise disintegrate or wear the actual body of the paving itself.

ROAD OIL. The Use of Road Oil. Am. City, Town & County Edition, vol. 20, no. 5, May 1919, pp. 423-427, 2 figs. Costs and tentative specifications prepared for highway engineers.

STATE HIGHWAY MANAGEMENT. State Highway Management,Control and Procedure, M. O. Eldridge, G. G. Clark and A. L. Luedke. Public Roads, U. S. Dept. Agriculture. Bur. Public Roads, vol. 1, no. 10, Feb. 1919, pp. 29-103, 28 figs. Schematic diagram of organization in state highway forces in 28 states.

WASHINGTON (STATE). The Road Building Sands and Gravels of Washington, Morris M. Leighton. Wash. Geol. Survey, bul 22, 1919, 307 pp., 45 figs. Studies covered (1) field examination to determinate nature, extent and manner of occurrence, and (2) laboratory tests to ascertain probably quality for gravel macadam and the various forms of pavement in which sand and gravel are used.

WOOD-BLOCK PAVEMENT. Procedure in Constructing an Open Joint Wood Block Pavement at Toledo, Ohio, Raymond Pierce. Mun & County Eng., vol. 56, no. 5, May 1919, pp. 174-175, 2 figs. Work carried on during winter months. Tractor was used to steam stone and sand and to furnish hot water for concrete mixer.

SANITARY ENGINEERING

COMFORT STATIONS. Comfort Stations Are National Necessities. Domestic Eng., vol. 87, no. 5, May 3, 1919, pp. 186-188 and 223, 2 figs. Need of immediate erection of public conveniences believed to be important part of reconstruction program. Arrangement suggested.

SEWAGE DISPOSAL. Results of Experiments With Miles Acid Process of Sewage Treatment, Edgar S. Dorr. Eng. & Contracting, vol. 51, no. 20, May 14, 1919, pp. 510-513. From experiments conducted at various institutions it is concluded that Miles process will produce a well-disinfected effluent from which 90 per cent. of settleable solids and 99 per cent. of the bacteria have been removed. From Jl. Boston Soc. Civil Engrs.

The Sewage Disposal Problem in Chicago, C. D. Hill. Mun. & County Eng., vol. 56, no. 5, May 1919, pp. 180-181. Dilution process used.

SEWAGE SCREENS. Operation of Fine Sewage Screens at Long Beach, California. Eng. News-Rec., vol. 82, no. 21, May 22, 1919, pp. 1012-1013. Tests reported to have indicated that screens remove 16.3 per cent. of solids.

SLUDGE ACTIVATION. Activated Sludge Experiments at Sheffield—Successful Results by Agitation, John Haworth. Contract Rec., vol. 33, no. 19, May 7, 1919, pp. 438-439, 1 fig. Analysis of samples from experimental aeration plant, Sheffield Sewage Works.

SURVEYING

ASTRONOMICAL MERIDIAN DETERMINATION. Polaris Observations for Azimuth in Northern Latitudes, J. Maughs Brown. Eng. Education, Bul. Soc. for Promotion of Eng. Education, vol. 9, no. 8, Apr. 1919, pp. 305-316, 4 figs. Suggestions intended to simplify field work and computations in determining astronomical meridian.

MAGNETIC MERIDIAN DETERMINATION. A Method of Determining the Magnetic Meridian as a Basis for Mining Surveys, T. Lindsay Galloway. Trans. Instn. Min. Engrs., vol. 56, part 4, Apr. 1919, pp. 222-227 and (discussion), pp. 227-235, 3 figs. Describes theodolite and three tripods, and appliance termed "magnetic reflector," which consists of a small plate-glass mirror to which is cemented a flat magnetized bar, the whole being delicately suspended by a single fiber of unspun silk, which are introduced in writer's method for the purpose of correcting what he terms the deficiencies in Beanland's extension of astronomical methods to underground surveying.

SPIRIT LEVELING. Spirit Leveling, R. B. Marshall. Dept. of the Interior, U. S. Geol. Survey, bulletins 632 to 636 and 638. In W. Va., Me., La., Ga., Ark.; and N. Mex. A separate bulletion for each state.

WATER SUPPLY

FACTORY WATER SUPPLY. What It Pays to Know About Factory Water Supply —III, Charles L. Hubbard. Factory, vol. 22, no. 5, May 1919, pp. 919-923, 7 figs. Contaminated drinking water supplied to workers said to have cost one company $50,000 in death and sickness claims.

FILTERING AT HIGH RATE. Reports on Detroit Waterworks. Mun. Jl. & Public Works, vol. 46, no. 19, May 10, 1919, pp. 334-337. Investigation conducted under auspices of Board of Water Commissioners concerning possibilities of filtering water at high rate.

RESERVOIRS. The High Service Reservoir of the St. Paul, Minn., Water Works, W. N. Jones. Mun. & County Eng., vol. 56, no. 5, May 1919, pp. 165-168, 6 figs. Investigation of proposition relative to securing entire city supply from artesian well and using Mississippi river as source of supply.

Improving Providence Water Supply, John Rositer Hess, Jr. Mun. Jl. & Public Works, vol. 46, no. 20, May 17, 1919, pp. 350-353. Temporary dam and regulating dam with spillway of horseshoe shape. Reservoir is expected to permit elimination of pumping.

TESTING STATIONS, WATER PURIFICATION. Testing Stations for Determining Critical Factors for Water Purification Plant Design, W. T. McClenahan and R. S Rankin. Eng. & Contracting, vol. 51, no. 20, May 14, 1919, pp. 515-516. Purpose of station was to study (1) effect of aeration on odor and taste, (2) kind and amount of chemical to be used and its effect on odor and taste, (3) period of sedimentation and time of contact giving best results, and (4) peculiarities in treatment of water contaminated by oil.

WATER SOFTENING. Water Softening for Municipalities, Milton F. Stein. Jl. Am. Water Works Assn., vol. 6, no. 2, June 1919, pp. 202-214, 5 figs. Essential features of softening plants are held to be mixing chambers in which softening reagents are thoroughly dispersed through the raw water, either by mechanical devices or by baffliug, large settling basins whose capaticy is based upon reaction period as determined for conditions of minimum temperature and means for adding a coagulant solution either at entrance to or near exist from settling basins or at both points.

WATERWAYS

CANAL, ADRIATIC TO SWITZERLAND. From the Adriatic to Switzerland by Canal Boat (Dall' adriatico alla Svizzera per canali navigabili), Guido Po. Rivista Marittima. vol. 52, no. 3, Mar. 1919, pp. 289-308, 11 figs. Venice-Brondola-Pizzighettones, up rivers Po and Adda and industrial canal to Milan. In process of construction.

FLOOD-WATER CONTROL. The Control of Flood Water in Southern California, Edw. N. Munns. Jl. Forestry, Soc. Am. Foresters, vol. 17, no. 4, Apr. 1919, pp. 423-129, 1 fig. Construction of stone ckeck-dams so placed across channel that the water, although able to percolate through them to some extent, collects in a basin behind the dam and then falls vertically, or nearly so, over its front face.

Short-Circuiting Floods in the Big Sioux River. Francis C. Shenehon. Eng. News-Rec., vol. 82, no. 20, May 15, 1919, pp. 961-964, 5 figs. Plan of spillway to guard against flood water in Big Sioux River near Sioux Falls, S. D.

VARIA

STUMP REMOVAL. Methods and Costs of Stump Removal in Land Clearing, F. M. White and E. R. Jones. Eng. & Contracting, vol. 51, no. 21, May 21, 1919, pp. 535-537, 3 figs. Examples of dynamite charges in various cases and stumping records made by crews. Investigations by Agricultural Experiment Station, Univ. of Wisconsin. Pulling with horse puller and then craking with dynamite said to have been found to be the most economical method of stump rem oval.

ELECTRICAL ENGINEERING

ELECTRODEPOSITION

GALVANIZING PLANTS. Planning and Operating a Galvanizing Plant, E. P. Later. Foundry, vol. 47, no. 7, May 15, 1919, pp. 289-291, 5 figs. Analysis of temperature factors and difficulties; remarks on choice of kettles, tanks and cleaning equipment.

ELECTROPHYSICS

CABLES, AERIAL. General Property of Aerial Cables (Sur une propriété très générale des câbles servant aux transport aériens), G. Leinekugel le Cocq. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 15, Apr. 14, 1919, pp. 761-764, 1 fig. Portion of cable between two suspension points considered as beam and deflections at various points determined in terms of horizontal tension at extremities and integral of bending moments to left of section.

CURRENT RECTIFICATION BY VOLTAMETER. Direct Current Generation by Applying Alternating Electromotive Force to Voltameter with Platinum Electrodes (Sur la production d'un courant continu par application d'une force électromotrice alternative *à* un voltamètre a électrodes de platine), P. Vaillant. Revue Générale de l'Electricité, vol. 5, no. 16, Apr. 1919, pp. 593-594. From Comptes rendus des séances de l'Académie des Sciences, vol. 168, Mar. 31, 1919, pp. 687-689.

EMISSION OF ELECTRICITY FROM INCANDESCENT BODIES. Emission of Electricity from Incandescent Bodies (L'émission d'électricité par les corps incandescents), A. Boutaric. Revue Générale des Sciences, vol. 30, no. 7, Apr. 15, 1919, pp. 198-211, 17 figs. Its application in construction of Fleming valve, audion and tudes acting by electronic discharges. The theory of operation of these apparatus is outlined and a mathematical theory of the operation of vacuum three-electrode tubes is presented. Second article.

OSCILLATIONS MAINTAINED. Electrotechnical Analogy of Maintained Oscillations (Sur une analogie électrotechnique des oscillation entretenues), Paul Janet. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 15, Apr. 14, 1919, pp. 764-766. Analogy between maintained oscillations used in wireless telegraphy and reversing motion of separately excited motor when fed by series generator and running on no load.

FURNACES

BOOTH-HALL ELECTRIC FURNACE. The Booth-Hall Electric Furnace, W. K. Booth. Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, p. 716, 3 figs., also Can. Machy., vol. 21, no. 18, May 1, 1919, pp. 430-433, 7 figs. This conducting-hearth electric furnace has an auxiliary electrode for starting and automatic control. Paper read before Iron & Steel Inst., and Instn. Elec. Engrs. at joint meeting.

CONTROL OF TEMPERATURE. Metal Melting in Electric Furnaces, E. F. Collins. Metal Indus., vol. 17, no. 5, May 1919, pp. 221-224, 3 figs. Some characteristics of the furnace installation treated are control of temperature of heat-generating source and uniform distribution of heat generated.

HEROULT FURNACE. Work of the Electric Furnace. Elec. Eng., vol. 52, no. 5, Nov. 1918, pp. 12-13, 4 figs. Installation at plant of Driver-Harris Co., Harrison, N. J. Furnace is of Héroult arc type featured with automatic regulation; it has capacity of two tons.

NON-FERROUS METAL MELTING. Electric Furnace for Melting Non-ferrous Metals—I, Edgar F. Collins. Foundry, vol. 47, no. 7, May 15, 1919, pp. 284-288, 6 figs. Diagram illustrating principles of carbon-electrode type of furnace. Notes on continuity and dependability of service is melting brass commercially.

Melting of Non-Ferrous Metals and Alloys. Elec. World, vol. 73, no. 21, May 24, 1919, pp. 1110-1114, 5 figs. Data presented to show that saving of 100 per cent or more may be expected from electrical method in brass-melting industry.

SAHLIN FURNACE. A New Type of Electric Furnace, Axel Sahlin. Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, p. 618, 2 figs. Built as circular ladle with contracted top and dished bottom. Paper read at joint meeting of Iron & Steel Inst. and Instn. Elec. Engrs.

STEEL-FURNACE PRACTICE. Pointers on Electric Steel Furance Practice, H. E. Diller. Foundry, vol. 47, no. 6. May 1, 1919, pp. 239-242, 6 figs. Data on arc-type furnaces based on research work conducted by writer and his experience in various foundries.

STEEL-FURNACE PROGRESS. Electrical Apparatus Development. Elec. World, vol. 73, no. 21, May 24, 1919, pp. 1102-1105, 4 figs. Growth of electric steel furnace indicated by-mentioning that while in July, 1913, there were only about 20 such furnaces in the U. S. A., at the end of 1918 there was a total of 287.

Electric Furnaces, W. E. Moore. Jl. Engrs. Club of St. Louis, vol. 4, no. 2, Mar.-Apr. 1919, pp. 166-183, 4 figs. History of development with remarks on quantity production. Arcetype furnace is considered as best suited type for foundry work.

Developments in Electric Iron & Steel Furnaces, J. Bibby. Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 611-617, 23 figs. Remarks confined to development in manufacture of iron and steel by means of electric furnaces. It is emphasized that it is important for electrical engineers to grasp requirements of metallurgists and to be acquainted with working conditions of blast furnaces and steel foundries. Paper read at joint meeting of Iron & Steel Inst. and Instn. Elec. Engrs.

STEEL FURNACES. Large Electric Steel-Melting Furnaces, Victor Stobie. Iron & Coal Trades Rev., vol. 98,no. 2671, May 9, 1919, pp. 618-621, 8 figs. Suggested connnections for various sizes. Paper read at joint meeting of Iron & Steel Inst. and Instn. Elec. Engrs.

GENERATING STATIONS

CENTRALIZATION OF ELECTRIC POWER. The Significance and the Opportunities of the Central Station Industry, R. F. Schuckardt. Elec. Jl., vol. 16, no. 5, May 1919, pp. 166-168. Believing centralization of electric power will come eventually writer urges planning present extensions so that in due time interconnection can be carried out most economically.

The Primaries of Today, the Secondaries of Tomorrow, W. S. Murray. Elec. Jl., vol. 16, no. 5, May 1919, pp. 168-170. Advantages of centralization of electric power illustrated by quoting comparative load factors of central plants and plants otherwise operated.

EASTERN COMPANIES. Promising Outlook for Eastern Companies. Elec. World, vol. 73, no. 20, May 17, 1919, pp. 984-991, 14 figs. Central-station situation outlined for several communities, notably Philadelphia, Baltimore, New Jersey and New York City.

HYDROELECTRIC PLANT, SMALL. Opportunities for and Data on Small Municipal Hydro-Electric Plants, Wm. G. Fargo. Min. & County Eng., vol. 56, no. 5, May 1919, pp. 168-171, 3 figs. Example of rating curve for determining intermediate stream flow based on several flow measurements.

ICE MAKING AND REFRIGERATION. Central-Station Service for Ice Making and Refrigeration, C. J. Carlsen. Elec. Rev., vol. 74, no. 20. May 17, 1919, pp. 783-787, 6 figs. Status and growth of load in New York and Chicago indicating tendency to use synchronous motors.

MIDDLE WEST. Central Station Progress in the Middle West, Elec. World, vol. 73, no. 20, May 17, 1919, pp. 1001-1006, 8 figs. Engineering development of last eighteen months.

PEAT-FIRED CENTRAL STATION. Steam-Driven Central Station at Vasteras, Sweden (La Station centrale thermo-électrique de Västerås), V. Forssblad. Génie Civil, vol. 74, no. 15, Apr. 12, 1919, pp. 296-298, 3 figs. Designed to insure constant feeding of network served by hydroelectric plants. It utilizes peat available in region. From Teknish Tidskrift.

RAILWAY POWER STATION. New Railway Power Station. Southern Engr., vol. 31, no. 3, May 1919, pp. 36-39, 4 figs. Stations generates 2,400 kw. at maximum rating; present equipment consists of horizontal cross-compound Nordberg-Corliss engines driving 1200-kw. direct-current generators.

ROTARY CONVERTERS. An Interesting Rotary Converter Installation at Ilford. Electricity, vol. 33, no. 1485, Apr. 25, 1919, pp. 257-259, 4 figs. Inverted rotary converter with step-up transformer and rotary converter supplying continuous current at substation installed by Ceneral Electric Co., Ltd.,

TOTALIZATION OF LOAD. New Emergency Bus Feature in Brantford Hydro-Electric Station. Elec. News, vol. 28, no. 9, May 1, 1919, pp. 29-30, 3 figs. Scheme provides for totalizing load no matter which way current is fed.

TURBINES. The Year's Electrical Development. Elec. Eng., vol. 53, no. 1, Jan. 1919, pp. 23-28, 2 figs. Concerning particularly turbine unit installations.

GENERATORS AND MOTORS

CONVERTERS. Adapting Automatic Control to Motor-Started Converters, R. J. Wensley. Elec. Ry. Jl., vol. 53, no. 20, May 17, 1919, pp. 948-951. 6 figs. Control developed by Westinghouse Electric & Manufacturing Co. Principle is same as that of automatic control of self-starting machines.

HIGH-FREQUENCY MACHINES. Regulation of High-Frequency Machines (Sur les machines à haute fréquence et leur réglage), J. Bethenod. Bulletin de la Société Française des Electriciens, vol. 9, no. 78, Mar. 1919, pp. 161-176, 2 figs. Technical study. Formulæ derived both in case of a single machine and when two machines are coupled.

INDUCTION MOTORS. Three-Phase Currents in Mining Work. Elec. Eng., vol. 52, no. 6, Dec. 1918, pp. 18-20, 2 figs. Simplicity of squirrel cage for induction motor, absence of commutator in all forms of induction motors, and convenience with which large amounts of power can be transmitted over long distances, and their pressures converted to any figure that may be desired at the points of consumption, are believed to have given three-phase curren preference over continuous-current service.

LIGHT-WEIGHT GENERATORS. Light Weight Electric Generating Sets. Engineering, vol. 107, no. 2782, Apr. 25, 1919, pp. 531-533, 9 figs. Sets made by A. Lyon & Wrench, Ltd., Willesden, London. These have been used by Admiralty, War Office and Air Ministry, supplying power for daylight signaling, X-ray apparatus, battery charging, landing lights for aerodromes and general lighting of huts, dugouts, etc.

RADIOTELEPHONY, GENERATORS FOR. Dynamotors and Wind-Driven Generators for Radiotelephony, R. G. Thompson. Elec. Jl., vol. 16, no. 5. May 1919, pp. 205-210, 12 figs. Single-armature, double commutator, bipolar, ball-bearing, totally-enclosed direct-current machine, 5 in. in diameter and 8.5 in. long, weighing aproximately 15 lb.

SYNCHRONOUS MOTORS. Synchronous Motor Characteristics—II, Theo. Schou Elec. World, vol. 73, no. 18, May 3, 1919, pp 880-883, 12 figs. Compound squirrel-cage winding developed for pulling into step synchronous motors carrying full load.

Utilizing the Time Characteristics of Alternating Current, Henry E. Warren. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 5, May 1919, pp. 629-643, 10 figs. Small self-starting synchronous motor devised for driving timing devices such as clocks, graphic-instrument movements, time recorders, etc., directly from lighting circuits.

WINDING. Rewinding 12,000-Kw. Turbo-Generator Field. Elec. World, vol. 73, no. 18, May 3, 1919, pp. 893-894, 3 figs. Work performed on insulation and damaged coils.

IGNITION APPARATUS

MAGNETOS. Sparking Power of Magnetos, Harry F. Geist. Automotive Industries, vol. 11, no. 18, May 1, 1919, pp. 949-953, 8 figs. Oscillogram showing electromotive force across contact points of breaker and current flowing in ignition circuit for five different points of interruption.

Experiments on the High-Tension Magneto—II, Norman Campbell. Lond, Edinburgh, and Dublin Phil. Mag., vol. 37, no. 220, Apr. 1919, pp. 372-396, 16 figs. Object of experiments was to discover how far the relation between peak potential, primary capacity, and coupling of circuits, which is predicted by theory, is found in experiment. (Continued.)

SPARK PLUGS. The Operation and Design of Sparking Plugs, H. Warren. Automobile Engr., vol. 9, no. 123, Feb. 1919, pp. 59-63, 14 figs. Actual ignition of explosive charge in engine cylinder is particular case with which writer deals, attention being confined to physical conditions under which ignition is effected and operation and design of sparking plugs. (To be concluded.)

LIGHTING AND LAMP MANUFACTURE

LIGHTING CODES. Present Status of Industrial Lighting Codes, G. H. Stickney. Am. Architect, vol. 115, no. 2264, May 14, 1919, pp. 694-698. In four states and in several establishments industrial lighting codes have been adopted for the protection of workers from accidents and eye strain. Specifications deal with intensity, glare limits and distribution. Various texts are discussed and suggestions are offered. (To be continued). Paper presented at joint meeting of Am. Inst. Elec. Engrs. and Illuminating Eng. Soc.

MOTION-PICTURE PROJECTION. Mazda C. Lamps for Motion Picture Projection, A. R. Dennington. Elec. Jl., vol. 16, no. 5, May 1919, pp. 201-204, 6 figs. Westinghouse equipment.

MEASUREMENTS AND TESTS

CAPACITY AND CAPACITANCE. Measuring Capacity in a Three-Phase Armored Cable and Evaluation of the Current of Capacitance (Mesure de la Capacité dans les câbles armés triphasés en vue de l'évaluation du courant de capacitance) Raymond Bouzon. Revue Générale de l'Electricité, vol. 5, no. 18, May 3, 1919, pp. 651-653, 4 figs. Theory and formulæ.

ELECTROSTATIC GLOW METER. The Electrostatic Glow Meter, R. J. Wensley. Elec. Jl., vol. 16, no. 5, May 1919, p. 228, 4 figs. For indicating in high tension switching stations presence of potential, grounded phase or synchronism between two separate high-tension lines.

INSULATOR TESTING. Western Practice in the Testing of Insulators. Elec. Rev., vol. 74, no. 19, May 10, 1919, pp. 741-743. Report of Insulator Committee presented before Pacific Coast Section N.E.L.A. Covers tests used and adopted by various operating companies of Pacific slope together with description of equipment and limitations of the various methods.

Insulating Materials, Dr. Bultemann. Elecn., vol. 82, no. 17, Apr. 25, 1919, pp. 491-492. Their uses, breakdown voltages and preparation. (To be concluded). From Gummi Zeitung, nos 43, 45, 46, 47, 48, 1918.

Methods of Measuring Conductivity of Insulating Materials at High Temperatures, F. B. Silsbee and R. K. Honaman. Jl. Wash. Acad. Sciences, vol. 9, no. 9, May 4, 1919, pp. 252-266, 4 figs. Results obtained by use of alternating-current method on a number of types of samples. Figures show variation in resistance but similarity-in constant *b*, which is a measure of temperature coefficient of their resistance.

MAGNETO, PERMANENT. Note on the Testing of Permanent Magnets, J. D. Morgan. Engineering, vol. 107, no. 2782, Apr. 25, 1919, pp. 525-526, 5 figs. Writer feels that it is undersirable to depart from established practice of specifying in term of Brem *and Hç* but he suggests additional test for determining maximum *B H product*.

TEMPERATURE INDICATORS FOR ALTERNATORS. Temperature Indicators for Alternators, S. L. Henderson. Elec. Jl., vol. 16, no. 5, May 1919, pp. 193-196, 11 figs. Of exploring coil and therm-couplo methods while both are admitted to give satisfactory results still the latter is believed to give results nearer maximum measurable temperature because it is said it indicates temperature at a spot while exploring coil gives average temperature over its length.

VOLTAGE, HIGH. Electrastatic Apparatus for Measuring Vevy High Voltages (Technische elektrostatische Apparate zur Messung sehr hoher Spannungen) A. Imhof. Schweiz. Elektrotechnischer Verein, Bul. no. 3, vol. 10, Mar. 1919, pp. 47-52, 7 figs. Apparatus described by writer is based on principle whereby only part of the voltage passes through "measuring system" (2 electrodes, one stationary the other movable), the remainder of the voltage passing through a series condenser.

POWER APPLICATIONS

Filtration Plant. Electric Filtration Plant, R. U. Steelquist. Jl. Electricity, vol. 42, no. 9, May 1, 1919, pp. 427-438, 5 figs. Electrically pumped electrically filtered water supply of Albany, Ore.

Heat Treatment How the Power House Aids the Forge, L. F. Johnson. Iron Trade Rev., vol. 64, no. 19, May 8, 1919, pp. 1221-1226, 12 figs. How electricity is used for heat-treating guns and other heavy forgings by Inland Ordnance Co.

Heating. Heating Liquids by Electricity—the Past, the Present and the Future, H. O. Swoboda. Proc. Engrs. Soc. Western Pa., vol. 34, no. 8, Nov. 1918, pp. 537-571 and (discussion) pp. 572-574, 26 figs. Examination of several electric circulation water heaters, notably in the West, leads writer to believe that with the establishment of high-power ceotral stations electric heating devices offer sufficient advantages to predict their general adoption.

Plate Mills. Electrically-Driven Plate Mills, G. W. Haney. Elec. Jl., vol. 16, no. 5, May-1919, pp. 188-192, 14 figs. Of Brier Hill Steel Co. Two 66,000 volt lines connect to a main and auxiliary bus which is supported in structural work by suspension insulators; has arrangement allows flexbility in switching to permit any piece of apparatus to be cut out of circuit.

Quarrying. Quarrying and Working Stone by Electricity. Elec. Eng., vol. 53, no. 3, March 1919, pp. 105-107. Applications in Belgium, U. S. A. and Great Britain.

STANDARDS

Motor Rating. The Continuous-Rated Motor and Its Application, L. F. Adams. Elec. World, vol. 73, no. 19, May 10, 1919, pp. 936-939. Reasons for adopting 50-deg. temperature rise for motor rating. Efficiency of economical use of motor material as affected by development of motor design and amelioration of hot spots.

Voltage Standardization. Standardization of Voltage in Switzerland (Zur Frage der Vereinheitlichung der Betriebs-spannungen in der Schweiz), H. Schweiz. Elektrotechnischer Verein, Bul. no. 3, vol 10, Mar. 1919, pp. 43-47. Normal voltage to be fixed on basis of voltage most generally employed lately. Figures on hand show that 90 per cent. of current systems used and motors installed in 1918 were of the three-phase alternating-current type.

STORAGE BATTERIES

Charging. Charging Storage Batteries under Constant Voltage (Charge des accumulateurs sous tension constante), Fernand T'sas. Société Belge des Electriciens, vol. 33, Jan.-Mar. 1919, pp. 41-43, 2 figs. Scheme of connections.

TELEGRAPHY AND TELEPHONY, RADIO

Airplane Telephone Sets. Development of Airplane Radiotelephone Set, H. M. Stoller. Elec. Jl., vol. 16, no. 5, May 1919, pp. 211-214, 10 figs. Transmitting circuit consists of two three-element vacuum tubes connected to an input transformer operated by a microphone telephone transmitter. S. C. R-68 set.

Nomenclature. Nomenclature in Wireless Telegraphy—II, W. H. Eccles. Elecn., vol. 82, no. 17, Apr. 25, 1919, pp. 499-500. Ionic tubes used in radio work. (To be concluded.)

Static Interference. Static Interference and the Wireless, Roy A. Weagant. Elec. Eng., vol. 53, no. 3, Mar. 1919, pp. 117-119, 1 fig. Writer states that other investigators have considered characteristics of signal wave and static wave to be the same. He holds an opposite view and claims to have discovered the nature of the difference and on this knowledge to have based his invention for preventing static interference. Paper read before Joint Meeting of Inst. Radio Engrs. and N. Y. Elec. Soc.

Transatlantic Reception. Transatlantic Radio Reception, Charles A. Culver, Jl. Franklin Inst., vol. 187, no. 5, May 1919, pp. 525-579, 13 figs. In order to provide for transatlantic communication in event of failure of cables, representatives of Navy and War Departments decided to establish six experimental radio stations at Army posts. Conditions, personnel, equipment and results are discussed.

Valves, Ionic. Three-Electrode Lamp Valve (La lampe-valve à trois electrodes), C. Gutton. Revue Générale de l'Electricité, vol. 5, no. 17, Apr. 26, 1919, pp. 629-640, 16 figs. Work undertaken in the laboratories of the Radiotélégraphie Militaire.

TELEGRAPHY AND TELEPHONY, WIRE

Field Telephones. Field Telephone of the German Army (L'appareil téléphonique de campagne de l'armée allemande). Annales des Postes, Télégraphes et Téléphones, vol. 8, no. 1, 1919, pp. 94-102, 6 figs. Electrical scheme and connection for apparatus serving two lines.

Fullerphone. The Fullerphone, A. C. Fuller. Elecn., vol. 82, no 19, May 9, 1919, pp. 536-538, 5 figs.; also Engineer, vol. 127, no. 3301, Apr. 4, 1919, p. 435, 5 figs. Among advantages claimed for its application to civil telegraphy are saving of battery power, simplicity of wiring and manipulation of instruments, covering long distances without relaying and reduction to minimum of maintenance of lines. Paper read before Instn. Elec. Engrs.

Marine Telephone, Anti-Noise. A Successful "Anti-Noise" Marine Telephone. Pac. Mar. Rev., vol. 16, no. 5, May 1919, pp. 121-123, 3 figs. Use of both ears is permitted by special construction of hand set.

Protection of Lines. Systems of Protecting Telephone Lines against Falling on Trolley Wires (Los sistemas de proteccion contra la caida de los hilos telefonicos sobre las lineas aéreas de los tranvias eléctricos), Eug. Aigouy. Energia Electrica, vol. 21, no. 5, Mar. 10, 1919, pp. 58-61. Systems employed in Norway, Switzerland, Russia and Spain. (Concluded.)

Telephone Receivers. On the Determination of the Electrical and Acoustic Characteristics of Telephone Receivers, Louis V. King. Jl. Franklin Inst., vol. 187, no. 5, May 1919, pp. 611-625, 5 figs. Theoretical aspect presented from viewpoint of possible improvements.

Unification of Telegraph and Telephone Facilities. Unification of Telegraph and Telephone Facilities in the St. Louis-East St. Louis Terminal District, Frederick E. Bentley. Official Proc. St. Louis Ry. Club, vol. 23, no. 11, Mar. 14, 1919, pp. 236-246. Suggests unification plan.

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

Insulation. The Insulation of Distribution Transformers, A. C. Farmer. Elec. Jl., vol. 16, no. 5, May 1919, pp. 223-227, 15 figs. Advantages claimed for treatment at Westinghouse plant, which reduced windings to solid mass of copper and insulation.

Parallel Connections of Transformers. Parallel Connection of Transformers Fed by Ooe System or by Two Systems (La pratique de la mise en parallèle des transformateurs alimentés par le même réseau ou par deux réseaux), B. Guerschinovitch. Industrie, Electrique, vol. 28, no. 644, Apr. 25, 1919, pp. 148-153, 13 figs. Possibility of realizing delta or star connection in cases when both primary and secondary windings are at high tension, conditions being assumed to be theoretically perfect as regards connection of phases, etc.

Phase Transformation. Essentials of Transformer Practice—XXII, E. G. Reed. Elec. Jl. vol. 16, no. 5, May 1919, pp. 216-218, 5 figs. Phase transformation with autotransformers.

Scott Transformer Connections. Intensity and Maximum Power of Scott System of Connecting Transformers (Le calcul des intensités dans les transformateurs disposés suivant le montage de Scott et ses conséquences au point de vue de la puissance maximum admissible), E. Baticle. Revue Générale de l'Electricité, vol. 5, no. 17, Apr. 26, 1919, pp. 619-621, 2 figs. The two transformers are found to work under notably different conditions; consequently taking of suitable precautions is recommended.

TRANSMISSION, DISTRIBUTION, CONTROL

Circuit Protecting Devices. Circuits and Their Protecting Devices (in Japanese), M. Shibuzawa. Denki Gakkwai Zasshi, no. 369, Apr. 10, 1919.

Inductive Interference. Inductive Effects of Power Lines on Communication (in Japanese), M. Shibuzawa. Denki Gakkwai Zasshi, no. 369, Apr. 10, 1919.

Line Construction, Medium-Voltage. Construction Developments for Medium-Voltage Lines, D. F. Parrott. Elec. Rev., vol. 74, no. 18, May 3, 1919, pp. 703-708, 9 figs. Data of cost on man-hour basis. Paper read before Minnesota Electrical Assn.

Overload Relays. Overload and Reverse Power Relays, A. E. Hester. Elec. Eng., vol. 53, no. 1, Jan. 1919, pp. 17-22, 9 figs. Induction-type overload relay.

Substations. Outdoor Substations for Intercounty Development. Elec. World, vol. 73, no. 18, May 3, 1919, pp. 884-887, 10 figs. Substation through which small groups of consumers are being served from 26,400-volt circuits.

A Modern Substation, Roy R. Kiine. Power Plant Eng., vol. 23, no. 10, May 15, 1919, pp. 437-440, 5 figs. Substation serving congested district in New York City. Attention is called to limitations imposed upon construction by the necessity of placing substation near center of load, among residences, where real estate is high and where quiet operation and freedom from vibration are essential.

Largest Portable Substation. Elec. Eng., vol. 52, no. 6, Dec. 1918, pp. 11-12, 3 figs. Long Island R. R. Co. emergency substation having normal capacity of 1500 kw.

Voltage Regulation. Voltage Regulation, J. Humphrey. Iron & Coal Trades Rev., vol. 98, no. 2668, Apr. 18, 1919, pp. 472-473, 6 figs. Importance of regulating voltage in collieries and other industrial concerns Methods for securing it and description of Westinghouse system of compounding alternators, invented by Prof. Miles Walker.

WIRING

Hotel. Electric Service in World's Largest Hotel—I, Elec. World, vol. 73, no. 19, May 10, 1919, pp. 940-943, 8 figs. Schematic diagram of feeders in riser shafts extending from basement to roof.

VARIA

Leclanche Cells. Renovation of Leclanché Porous Pots and the Re-use of the Interiors of Spent Dry Cells, W. J. Thorrowgood. Ry. Gaz., vol. 30, no. 18, May 2, 1919, pp. 763-764. Reported that old porous pots were renovated by treatment with solution of one part hydrochloric acid and five parts water. Paper read before Instn. Ry. Signal Engrs.

Statistics. Statistics of the Electrical Industry. Gas Age, vol. 43, no. 9, May 1, 1919, pp. 474-475. Reports upon central stations and street railways issued by U. S. Census Bureau.

MECHANICAL ENGINEERING

CORROSION

Electrolytic Theory of Corrosion. The Effect of Air and Water on Materials Used in Engineering Work, H. E. Yerbury. Electrical Review, vol. 84, no. 2161, Apr. 25, 1919, pp. 484-486. Writer favors electrolytic theory of corrosion and quotes instances which, in his estimation, confirm it.

RUSTPROOFING. Metallic Coating for Rust-Proofing Iron and Steel—I, Henry S. Rawdon, M. A. Grossman and A. N. Finn. Chem. & Metallurgical Eng., vol. 20, no. 9, May 1, 1919, pp. 458-464, 1 fig. Recommendations in regard to rust-proofing metal coatings, with discussion of comparative values of different methods especially of zinc.

WIRE ROPE. The Internation Corrosion of Cables, Wm. Fleet Robertson. Min. & Sci Press, vol. 118, no. 18, May 3, 1919, pp. 589-591, 1 fig. Lack of internal lubrication is believed to have been cause of rope failure at Nanaimo, B. C. Colliery, which resulted in 16 instant deaths.

FOUNDRIES

ALUMINUM CASTING. Progress in Aluminum Casting. Metal Indus., vol. 17, no. 5, May 1919, pp. 211-213, 4 figs. McAdamite Aluminum Co's plant at Detroit said to have been erected with a view to have all operations go in continuous process from unloading of raw material to shipment of finished castings.

BRASS FOUNDRY. Materials and Chemicals Used in Brass Foundry Practice—VI, Charles Vickers. Brass World, vol. 15, no. 5, May 1919, pp. 139-141, 1 fig. Patented processes for producing phosphorus and its compounds. Serial dealing with history, properties, appearance, physiological action and commercial use of substances commonly used in brass founding.

CHAIN STEEL ANCHOR. Molding and Casting Heavy Steel Anchor Chain. Foundry, vol. 47, no. 320, Apr. 1, 1919, pp. 141-147, 13 figs. Development of process; method of assembling individual links in molds preparatory to pouring connecting links.

CRUCIBLES. Behavior Under Brass Foundry Practice of Crucibles Containing Ceylon, Canadian and Alabama Graphites, R. T. Stull. Jl. Am. Ceramic Soc., vol. 2, no. 3, Mar. 1919, pp. 208-226, 2 figs. Experimental research showed that substitution of Canadian graphite up to 25 per cent for Ceylon decreased life of crucible; the crucibles containing 100 per cent Canadian graphite are nearly as good as those containing 25 per cent Canadian and 75 per cent Ceylon, but that substitution of Alabama flake graphite for Ceylon improved crucible's life.

DIE CASTINGS. Die Castings and Their Application to the War Program, Charles Pack. Automotive Eng., vol. 4, no. 4, Apr. 1919, pp. 183-186, 9 figs. Development of industry, early machines and their work. Attempts to avoid blowholes and influence of this on machines. War castings produced.

JOB WORK. Diversified Output at Canton Plant. Foundry, vol. 47, no. 6, May 1, 1919, pp. 243-250, 11 figs. Organization of large foundry which produces castings weighing from 1 lb. up to 100 tons.

PUMP CASING. How a Large Pump Casing was Molded and Cast. Foundry, vol. 47, no. 7, May 15, 1919, pp. 281-283, 6 figs. Green-sand, skin-dried mold used with dry-sand core made on floor with the mold and dried in an oven.

RESEARCH. Application of Physical and Chemical Research to Cast Iron Foundry Practice (Exemples d'utilisation dans la pratique industrielle de la fonderie de fonte des résultats d'essais physiques et chimiques), J. Seigle. Bulletin et comptes rendus mensuels de la Société de l'Industrie Minérale, series 5, vol. 15, first issue of 1919, pp. 127-143, 13 figs. Technical discussion. Reference is made to investigations outlined in Industrie Minérale, second issue, 1918.

SAND BLAST. Application of the Sand-Blast, H. D. Gates. Iron Age, vol. 103, no. 18, May 1, 1919, pp. 1135-1138, 5 figs. also Metal Trades, vol. 10, no. 5, May 1919, pp. 203-206, 4 figs. second article. Relationship between air pressure and abrasion; sand-blast air drier adopted by Emergency Fleet Corp. Barrel, cabinet and table types at sand-blast equipment. Paper read before Newark Foundrymen's Assn.

SAND MOLDING. Ferruginous and Other Bonds in Molding Sands, P. G. H. Boswell. Foundry, vol. 47, no. 320, Apr. 1, 1919, pp. 148-150. European practice: mechanical and chemical analyses of English sands.

SHIP WORK. Making Castings Used in Ship Construction—II. Ben Shaw and James Edgar. Foundry, vol. 47, no. 6-7, May 1-15, 1919, pp. 251-255 and 297-300, 41 figs. Details of making rudder pattern by two methods and description of core-box construction. Ramming, setting and pouring basins.

STEEL CASTINGS. Making Steel Castings by the Best Steel Casting Company. Metal Trades, vol. 10, no. 5, May 1919, pp. 199-201, 5 figs. Lebanon pig iron, to which is added a considerable amount of low-phosphorus and low-carbon plate scrap, is used.

Foundry With Diversified Output. Iron Trade Rev., vol. 64, no. 19, May 8, 1919, pp. 1211-1217, 11 figs. Facilities created for large scale production of steel castings.

WHEELS, TRUCK. Making Quad Wheels in a Tractor Foundry. Foundry, vol. 47, no. 320, Apr. 1, 1919, pp. 157-161, 8 figs. Operation involved in manufacture of four-wheel drive army trucks.

FUELS AND FIRING

COAL STORAGE. The Storage of Coal, Eugene McAuliffe. Ry. Rev., vol. 64, no. 20, May 17, 1919, pp. 712-714, 1 fig. Concerning methods of unloading. Fuel Conservation Circular no. 17 of U. S. Fuel Administration.

PEAT. The Future of Peat as a Fuel—I, J. B. C. Kershaw. Coal Age, vol. 15, no. 20, May 15, 1919, pp. 898-901, 6 figs. Peat being considered as more widely distributed throughout the world than were the original beds of coal-forming materials, its utilization is considered advisable, and reference made to uses in various countries of drying and briqueeting it. (To be continued.)

PULVERIZED FUEL. Instructions for Safe Use of Pulverized Fuel. Engineer, vol. 127, no. 3304, Apr. 25, 1919, pp. 398-399. Prepared by Pulverized Fuel Equipment Co., N. Y.

Use of Pulverized Coal, With Special Reference to Its Application in Metallurgy, L. C. Harvey. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 8, 73 pp., 29 figs., also, slightly abridged, Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 590-599, 17 figs., and Colliery Guardian, vol. 117, no. 3045, May 9, 1919, pp. 1081-1085, 5 figs. (To be continued.) Examples of installations, details of burners, curves showing results of operation and operating costs, and bibliography of recent articles on powdered coal.

Pulverized Coal and Its Bearing on the Fuel Situation, H. G. Barnhurst. Am. Fertilizer, vol. 5^, no. 9, Apr. 26, 1919, pp. 48-49. Cost of pulverized coal equipment per boiler per rated boiler hp

GAGES

ERRORS. On Some Principles of Manufacturing Interchangeable Articles to Limit Gauges, G. Gerald Stoney and S. Lees. Engineering, vol. 107, no. 2777, Mar. 21 1919, pp. 361-362, 1 fig. Analytical derivation of error, based on Gauss' theoretical law of distribution of errors.

FLUSH-PIN SLIDING BAR. Flush-Pin Sliding Bar and Hole Gauges. Machy (Lond.), vol. 14, no. 345, May 8, 1919, pp. 163-171, 34 figs. Principles involved and procedure followed by Pratt & Whitney Co. in developing gauging systems for interchangeable manufacture. (Fourth article.)

JOHANNSON GAGES. The Use of Gage Blocks in Inspection, Ernst Mentor. Inspector, vol. 1, no. 1, June 1919, pp. 5-11, 37 figs. Development and uses of Johansson gages.

OPTICAL TESTING OF FLAT SURFACES. U. S. Bureau of Standards' Method of Measuring in Millionths, H. S. Bean. Inspector, vol. 1, no. 1, June 1919, pp. 12-13 & 21, 3 figs. Optical testing of flat surfaces and comparison of size standards.

TOLERANCES. Notes on the System of Tolerance in Mechanical Construction (Remarques sur le système des tolérances dans les constructions mécaniques). Génie Civil, vol. 74, no. 18, May 3, 1919, pp. 353-355, 10 figs. Technical study of limitations, based on principls of symmetrical and unsymmetrical systems.

GAS ENGINEERING

CENTRALIZATION OF GAS SUPPLY. Centralization in Public Gas Supply, J. H. Brearley. Gas World, vol. 70, no. 1812, Apr. 12, 1919, pp. 274-276, 1 fig. Discusses objections generally offered against centralization of gas supply. As example a scheme for Huddersfield (town adjacent to a number of small gas undertakings) is proposed.

DOORS, SELF-SEALING. Fifteen Oven of Michigan Light Company at Kalamazoo Have Capacity of 1,250,000 Cu. Ft. of High-Grade Gas per Day, Louis Resnick. Am. Gas Eng. Jl., vol. 110, no. 18, May 3, 1919, pp. 373-380, 6 figs. Salient features of installation is self-sealing doors which are said to have given satisfaction throughout six months of operation.

GAS FROM WOOD AND PEAT. Manufacture of Gas from Wood and Peat. Gas Jl., vol. 146, no. 2917, April 8, 1919, pp. 83-84. Swiss experience in commercial practice.

GAS PRODUCTION, NEW METHOD OF. New System of Gas Production (Et nyt system for gasfremfremstilling). Teknisk Ukeblad, vol. 66, no. 12, Mar. 21, 1919, pp. 174-175. Combination of present system of externally fixed retorts and water-gas producers, but combustion takes place inside retorts and is arrested when coal is changed to coke.

WATER-GAS. Water-Gas Operating Methods with Central District Bituminous Coals as Generator Fuel—Notes on Experiments on a Commercial Scale, W. A. Dunkley and W. W. Odell. State of Ill., Dept. Registration & Education, Div. State Geol. Survey, Co-operative Min. Ser., bul. 24, 1919, 27 pp. Summary of experiments on commercial scale.

HANDLING OF MATERIALS

BELT CONVEYORS. Coal and Ash Handling Equipment—III, Robert June. Refrig. World, vol. 54, no. 5, May 1919, pp. 25-27, 4 figs. Requirements for installing continuous belt conveyors.

COAL TIPPLES. New Coal Tipple at a Virginia Operation, C. Sharon. Coal Age, vol. 15, no. 18, May 1, 1919, pp. 796-798, 7 figs. Compact design embodying means for obtaining various grades or mixtures of grades.

IRON AND STEEL WORKS. Some Notes on the Handling of Raw Materials for Iron and Steel Works, W. W. McGosh. Jl. West of Scotland Iron & Steel Inst., vol. 26, parts 4 & 5, sessions 1918-1919, January 1919, pp. 68-74 and (discussions), pp. 74-78, 18 figs. on supp. plates, also Iron & Coal Trades Rev., vol. 98, no. 2670, May 2, 1919, p. 532. Illustrating practice in various Scottish plants.

ORE HANDLING. Automatic Ore Handling Plant. Iron & Coal Trades Rev., vol. 98, no. 2670, May 2, 1919, pp. 534-536, 15 figs., partly on supp. p.ate. Design for unloading railway wagons as they come into works with iron ore at a rate of 300 tons per hour.

TELPHERAGE. Power Plant Management; Coal and Ash Handling—III, Robt. June. Power House, vol. 12, no. 6, May 5, 1919, pp. 154-156, 4 figs., also Brick & Clay Rec., vol. 54, no. 9, May 6, 1919, pp. 778-779, 3 figs. (Third article). Installation of Jeffrey telpherage system at plant of Scioto Traction Co. Contents are discharged directly into coal pit from which coal is removed by brab bucket and transferred either to overhead bunker or to storage.

HEAT-TREATING

CARBURIZATION AT LOW TEMPERATURES. The Carburization of Iron at Low Temperatures, Andrew McCance. Iron & Steel Inst., Ann. Meet., May 8 ;& 9, 1919, no. 12, 5 pp., 1 fig. Consideration of variation of equilibrium conditions with temperature leads to assertion that above 550 deg. cent. ferrous oxide is more easily converted into carbide than pure iron.

CASE-HARDENING. Improvements in the Case-Hardening Process, D. Hanson and J. E. Hurst. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 7, 19 pp., 6 figs., also Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 573-575. Theoretical and experimental research leads to assertion that ordinary methods of case-hardening at or above 900 deg. cent. tend to formation of hyper-cutectoid layer in the case, which is a frequent source of flaking and grinding cracks.

FURNACES. Metallurgical Furnaces—II. Adolph Bregman. Metal Indus., vol. 17, no. 5, May 1919, pp. 218-220, 5 figs. Advises that in the design and operation of heat-treating plants, efficiency of furnace from standpoint of finished product be estimated from uniformity with which product is heated throughout its entire mass when heat chamber is filled to its full working capacity.

LOW-CARBON STEEL. Heat Treatment of Low-Carbon Steel, W. H. Wilkie. Jl. Am. Steel Treaters Soc., vol. 1, no. 6, Mar. 1919, pp. 194-206, 12 figs. Cautions against placing cold piece of steel into highly heated furnace, and recommends quenching piece with axis vertical in order to prevent excessive warping or cracks due to unequal contraction in cooling.

MEN. Fundamental Principles to be Considered in the Heat Treatment of Steel, R. A. Hayard. Chem. & Metallurgical Eng., vol. 20, no. 10, May 15, 1919, pp. 519-523. Advises encouraging men to think about the work they are handling and exercising creative instinct whenever possible, and developing sense of responsibility by allowing men to visualize their work by using charts and graphs.

STEEL-MILL PRACTICE. Relation of Steel Mill Practices to Subsequent Heat Treating, A. F. MacFarland. Jl. Am. Steel Treaters Soc., vol. 1, no. 6, Mar. 1919, pp. 183-193, 10 figs. Quantity of steel produced and its ability to respond to heat treatment giving superior pysical properties desired, said to depend entirely upon local conditions surrounding its manufacture.

HEATING AND VENTILATION

CENTRAL-STATION HEATING. Central-Station Heating in Detroit, J. H. Walker. Mech. Eng., vol. 41, no. 6, June 1919, pp. 497-503, 8 figs. Complete utilization of heat ordinarily discharged to condensing water in central electric generating station for purpose of heating buildings is held responsible and difficulties in way of even its partial utilization are pointed out with particular reference to conditions existing in Detroit. Paper for Springfield Meeting of A. S. M. E.

EQUIPMENT. Care of Heating and Ventilating Equipment—IX, Harold L. Alt. Power, vol. 49, no. 18, May 6, 1919, pp. 675-679, 9 figs. Several vapor systems are taken up and their characteristics explained, together with information regarding some of the special apparatus used with each.

THEATER VENTILATION. Theater Ventilation From a Health and Business Standpoint, E. Vernon Hill. Domestic Eng., vol. 87, no. 6, May 10, 1919, pp. 237-239 and 270. Mechanical equipment is judged necessary, and its installation profitable to contractor and owner.

HOISTING AND CONVEYING

COMPRESSED-AIR HOISTING ENGINE. Compressed Air Hoisting Engine for a Mine in India. Engineer, vol. 127, no. 3302, Apr. 11, 1919, pp. 356 & 363, 4 figs. Cylinders are 18 in. in diameter by 3-ft. stroke and work at pressure of 60 lb. per sq. in.

CONVEYORS, PORTABLE. Cutting Conveying Costs in the Brick Plant. Brick and Clay Rec., vol. 54, no. 9, May 6, 1919, pp. 765-767, 6 figs. Installation of portable conveyor. Examples of its applications as illustrated.

CRANE BRIDGE. TRANSPORTERS. Handling Devices in British Shell Shops—IV. Eng. & Indus. Management, vol. 1, no. 2, Apr. 24, 1919, pp. 349-355, 13 figs. Material is conveyed through shop by railways and two bridge crane transporters. (Concluded from p. 161.)

CRANES, GANTRY. A New Way of Loading Ocean Freighters. Ry. Elec. Engr., vol. 10, no. 5, May 1919, pp. 153-156, 7 figs. Illustrating how elecrically operated gantry cranes quickly transfer locomotives from cars to ship.

ELEVATOR CONTROL, ELECTROMAGNETIC. Electro-Magnetic Electric Elevator Control, T. Shutter. Elec. Eng., vol. 52, no. 6, Dec. 1918, pp. 36-38, 4 figs Otis Elevator control.

ELEVATORS, MECHANICAL. Mechanical Lifts—Past and Present, J. F. Robbins. Mech. Eng., vol. 41, no. 6, June 1919, pp. 507-512, 9 figs. A new type of lift described has the points of support of two counter-balancing loads so interconnected that movements of supporting elements of structure are synchronized and it is made impossible for supports to get out of level. Applicable to freight-car lifts, lift bridges, canal-lock lifts, etc.

FORDSON METHODS. Handling Parts in the Shop and on the Assembly Floor, J. Edward Schipper. Automotive Industries, vol. 40, no. 19, May 8, 1919, pp. 1009-1012, 5 figs. Conveying apparatus installed in tractor works of Henry Ford & Son plant.

INCLINED PLANE. Inclined Plane of the Union Mining Co., U. U. Carr. Coal Age, vol. 15, no. 19, May 8, 1919, pp. 856-857, 3 figs. Electrically driven hoist was installed in place of inclined-plane machine that proved inadequate to handle increased output.

MECHANICAL HANDLING EQUIPMENT. Seattle's Mechanical Handling Equipment, G. F. Nicholson. Pac. Mar. Rev., vol. 16, no. 5, May 1919, pp. 102-105, 4 figs. Consists partly of shearl-leg derricks, gantry cranes, stiff-leg derricks, 12 miles of railway tracks and eight loading platforms; equipment is electrically operated.

WINDING EQUIPMENT. An Electrically Driven Winding Equipment. Electrical Review, vol. 84, no. 2161, Apr. 25, 1919, pp. 460-461, 2 figs. Induction motor is geared to spur wheel on drum shaft, driving pinton being mounted on extension shaft supported by two bearings, connection to latter shaft being made through flexible coupling. Installed at Kilton Colliery in shaft 720 ft. deep.

HYDRAULIC MACHINERY

BIG CHUTE PLANT. Big Chute Generating Station, W. L. Amos. Can. Engr., vol. 36, no. 19, May 8, 1919, pp. 436-438, 4 figs. Evolution of present power plant at Big Chute on Severn river from 1909 to addition of four generating units in January 1919.

FRENCH PLANT. Hydroelectric Plant of the Loire and Center Electric Co. at Ance (L'usine hydro-électrique de l'Ance de la Compagnie électrique de la Loire et du Centre), Jacques de Soucy. Revue Générale de l'Electricité, vol. 5, no. 18, May 3, 1919, pp. 659-670, 15 figs. Output is 30,000,000 kw-hr. per year. (To be continued.)

GOVERNOR, HYDRAULIC TURBINE. New Hydraulic Turbine Governor (Nouveau regulateur à action indirecte et à indication mixte), Mo. Barbillion and M. Cayere. Houille Blanche, vol. 18, no. 25-26, Jan.-Feb. 1919, pp. 23-25, 4 figs. Advantages claimed are: extra rapid regulation, disappearance of speed oscillations, easy setting, and sensitiveness.

ICE TROUBLES. Design of Hydro-Electric Plants for Combatting Ice Troubles. R. M. Wilson. Jl. Eng. Inst. Can., vol. 2, no. 5, May, 1919, pp. 383-387 and (discussion), pp. 387-395, 2 figs. Classification and discussion of ice troubles. Remarks upon selection of site and design of head and tail-race channels with a view to eliminate trouble and damage both to the outside portion of development and to hydraulic equipment.

WATER HAMMER. Water Hammer in Conduits Made Up of Truncated Cones (Sur les coups de bélier dans les conduite de diamètre variable et formées de parties tronconiques), G. Guillaumin. Comptes rendus des séances de l'Academie des Sciences, vol. 168, no. 14, Apr. 7, 1919, pp. 723-725. Analytical. Concusion is reached that oscillation period is either smaller or greater than $2\theta = l/a$ according as conduit diverges or converges up the stream.

Pressures in Penstocks Caused by the Gradual Closing of Turbine Gates, Norman R. Gibson. Proc. Am. Soc. Civ. Engrs., Papers and discussions, vol. 45, no. 4, Apr. 1919, pp. 173-206, 9 figs. Determined from Professor Joukovsky's theory of maximum water hammer. Solution of problem by trial-and-error method is first given, and then formulæ are derived that cover governor time and relation between stroke and gate movement.

WESTERN CANADA PLANT. The Plant of the Western Canada Power Company, F. C. Perkins. Power House, vol. 12, no. 6, May 5, 1919, pp. 145-146, 1 fig. Hydro-electric plant operating at 125 ft. head.

INTERNAL-COMBUSTION ENGINES

ATMOSPHERIC CONDITIONS. Atmospheric Conditions Affecting Power, A. Johnson. Automobile Engr., vol. 9, no. 123, Feb. 1919, pp. 37-38, 3 figs. Table for estimating probable power and consumption of engine at elevations above sea level. Mathematical reasoning on which it is based is included.

DIESEL ENGINES. Diesel Engines Prove Economical at Lincoln, O. J. Shaw. Elec. Ry. Jl., vol. 53, no. 19, May 10, 1919, pp. 902-905, 9 figs., also Power, vol. 49, no. 19, May 13, 1919, pp. 734-736, 4 figs. Maintenance cost figures obtained at plant where three 350-kw. Diesel units have been in service for more than two years in combination with steam equipment.

War Developments in Marine Oil Engines, Mar. Eng. & Can. Merchants Service Guild Rev., vol. 9, no. 4, Apr. 1919, pp. 140-141, 3 figs. Schneider 2150-i.hp. submarine Diesel engine, as used in French navy.

ENGINE EXPERIMENTS. Engine Experiments, L. H. Pomeroy. Automobile Engr., vol. 9, no. 123, Feb. 1919, pp. 44-50, 11 figs. Influence of valve area, revolution speed, and combustion chamber design upon horsepower and thermal efficiency. Experiments made by Vauxhall Motors, Ltd., upon two 4-cyl. engines identical in design, save in arrangement of valves, which were of side-by-side type in one engine and overhead in the other.

GAS ENGINES. Large Horizontal Gas Engines in Modern Industry, H. Pilling. Gas & Oil Power, vol. 14, no. 164, May 1, 1919, pp. 109-119. Their application and working. Paper read before Cleveland Instn. of Engrs.

HEAVY-DUTY CAR ENGINE. New Golden, Belknap & Swartz Engine for Trucks. Commercial Vehicle, vol. 20, no. 8, May 15, 1919, pp. 32-33, 4 figs. Four-cylinder model, designed to handle low-grade fuel.
The 150 H. P. Ricardo Tank Engine, H. A. Hetherington. Automobile Engr., vol. 9, no. 125, May 1919, pp. 147-153, 27 figs. Cam details, governor arrangement, connecting-rod dismantling diagram, and table of general data. (Concluded.)

OIL ENGINE, MARINE. The Doxford Opposed-Piston Marine Oil Engine. Pac. Mar. Rev., vol. 16, no. 5, May 1919, pp. 106-108, 4 figs. Results obtained in tests on fuel economy and mechanical efficiency, tried out under supervision of chief surveyor of Lloyds.

ROTARY ENGINE. A Novel Rotary Engine. Autocar, vol. 42, no. 1228, Apr. 1919, pp. 572-573, 2 figs. Power controlled by varying mass of charge and combustion space in invention of P. H. Gergasse, Sussex, England.

LUBRICATION

SUBMERGED GOVERNOR PINS. Operation at Holtwood, Charles H. Bromley, Power, vol. 49, nos. 19 & 20, May 13 & 20, 1919, pp. 713-715, and pp. 770 776, 24 figs. Lubrication of submerged pins in governor operating mechanism. Record-keeping forms and follows-ups.

MACHINE ELEMENTS AND DESIGN

BALL BEARINGS. Ball Bearings and Haulage Economics, Arthur Hall. Iron & Coal Trade Rev., vol. 98, no. 2669, Apr. 25, 1919, p. 512, 2 figs. Test made at South African mines.

MACHINE SHOPS

CYLINDER GRINDING. Cylinder Grinding. Machy, (Lond.), vol. 14, no. 343, Apr. 24, 1919, pp. 93-99, 13 figs. Advantages of finishing cylinder bores by grinding; machines and auxiliary equipment used; practice in different plants manufacturing engines for automobiles and airplanes. (First article).

CYLINDER MACHINERY. Operations on the Liberty Motor Cylinders—11, H. A. Carhart. Am. Mach., vol. 50, no. 21, May 22, 1919, pp. 985-991, 14 figs. Information as to speeds, etc., in machining operations.

JIGS AND TOOLS. Jigs, Tools, and Special Machines, with Their Relation to the Production of Standardised Parts, Herbert C. Armitage. Engineering, vol. 107, no. 2778, Mar. 28, 1919, pp. 402-406, 10 figs., also Eng. & Mans. Management, vol. 1, no. 10, Apr. 17, 1919, pp. 301-306, 11 figs. (2d article). Advantages claimed are interchangeability of work, chapening of production, ability to use less-skilled class of lahor, elimination of fitting and introduction of assembling methods. (To be continued).
Templets Jigs and Fixtures, Joseph Horner. Engineering, vol. 107, nos 2777 & 2781, Mar. 21 & Apr. 18, 1919, pp. 367-370 & 493-497, 39 figs. Fixtures for use on plain millers, made by Kempsmith Mfg Co., Milwaukee, Wis. Multiple drilling machines constructed by Moline Tool Co., Moline, Ill. (Continuation of serial).

MILLING AND DRILLING MOTOR PARTS. Machining a Six-Cylinder Motor—I & II, J. V. Hunter. Am. Mach., vol. 50, nos. 18 & 19, May 1 & 8, 1919, pp. 851-853 & 887-890, 17 figs. Milling and drilling operations followed hy Falls Motor Corp. of Sheboygan Falls, Wis. Milling motor parts in Multiple.

THREADS, METRIC. Metric Threads, Theodore Chaundy and T. H. Plummer Engl. Mechanic & World of Sci., vol. 109, no. 2823, May 2, 1919, pp. 172-173. Rules for cutting them on English lathes. From Ministry of Munitions Jl.

TRAYS, WRENCH HOLDERS AND PANS. Arranging Trays, Wrench Holders and Pans on Machine Tools, F. Scriber. Can. Machy., vol. 21, no. 20, May 15, 1919, pp. 487-489, 18 figs. Examples of various types and discussion of their advantages.

MACHINERY, METAL-WORKING

CAST CUTTING TOOLS. Casting Cutting Tools from Crucible Steel, J. E Johnson, Jr. Foundry, vol. 47, no. 320, Apr. 1, 1919, pp. 162-164, 7 figs. Microphotographs made by Dividson process.

CYLINDER BORING AND REAMING TOOLS. Cylinder Boring and Reaming Tools. Machy. (Lond.), vol. 14, no. 342, Apr. 1919, pp. 61-68, 28 figs. Types and designs of cutter heads and reamers used for rough-boring and reaming small engine cylinders.

LATHE TOOLS. Capstan Lathe Tools—I, E. W. Field and A. E. Simpson. Machy. (Lond.), vol. 14, no. 345, May 8, 1919, pp. 173-175, 10 figs. Deals with spring-collet or split-jaw type of chuck, particularly design of H. W. Ward & Co., Brimingham. Paper read before Coventry, Eng., Soc.
Some Fittings and Attachments to a 5-in. S. C. Lathe for Repetition Work, T. W. Averill. Model Engr. & Elecn., vol. 40, no. 938, Apr. 17, 1919, pp. 275-282, 20 figs. Reduction gear and clutch for actuating lead screw to obtain self-acting sliding motion.

LATHES. The New Drummond Lathes. Machy. (Lond.), vol. 14, no. 345, May 8, 1919, pp. 153-158, 13 figs. Special reference is made to manner of testing, truth of fast headstock in relation to center axial line, relative height of center, cam action in chuck, cam action in lead screw and lead-screw pitch.

MACHINE TOOLS. Machine Tools, Alfred Herbert. Engineering, vol. 107, no. 2776, Mar. 14, 1919, pp. 355-358. Their development in recent years, with special reference to present tendencies to standardization. Paper before North East Coast Instn. of Engrs. & Shipbuilders.

MILLING MACHINES. The Becker Model D-1 Vertical Milling Machine, Am. Mach., vol. 50, no. 18, May 1, 1919, pp. 825-827, 3 figs. Designed to permit pieces of work weighing up to 10 tons being carried and machined on work table.
The New Cincinnati No. 5, High Power Milling Machine, John H. Van Deventer. Am. Mach., vol. 50, no. 21, May 22, 1919, pp. 971-976, 14 figs. Tool specially designed for quantity production.

MACHINERY, SPECIAL

COKE-QUENCHING, SCREENING AND LOADING MACHINE. Coke Quenching, Screening and Loading Machine. Gas World, vol. 70, no. 1811, Apr. 5, 1919, pp. 12-13, 1 fig. Machine consists of water-jacketed steel receptahle, slightly larger than the coke oven, and mounted on steel-framed traveling structure running on rails. Endless chain conveyor propels charge of incandescent coke into receptacle without exposure to air.

ROLLS. Design of Rolls for Making Ship and Boiler Plates. Machy. (Lond.), vol. 14, no. 342, Apr. 17, 1919, pp. 68-71, 4 figs. Drafts of slabbing and plate-mill rolls; universal mill; surface speed of rolls; rolling tin plate.

SEPARATOR, CENTRIFUGAL. Continuous Centrifugal Separation Machines. Engineering, vol. 107, no. 2776, Mar. 14, 1919, pp. 354-355, 7 figs. South African type which consists essentially of two bottomless buckets or vertical cylinders, revolving rapidly in a frame, around an upright spindle, each having an independent revolution on its own axis.
The Mauss Centrifugal Separators, E. M. Weston. Eng. & Min. Jl., vol. 107, no. 20, May 17, 1919, pp. 862-863, 6 figs. Type used for separation of colloids from slimes, particularly tin-ore slimes, consists of two bottomless buckets or vertical cylinders revolving rapidly in a frame around an upright spindle at a rate, for treatment of tin slimes, of 700 to 800 r p.m.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

BRASS. The Effect of Work on Metal and Alloys, Owen Wm. Ellis. Metal Industry, vol. 14, no. 14, Apr. 4, 1919, pp 284-288, 13 figs. Effect of reduction by rolling on alpha-heta brass determined hy subjecting to deformation in the rolls a casting of 61 :39 brass containing traces of impurities and having had no prior treatment.

CEMENT. Why Materials of Construction Should Be Tested Prior to Their Use, Emmanuel Mavant, Mun. & County Eng., vol. 53, no. 5, May 1919, pp. 184-186. Argues that cement should not he considered as standard material hecause there is always a possibility, even though remote, of its coming out too fresh, to high in sulphuric anhydric, in magnesia or too low in specific gravity.

CHINA AND SEMI-PORCELAIN. Impact Tests and Porosity Determinations on some American Hotel China and Semi-Procelain Plates. Homer F. Staley and J. S. Hromatko. Jl. Am. Ceramic Soc. vol. 2, no. 3, Mar. 1919, pp. 227-240, 6 figs. Vitrified hotel china plates tested were not found superior as a class to semi-procelain plates resistance to heavy impact blows; however, they are said not to have chipped with light blows, while semi-porcelain did. No direct relation was believed to be discernible between porosity and resistance to impact.

CLOTH. Notes on the Quantitative Testing of Rainproof and Waterproof Cloth, Geoffrey Martin and James Wood. Jl. Soc. Chem. Indus., vol. 38, no. 7, Apr. 15, 1919, pp. 84T-87T, 2 figs. Six ways of waterproofing are mentioned, and methods of determining which of these has been applied to given cloth are indicated.

COPPER. The Influence of Cold-Rolling upon the Mechanical Properties of Oxygen-Free Copper, F. Johnson. Metal Indus. (Lond.), vol. 14, no. 14, Apr. 11, 1919, pp. 297-302, 14 figs. Method adapted to obtain sound piece of pure copper was to melt copper in graphite crucible under layer of fine charcoal, adding further portions step hy step until crucible was full of molten copper. When solidified, metal was heated to 900 deg. cent. and forged on anvil. Results of tensile tests are tahulated and figures of maximum breaking load. Paper read before Inst. Metals.

DEFORMATION OF CAST IRON IN BENDING. Observations of Elastic and Permanent Deformations in Testing Cast Iron and Steel Bars (Observations de déformations élastiques et permanentes dans les essais de flexion sur barreaux en fonte et en acier), J. Seigle. Bulletin l'Industrie Minérale, series 5, vol. 15, first issue of 1919, pp. 87-126, 30 figs. Characteristics of elastic curves of various specimens. Curves were drawn from values obtained in tests.

FATIGUE OF METALS. The Fatigue of Metals, H. F. Moore. Jl. Engrs. Club, Philadelphia, vol. 36-1, no. 173, Apr. 1919, pp. 138-142, 19 figs. Photomicrographs of specimens hefore and after stressing; proposed formula for failure-stress calculations; test data of repeated-stress tests.

FUEL OIL. Physical Tests of Fuel Oil, John W. Newton and F. N. Williams-Petroleum Age, vol. 6, no. 5, May 1919, pp. 189-191. Discussion of various tests and apparatus required in laboratory with reference to U. S. Navy specifications for fuel oil. Third article.

GALVANIZED SHEETS. Selection of Galvanized Sheets. Raw Material, vol. 1, no. 2, Apr. 1919, pp. 144-146, 5 figs. Concludes that from results of experiments and work done in commercial mill operations, the factors that are active in producing small granular spangles in galvanizing have their origin in the open-hearth process; and these causes can be eliminated only when sufficient care is taken to produce a steel substantially free from oxide.

IMPACT TESTING MACHINE. The Eden-Foster Repeated Impact Testing Machine. Machy. (Lond.), vol. 14, no. 343, Apr. 24, 1919, pp. 105-109, 11 figs. Machine attempts to combine effect of vibration test and impact test by subjecting specimen to both shock and reversal of stress.

MICA. Raw Materials Needed in the Electric Industry. Mica (De quelques matières premières nécessaires à l'industrie électrique. Le Mica), Desiré Pector. Revue Générale de l'Electricité, vol. 5, no. 18, May 3, 1919, pp. 673-678. Location of mica deposits in the world; crystallization of various kinds of mica. (Continuation of serial). Preceding articles appeared in R. G. E., vol. 4, July 20 & 27, 1918, pp. 87 and 121.

PORCELAIN (SEE ALSO CHINA). The Effect of Time and Temperature on the Microstructure of Porcelain, Albert B. Peck. Jl. Am. Ceramic Soc., vol. 2, no. 3, Mar. 1919, pp. 175-194, 15 figs. Petrographic microscopic examination reported as showing that quite dissimilar bodies can be produced by holding porcelain at a constant temperature for lengths of time which lie within variations of commercial practice, clay passing into amosphous silica and sillimanite which in turn passed into crystallized sillimanite.

RESISTANCE OF MATERIALS. The Resistance of Materials—III, G. S. Chiles and R. G. Kelley. Ry. Mech. Engr., vol. 93, no. 5, May 1919 pp. 241-243, 7 figs. Effect of sudden or abrupt changes in section on the distribution of the unit stress. Rubber specimens having cross-ruling in white ink were subjected to stresses; diagrams of resulting distortions in rulings are shown.

RUBBER (SEE ALSO: RESISTANCE OF MATERIALS). The Tensile Strength of Rubber-Sulphur Mixtures, O. de Vries and H. J. Hellendoorn. Jl. Soc Chem. Indus., vol. 38, no. 7, Apr. 15, 1919, pp. 91T-93T, 4 figs. Stress and strain curves on Schopper testing machine.

X-RAY EXAMINATION OF MATERIALS. The Examination of Materials by X-Rays. Engineering, vol. 107, no. 2783, May 2, 1919, pp. 576-578, 1 fig. General discussion held at joint meeting of Faraday Soc. and Rontgen Soc.

MEASUREMENTS AND MEASURING APPARATUS

DILATATIONS, MEASUREMENTS OF. The Use of the Interferometer in the Measurement of Small Dilatations or Differential Dilatations, C. G. Peters. Jl. Wash. Acad. Sciences, vol. 9, no. 10, May 19, 1919, pp. 281-284. Equations for determining changes in length observable with dilatometer originated by Fizeau.

FLOW METERS. Petrol Flowmeters and the Calibration of Jets, G. Smith-Clarke. Automobile Engr., vol. 9, no. 126, May 1919, pp. 140-146, 19 figs., also Automotive Industries, vol. 40, no. 21, May 22, 1919, pp. 1110-1113, 2 figs. Instruments devolved under specifications of standardization, requiring all jets to be calibered under constant head of 100 cm. and stamping number upon jets indicating quantity of gasoline in cubic contimeters passed through in 1 min.

FLUID PRESSURE AND VELOCITY. The Measurement of Fluid Velocity and Pressure, J. R. Pannell. Engineering, vol. 107, nos. 2776, 2777, 2778, Mar. 14, 21 & 28, 1919, pp. 333-334, 364-366, and 394-398, 23 figs. Hotwire anemometers. Direction and velocity meter. Manometers and hydrometers. (Concluded.)

KATA-THERMOMETER. On the Cooling and Evaperative Powers of the Atmosphere, as Determined by the Kata-thermometer, Leonard Hill and D. Hargood-Ash. Proc. Roy. Soc., Series B., vol. 90, no. B. 632, Apr. 1, 1919, pp. 438-444, 3 figs. In observations taken the kata-thermometer was heated in hot water in a thermos flask, being kept in water till the air space at top was about half full of alcohol. For theory and use of kata-thermometer see phil. Trans. (B. vol. 207, 1916, pp. 183-220).

MOISTURE AND GASES. Device for Measuring Small Quantities of Moisture in Gases, A. J. Crockatt and R. B. Forster. Jl. Soc. Chem. Indus., vol. 38, no. 8, Apr. 30, 1919, Trans. pp. 95T-96T, 1 fig. Fiber principle; chardonnet silk used.

OPTICAL METHODS OF MEASUREMENT. Measuring to the Millionth Part of an Inch. Robert I. Clegg. Iron Age, vol. 103, no. 21, May 22, 1919, pp. 1345-1348, 8 figs. Optical method used by U.S. Bureau of Standards and other similar optical methods.

SNOW SAMPLERS. The Measurement of Snow, Robert E. Horton. Can. Engr., vol. 36, no. 18, May 1, 1919, pp. 426-427, 5 figs. Description of various samplers.

SCALES. The Effect of Distance Between the Knife Edges on the Errors of Scales, C. A. Briggs, Scale Jl., vol. 5, no. 8, May 10, 1919, pp. 7-9, 4 figs. Assuming distance between load knife edge and fulcrum knife edge is changed by circumstances of rust or wear, or by error of construction, the resulting error in indication of scale is considered to depend on distance between knife edges and not on nominal multiplication of levers.

SPHEROMETRY. Refinements in Spherometry, G. W. Moffitt. Physical Rev., vol. 13, no. 4, Apr. 1919, pp. 251-271, 8 figs. Precision in mechanical methods is asserted to decrease rapidly as radius becomes larger; by auto-collimating method, up to limit of slide on turntable, precision is said to be high and independent of radius; methods are found to possess high degree of precision of measurement for concave surfaces of any radius, in measurement of convex surfaces, to decrease in precision with increase of radius.

TINTOMETER. Estimation of Cyanogen Compounds in Concentrated Ammonia Liquor, Percy. E. Spielmann and Henry Wood. Chem. News, vol. 118, no. 3077, Apr. 4, 1919, pp. 157-159. Calorimetric method employing the Lovibond tintometer.

VISCOSITY OF GASOLINE. Viscosity of Gasoline, Winslow H. Herschel Technol. Papers of Bur. Standards. no. 125, May 5, 1919, 18 pp., 4 figs. Method of judging volatility and viscosity of gasoline by density is considered as only a rough approximation and measurement of fluidity by Ubbelohde viscosimeter is estimated as a preferable criterion.

MECHANICS

CABLES, SUSPENDED. Laying Aerial Lines (La pose des lignes aériennes). Emile Pierard Société Belge des Electriciens, vol. 33, Jan.-Mar. 1919, pp. 10-40, 10 figs. Cloeren and Barbaret formulæ for determining tension in suspended cable. Writer proposes stretching to one-fourth ultimate strength at — 15 deg. cent.

COLUMNS. Strength of Various Long Columns, William Jackson. Can. Engr., vol. 36, no. 21, May 22, 1919. pp. 467-468, 1 fig. Formulæ said to have been derived from results of a large number of tests on columns.

PLATES. Maximum Tension in Square Plate Carrying Load Concentrated at Center (Valeurs maxima de la tension près de la face inférieure d'une plaque carrée supportant une charge unique concentrée en son centre), M. Mesnager. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 8, Feb. 24, 1919, pp. 392-395. Mechanical theory of plate supported at its periphery, taking into account thickness of plate.

PROJECTORIES. Formulæ of Trajectories (Sur les formules représentatives des trajectoires), M. Risser. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 8, Feb. 24, 1919, pp. 390-392. Parameters of compensating hyperbola.

STRESSES IN BEAMS AND TRUSSES. Ladders. Robt. T. Reddy. Fire & Water Eng., vol. 65, no. 21, May 21, 1919, pp. 1133-1135, 10 figs. On the manner of using a truss ladder of form used by fire departments. Remarks based on theory of stresses in beams and trusses.

STRESSES IN MACHINES. Stresses in Machines When Starting and Stopping—V. F. Hymans. Automative Eng., vol. 4, no. 4, Apr. 1919, pp. 189-190, 6 figs. Energy equations and mathematical calculations developed from consideration of forces on machine-tool parts without assuming that they are either at rest or in motion.

MECHANICAL PROCESSES

BARRELS, STEEL. Manufacture of Steel Barrels. Machy. (Lond.), vol. 14, no. 342, Apr. 17, 1919, pp. 72-76, 12 figs. Blanking barrel heads, bending sheets for bodies; welding, flanging, brazing, bilging, pickling and testing.

BOILERS. How to Design and Lay Out a Boiler—VII, Wm. C. Strott. Boiler Maker, vol. 19, no. 5, May 1919, pp. 137-139, 3 figs. Calculations for design of girth seams; layout of tubes; location of fusible plug and water-gage glass. (To be continued.)

Flues — II, George L. Price. Boiler Maker, vol. 19, no. 5, May 1919, pp. 128-130, 8 figs. Kinds of tools used on flue work and reasons for using them.

CHUCK MANUFACTURE. Universal Chuck Manufacture Machy. (Lond.), vol. 14, no. 343, Apr. 24, 1919, pp. 101-104, 16 figs. Methods employed by F. Pratt & Co., Ltd., Halifax.

CRANKSHAFTS. Manufacture of Crank-Shafts for Aeroplane Engines, Richard Vosbrink. Metal Trades, vol. 10, no. 5, May-1919, pp. 219-221, 10 figs. Specfications require that pins and journals must be to size within plus or minuis 0.0005 in.; other similar examples are quoted to indicate accuracy required.

DRAWING STEEL. Making Cold-Drawn Screw and Shaft Stock. Robert E. Clegg. Iron Age, vol. 103, no. 18, May 1, 1919, pp. 1129-1131, 5 figs. Factory of New England Drawn Steel Co. at Mansfield, Mass. Product is 3/16 in. to 1½ in. shafting and screw stock, rounds, hexagons and other shapes in cold-drawn free-cutting material.

FILES. Some Points in the Manufacture of Files, Geo. Taylor. Iron & Steel Inst., Ann. Meeting, May 8 & 9, 1919, no. 15, 34 pp., 29 figs., also abridged, Iron & Coal Trades Rev., vol. 98, no. 2671, May 9, 1919, pp. 584-588, 12 figs. Pleads for definite and organized systems of working in manufacture of files, such as will insure reliable quality of steel and production of blanks of uniform size and quality.

Gears. Gear Plant Makes War Record Iron Trade Rev., vol. 64, no. 15, Apr. 10th, 1919, pp. 947-952, 12 figs. How Falk Co. of Milwaukee organized for mass production of reduction gear sets for destroyers and cargo boats.

Hosiery Machinery. Manufacturing Banner Hosiery Machine—IV, Robert Mawson. Can. Machy., vol. 21, no. 20, May 15, 1919, pp. 481-483, 6 figs. Manufacturing operations on frames.

Liberty Motor Parts, Production of. Production of Liberty Motor Parts at Ford Plant, W. F. Verner. Mech. Eng., vol. 41, no. 6, June 1919, pp. 517-522 & 556. 11 figs. Describes process of forging cylinders from high-carbon steel tubing; also the 21 machining operations on bronze babbitt-lined crank-shaft bearings. Paper for Spring Meeting of A.S.M.E.

Marine Engine. Building Marine Engines on a Quantity Basis, F. B. Jacobs. Mar. Rev., vol. 49, no. 6, June 1919, pp. 273-282, 13 figs. Hooven, Owens, Rentschler Co. of Hamilton, O., said to be completing four 2800-hp. 3-cyl., triple-expansion, inverted-type marine engines per week, First article of a series, dealing with heavy units such as cylinders, crankshafts, bed plates, connecting rods, etc.

Milling-Machine Manufacture. Special Operations in Milling Machine Manufacture, F. B. Jacobs. Iron Trade Review, vol. 64, no. 14, Apr. 3, 1919, pp. 893-896, 13 figs. Seasoning of castings accomplished by exposing them to weather for a number of weeks, during which time they expand and contract with change in temperature from midday to midnight.

Rolling Mills. 19,000-Hp. Electric Reversing Rolling Mill Equipment. Engineer, vol. 127, no. 3301. Apr. 4, 1919, pp. 334-336, 6 figs. Motor comprises three units rigidly coupled together and mounted on common bedplate.
New Steel Works Built in England, Joseph Horton. Iron Trade Review vol. 64, no. 14, Apr. 3, 1919, pp. 879-883, 5 figs. Arrangement of 36-in. blooming mill and 21 and 18-in. bar mills at Phoenix Special Steel Works, Sheffield.
Pointers on the Designing of Wire Rod Mills, W. S. Standiford. Can. Machy., vol. 21, no. 18, May 1, 1919, pp. 426-429, 4 figs. Design of roll passes developed for manufacture of wire used in entanglements in front of trenches.

Vise Manufacture. How the Reed Vise is Made ,J. V. Hunter. Am. Mach., vol. 50, no. 20, May 15, 1919, pp. 923-926, 14 figs. Machining operations used by Reed Mfg. Co., Erie, Pa., especially in regard to obtaining interchangeability of parts.

MOTOR-CAR ENGINEERING

Daimler. The Daimler 2-3 Tonner Motor Traction, vol. 28, no. 739, Apr. 30, 1919, pp. 373-375, 7 figs. Specifications: 22.4-hp., 4-cyl., sleeve-valve engine; gross loaded weight allowable, 5½ tons four forward and one reverse speeds: overhead worm.

Gazelle. The 8-hp. Gazelle. Autocar, vol. 42, no. 1227, Apr. 26, 1919, pp. 616-618, 6 figs. Four-cyl. French car. Some of specifications are; forced lubrication, 3-speed gear box, and bevel-driven back axle.

Military Trucks. Military Transport Chassis—XI & XIV. Automobile Engr., vol. 9, nos. 123 & 126 Feb. 1919, and May 1919. pp. 39-42 & 137-139, 9 figs. Performance of Kelly Springfield K 40 (3½ ton) and Packard "4D" truck under war conditions.

Tractor Engines. Fuel Limitations of Tractor Engines, H. L. Horning. Automotive Industries vol. 40, no. 19, May 8, 1919, pp. 1001-1003 and 1043. Hints on overcoming common troubles. Paper read before Soc. Automotive Engrs.

POWER GENERATION

Delivery and Relative Fall Determination. Utilization of Hydraulic Energy (Programme d'étude pour l'amenagement des forces hydrauliques), R. de la Brosse. Houille Blanche, vol. 18, nos. 25-26, Jan.-Feb. 1919, pp. 1-5. How to determine delivery and relative fall; their significance in calculation of available energy. Reference is made by way of illustration to region of Pyrenées and central basin of France.

New England. War-Time Service Problems in New England Elec. World, vol. 73, no. 20, May 17, 1919, pp. 1007-1019, 31 figs. Details of plant growth, connected load and enforced economies are presented as factors which have contributed to establish reliability of central station service.

New South Wales. White Bay Power Station of the New South Wales Railways, O. W. Brain. Tramway & Ry. World, vol. 45, no. 18, Apr. 10, 1919, pp. 177-186, 6 figs. Plant supplies traction current for Sydney's tramways and also furnishes electric power for railway and tramway workshops, and various auxiliary services of department throughout metropolis, including signaling system, elevators, conveyors, lifts, pumps, air compressors, etc. Paper read before Elec. Assn. of Australia.

New Zealand. Hydro-Electric Development of New Zealand, E. Parry. Elec. Times, vol. 55, no. 1436, Apr. 24, 1919, pp. 259-260, 1 fig. Report of chief electrical engineer to Minister of Public Works.

Niagara Falls. Niagara Falls a War-Load Center. Elec. World, vol. 73, no. 20 May 17, 1919, pp. 996-1000, 4 figs. How electrochemical and electro-metallurgical loads were helped by interconnection of power.

Norway. Utilization of Water-Power in Norway (Statens forhold til vandkraften). Teknisk Ukeblad, vol. 66, no. 11, Mar. 14, 1919, pp. 156-160. For domestic heating, lighting and power purposes in place of imported coal. Comparison of costs.

Pacific Coast. Pacific Coast Plants Fully Loaded. Elec. World, vol. 73, no. 20, May 17, 1919, pp. 1031-1037, 12 figs. Interconnection of system is claimed to have enabled Western companies to carry increased loads despite lack of hydro-electric development.

Southern States. How the South Handled War-Time Loads, Elec. World, vol. 73, no. 20, May 17, 1919, pp. 1022-1030, 12 figs. Extensions and interconnections of transmission lines, particularly installation of reserve steam plant by Alabama Power Co.

Tennessee. The Larger Undeveloped Water-Powers of Tennessee, J. A. Switzer. State of Tenn. Geol. Survey, bul. 20, 1918, 35 pp. 36 figs. Description of existing plants and scheme for the utilization of available energy. Paper presented before Am. Electrochemical Soc.

United States. The Question of Hydro-Electric Development, D. H. Colcord. Elec. Eng., vol. 53, no. 2, Feb. 1919, pp. 59-63, 4 figs. Estimate of undeveloped resources in the U. S. A. is considered as 60,000,000 hp. Economic and other causes affecting development in various sections are mentioned.

POWER PLANTS

Boiler Efficiency. Graphic Calculation of Boiler Efficiency, Ralph E. Turner. Power Plant Eng., vol. 23, no. 10, May 15, 1919, pp. 450-451. 4 figs. Chart for calculating combined boiler and furnace efficiency when feed water is measured in cubic feet or pounds.

Boiler Room, Air Supply for. The Air Supply to Boiler Rooms, Richard W. Allen. Tran. Inst. Marine Engrs., vol. 30, no. 241, Mar. 1919, pp. 347-387, 38 figs. Report of investigation conducted in various vessels where closed stokehole systems had been adopted.

Boiler Supports. Reinforced Concrete Supports for Horizontal Tubular Boilers, H. E. Dart. Locomotive, Hartford Steam Boiler Inspection & Insurance Co., vol. 32, no. 5, Jan. 1919, pp. 130-142. 4 figs. Reinforced concrete is preferred for supporting suspended boilers because it is said that all of the material used (including reinforcing rods, lumber for forms, cement, sand. stone and water) are much more easily obtainable than structural-steel shapes and cast-iron columns and there is no delay in waiting for any of them to be fabricated.

Condensers. Notes on Surface Condensing Plants, with Special Reference to the Requirements of Large Power Stations, R. J. Kaula. Eng. & Indus. Management, vol. 1, no. 2, Apr. 24, 1919, pp. 342-346, 4 figs.. also Elecn., vol. 82, no. 17, Apr. 25, 1919, pp. 488-490, 3 figs., and Engineering, vol. 107, no. 2781, Apr. 18, 1919, pp. 522-524, 5 figs. Deals with problem of tube erosion. Advantage to be derived on siphonic circulating-water system by adopting parallel-flow principle. Paper presented before Instn. Elec. Engrs.

Hotel Plants. Plant of the Hotel Traymore. Power, vol. 49, no. 20, May 20, 1919, pp. 760-762, 5 figs. Plant comprises six 200-hp. water-tube boilers in three batteries. Building is heating with exhaust steam.
Electric and Elevator Equipment of the Hotel Pennsylvania, Chas. E. Knox. Power, vol. 49, no. 19, May 13, 1919, pp. 708-712, 8 figs. After studying possible methods of supply it was agreed upon to purchase steam and electricity from Pennsylvania R.R. and to install only a single engine-driven 500-kw. electric generator to be run during winter months, exhaust being used for heating and hot-water supply.

Oil-Fuel Plants. Economy of Arizona Power Plants Using Oil Fuel, C. R. Weymouth. Mech. Eng., vol. 41, no. 6, June 1919, pp. 523-526, 3 figs. Tables and curves of operating characteristics of three plants, embodying various similar features, but differing in methods of condensing, are presented. Paper for Spring Meeting of A. S. M. E.

Plants. Power Installation at the Old Hickory Powder Plant near Nashville, Tennessee. Power, vol. 49, no. 20, May 20, 1919, pp. 748-755, 8 figs. Equipment includes sixty-eight 823-hp. boilers, fifty-two 350 hp. engines, 17500-kw. in turbo-generators and 13 ammonia compressors driven by uniflow engine.
Power Plant Installation of the Braden Copper Co. at Rio Pangal, Chile (Instalacion de fuerza motriz para la Brandon Copper Co. en Rio Pangal, Chile), H. L. Cooper. Ingenieria Internacional, vol. 1, no. 2, May 1919, pp. 77-80, 5 figs. Details of hydroelectric plant with special reference to conduits.

Prime-Mover Plants. Tendencies in Prime-Mover Practice. Elec. World, vol. 73, no. 21, May 24, 1919, pp. 1106-1109, 4 figs. Advises that continuous service be safeguarded as steam turbines of great size are adapted.

PULVERIZED-COAL PLANT. Equipment for Using Pulverized Coal. Can. Mfr., vol. 39, no. 5, May 1919, pp. 40-42. Features of distributing system and waste-heat boilers at plant of Armstrong, Whitworth Co. of Canada, Ltd., at Longueuil. P.Q.

STEEL-MILL PLANTS. Steel-Mill Electric Drive—Present Status and Recent Developments, Brent Wiley. Elec. Rev., vol. 74, no. 19, May 10, 1919, pp. 737-740, 6 figs. One of noteworthy features of recent practice described is selection of large-size turbine units and a more liberal policy to provide for general plant electrification; this is approved on the ground that water rate for large-size turbines is materially better than for size of units formerly selected for mill use.

SUPERHEATERS. Superheaters at Collieries, Edward Ingham. Colliery Guardian vol. 117, no. 3045, May 9, 1919, pp. 1084-1085. In order to avoid unnecessary blowing off, writer believes superheater safety valve, which he recommends as a safety measure, should be loaded to pressure a few pounds in excess of that to which boiler safety valve is loaded.

TURBO GENERATORS. A Big Turbine-Generator Equipment, J. P. Rigsby, Elec. Eng., vol. 53, no. 4, Apr. 1919, pp. 156-159, 1 fig. Westinghouse cross-compound double unit, 45,000 kw. type, installed in power station of Narragansett Electric Light Co., Providence, R. I.

Sixty-Thousand-Kw. Turbine Installation, W. S. Finlay. Elec. Jl., vol. 16, no. 5, May 1919, pp. 172-182, 24 figs. Features specially proposed in design of scheme were concentration of auxiliary equipment and piping to provide ready access to machinery, valves, etc., placing auxiliaries within reach of cranes to facilitate dismantling and overhauling during off-peak hours, and avoiding right-and left-hand arrangements in auxiliary units in order to reduce necessary stock of spare parts.

POWER TRANSMISSION

BELTING. Relative Efficiency of Different Kinds of Belting, E. W. Bowman. Wood-Worker, vol. 38, no. 3, May 1919, p. 40, 1 fig. Chart of horsepower slip-curves obtained from comparative tests.

MOTOR LOCATION. Effective Transmission Most Essential to Economy, J. H. Rodgers. Power House, vol. 12. no. 6, May 5, 1919, pp. 147-154, 18 figs. Location of motor drive about midway of shaft length claimed to minimize shaft torque.

PRODUCER GAS

GAS PRODUCERS. Practical Operation of Gas Producers, J. S. M'Climon. Blast Furnace & Steel Plant, vol. 7, no. 5, May 1919, pp. 230-233, 4 figs. Methods of measuring fire. Generating of hot and cold gas; steam requirements. Purpose of article is to offer method for systematizing operating conditions in ordinary plant.

PUMPS

CORROSIVE LIQUORS, PUMPING. Pumping Corrosive Liquors. Engineering Review, vol. 32, no. 10, Apr. 15, 1919, pp. 296-297, 2 figs. Pumps made of "ceratherm." This material is an earthenware composition said to be insensible to sudden changes of temperature.

HYDRAULIC PUMPS. Steel Works Machinery. Engineering, vol. 107, no. 2783, May 2, 1919, pp. 567-569, 5 figs. Typical battery of hydraulic pumps. Features taken up are driving motor, working pressure, single-reduction gear with double helical machine-cut teeth, valve chambers and pump barrels of forged steel with renewable bronze valves and seats arranged for quick removal. (To be continued.)

REFRIGERATION

ETHYL AND METHYL CHLORIDE. Properties of Ethyl and Methyl Chlorides, Charles H. Herter. Refrig. World, vol. 54, no. 5, May 1919, pp. 11-14 and 27-28. Attention is called to possibilities of methyl chloride as refrigerating agent.

ICE PLANTS. Deterioration of Ice Plants, Fred Ophuls. Refrig. World, vol. 54, no. 5, May 1919, pp. 21-22. Advises giving attention to repairs immediately defects are known as means to prevent rapid deterioration.

The Toronto Plant of the Wm. Davies Co., W. F. Sutherland. Power House, vol. 12, no. 5, Apr. 25, 1919, pp. 111-113, 7 figs. Ice plant.

INSULATION, COLD-STORAGE. Cold Storage Insulation: Government Research. Cold Storage & Produce Rev., vol. 22, no. 253, Apr. 17, 1919, pp. 85-86, 1 fig. Report of tests at Nat. Physical Laboratory conducted by immersing large coil of piping in insulating material under test, and obtaining heat transmitted from the observed rise of temperature of the brine stream.

RESEARCH

BUREAU OF MINES, PITTSBURGH STATION. The New Pittsburgh Station of the Bureau of Mines—III & IV, George W. Marris. Coal Age, vol. 15, nos. 19 & 20, May 8 and 15, 1919, pp. 852-855, and 907-911, 11 figs. Analytical apparatus used in analysis of coal. Researches on combustion of coal in furnaces and absorption of heat by boiler.

INDUSTRIAL RESEARCH LABORATORIES. Industrial Physical and Mechanical Research Laboratories (Les laboratoires d'enseignement et de recherches de physique et mécanique industrielles), Jean Villey. Revue Générale des Sciences, vol.30, no. 8, Apr. 30, 1919, pp. 233-240. Scheme of co-operation between universities and industries. Its adoption expected to be important factor in developing French industry.

The Relationship between the Laboratory and the Workshop, W. R. Barclay. Metal Indus. (Land), vol. 14, no. 14, Apr. 11, 1919, pp. 306-309. Likeness of principles of operation and objects of accomplishment in laboratory and in workshops.

Co-ordination of Research in Works and Laboratories, H. R. Constantine. Elecn., vol 82, no. 16, Apr. 18, 1919, pp. 464-466. Scheme for establishing a self-supporting Board of Research. Board is to be treated in a similar way to Boards of Trade and Education. Paper before Instn. Elec. Engrs.

MUNICIPAL TESTING LABORATORIES. The Organization of a Standard Municipal Testing Laboratory, J. O. Preston. Can. Engr., vol. 36, no. 21, May 22, 1919, pp. 480-482. Installation of municipal laboratory for purpose of developing uniform standards and establishing fair basis for purchase of materials as well as securing proper usage of them.

PHOTOGRAPHY. Photography in Research, Arthur G. Eldredge. Chem. & Metallurgical Eng., vol. 20, no. 10, May 15, 1919, pp. 506-510, 14 figs. Examples of applications in industry and their considerations on opportunities of development.

TESTING EQUIPMENT—ARMOUR INST. OF TECHNOLOGY. Armour's Special Testing Equipment. Power, vol. 49, no. 18, May 6, 1919, pp. 670-679, 9 figs. Among other equipment which the Armour Inst. of Technology employs are apparatus for determining horsepower of automobile engines, influence of impact, bearing friction, belt slippage and heat flow through any material that can be prepared in flat slabs.

SPECIFICATIONS

STEEL. Specifications for Steel. Times Eng. Supp., vol. 15, no. 534, Apr. 1919, p. 130. Chemical specifications are not believed to be an expression of physical properties; it is said that much steel has been found serviceable which has been condemned on its chemical specification..

STANDARDS AND STANDARDIZATION

SULPHUR BOILING PLANT. The Standardization of the Sulphur Boiling Point, E. F. Mueller and H. A. Burgess. Jl. Am. Chem. Soc., vol. 41, no. 5, May 1919, pp. 745-763, 4 figs. Importance of sulphur boiling point as defining a standard temperature, and the necessity of obtaining further evidence upon certain questions concerning effect of experimental conditions upon the results obtained in its use, are considered.

STEAM ENGINEERING

BOILER POWER VS. TRACTIVE POWER. Boiler Power Versus Tractive Power—II, Wm. N. Allman. Boiler Maker, vol. 19, no. 5, May 1919, pp. 132-134, 2 figs. Graph showing percentage of boiler pressure for various piston speeds for both saturated and superheated steam, designed for use in calculating tractive power at any desired speed and to determine hp. (To be continued.)

TURBINES, LARGE. The Large Steam Turbine, J. F. Johnson. Jl. Engrs. Club Philadelphia, vol. 36-5,no. 174, May 1919, pp. 174-183, 7 figs. Graph indicating relative steam consumption for units of various capacities designed for equal costs per kw. hour; records of performance of large turbine units; notes on design and construction. Paper read before Phila. Section Soc. Mech. Engrs.

Three-Cylinder, 60,000-Kw. Turbine Installation, W. S. Finlay, Jr. Elec. World, vol. 73, no. 19, May 10, 1919, pp. 933-935, 4 figs. Operating details of three-element turbo-generator fitted with automatic control which enables any two elements to do the work of three in case of trouble.

Interborough Commission's 60,000-Ky Turbo-Generator Unit, W. S. Finlay. Jr. Elec. Ry. Jl., vol. 53, no. 19, May 10, 1919, pp. 906-907, 3 figs. Attention is directed particularly to automatic control features of installation.

TEXTILES

SLASHING OF COTTON WARPS. Slashing of Cotton Warps, Everett H. Hinckley. Textile World Jl., vol. 55, no. 19, May 10, 1919, pp. 61-63, 9 figs. Tests to determine influence of temperature on finer work.

SOAPS, SCOURING AND FULLING. Properties of Scouring and Fulling Soaps, F. Albert Hayes. Textile World Jl., vol. 55, no. 21, May 24, 1919, pp. 21 and 33, 4 figs. Theories as to deterrent power and photomicrographs showing structure of wood fibre.

WELDING

CRANKSHAFT WELDING. Welding Broken Crankshafts, J. H. Deppeler. Iron Age, vol. 103, no. 19, May 8, 1919, p. 1217, 2 figs. Suggestions in regard to methods of lining up broken parts for thermit process.

ELECTRIC WELDING. Electric Welding, W. H. Gard. Times Eng. Supp., vol. 15, no. 534, Apr. 1919, p. 137 Experiences in warships.

Electric Welding; Its Theory, Practice, Application and Economics. H. S. Marquand. Elecn., vol. 82, nos. 16, 17, 18 & 19. Apr. 18 & 25, May 2 & 9, 1919. pp. 468-469; 495-496; 515-517 and 541-543; 16 figs. Deals generally with Thomson process of resistance welding; describes plant used for spot welding, seam welding and butt welding; application of method to chain welding, tire and wire welding; spot-welding curves for equal thickness of sand-blasted plates and butt-welding curves for copper. (Continuation of serial.)

Electric Welding and Welding Appliances—VIII, IX, X, XI, XII. Engineer, vol. 127, nos. 3301, 3302, 3303, 3304, 3305, Apr. 4, 11, 18, 25, and May 2, 1919, pp. 319-332, 352-354, 375-378, 394-396 & 421-422, 36 figs. Resistance welders of Electric Welding Co., Holmes portable generating sets: plant consists of 4-cyl. gas engine of 28 b. hp. coupled to d. c. compound-wound dynamo having output of 250 amperes at 65 volts. Process followed by Steel Barrel Co., Ltd., in manufacture of steel drums.

The Technique of Arc Welding, F. A. Anderson. Jl. Electricity, vol. 42, no. 9, May 1, 1919, pp. 437-439, 23 figs. Methods of preparing work and detecting faults.

A Review of Some Modern Methods of Arc Welding, Thomas H. Heaton. Can. Machy., vol. 21, no. 19, May 8, 1919, pp. 463-465, 3 figs. Comparison of Benardos, Kjelberg and quasi-arc systems. (To be continued.)

Electric Welding, James Caldwell and Henry Bailey Sayers. Engineering, vol. 107, no. 2776. Mar. 14, 1919, pp. 350-351. Developments in Great Britain and U. S. A.; experiments on application of electric welding to large structures; application of electric welding in ship construction and repairs. Abstracts of papers read before Instn. Civ. Engrs.

Equipment Designed for Electric Arc. Welding—III, E. Wanamaker and H. R. Pennington. Ry. Elec. Engr., vol. 10, no. 5, May 1919, pp. 141-146, 14 figs. Types used in different systems, operating characteristics and circuits.

Electric Arc Welding for Repairing of Steel Parts (Soldadura de piezas de acero por medio del arco electrico), O. H Eschholz. Boletin de la Asociacion Argentina de Electro-Tecnicos, vol. 4, no. 12, Dec. 1918, pp. 902-905, 2 figs. Small arc and proper control of flame claimed to insure minimum oxydization of arc vapors and superficial deposits. (Concluded.)

Experiments on the Application of Electric Welding to Large Structures, Westcott Stile Abell. Steamship, vol. 30, no. 359. May 1919, p. 257. Account of experiments carried out on behalf of Lloyd's Register of Shipping. in order to determine possibility of application of electric arc welding to ship construction. Paper read before Instn. Civil Engrs.

Electric Welding and Its Applications. Walter Leonard Lorkin. Tramway & Ry. World, vol. 45, no. 18, Apr 10. 1919, pp. 197-200, 9 figs. Endeavors to show that process is simple, that it can be carried out with ordinary labor and that the welds are efficient and effected at small cost. Paper read before Roy. Soc. Arts.

GAS TORCHES. Modern Welding and Cutting—XII, Ethan Viall. Am. Mach., vol. 50, no 21, May 22, 1919, pp. 977-983, 21 figs. Description of various make of gas torches.

INSPECTION OF WELDS. Inspection of Metallic Electrode Arc Welds. Elec. Traction vol. 15, no. 5, May 1919, pp. 330-334, 7 figs. Graphs indicating approximate arc current and electrode diameter for welding steel plates of various thicknesses, also variation in weld strength with change in arc current.

OXY-ACETYLENE WELDING. Oxy-Acetylene Apparatus and Its Accomplishments in the M. C. T. Reconstruction Camp in France, George N Sieger. Welding Engr., vol. 4, no 5, May 1919, pp. 19-23, 7 figs. Personnel of welding shop. Installation of compression plant.

Safety Rules for Oxy-Acetylene Welding. Boiler Maker, vol. 19, no. 5, May 1919, pp. 134 and 136. Adopted by Western Pa. Div. of Nat. Safety Council.

Modern Welding and Cutting—X, Ethan Viall. Am. Mach., vol. 50, no. 18, May 1, 1919, pp. 833-838, 7 figs. Details regarding acetylene in cylinders and description of positive-pressure type of generator.

SHEET AND TUBE WELDING (SEE THIN PLATES). Autogenous Welding at Albuquerque, H. Louis Hahn. Ry. Mech. Engr., vol. 93, no. 5, May 1919. pp. 271-272 7 figs. Repairing burned or cracked sheets and tubes by gas or electric welding; welding of flue beads.

STEEL CASTINGS. The Welding of Steel Castings, J. F. Springer, Ry. & Locomotive Engr., vol. 32, no. 5, May 1919, pp 142-143, 1 fig. Effect of carbon percentage in behavior of casting when being welded.

TESTING WELDS. A Review of Some Modern Methods of Arc Welding, Thomas H. Heaton. Can. Machy., vol. 21. no. 20, May 15, 1919, pp. 490-492, 9 figs. Application of petroleum is considered a good test of a weld because of its penetrating quality.

THIN PLATES. The Gas Welding of Thin Plates—II, J. F. Springer. Ry. Mech Engr., vol. 93, no. 5, May 1919, pp. 268-271, 2 figs. Requirements of thin work with and without use of rods; behavior of various metals.

WOOD

CREOSOTE TREATMENT. Creosote Treatment of Car Timbers. Ry. Mech. Engr., vol. 93, no. 5, May 1919, pp. 255-257, 3 figs. Methods used by Marsh Refrigerator Service Co. Cost of work and estimates of increased life.

FOREST CONSERVATION. A Program of Forest Conservation for the South, J. G. Peters Jl. Forestry, Soc. Am. Foresters, vol. 17, no. 4. Apr 1919, pp. 364-370. Argues that since states and Federal Government disposed to Southern lands to such an extent as to make it impossible for the small population of these states to develop adequately and use the land, the states and the Federal Government have contracted obligation in the matter at least until owners can be expected to handle land properly. Paper read before Soc. Am. Foresters, Washington Section.

TASMANIAN HARDWOOD. Use of Tasmanian Hardwood in Holland (Eene toepassing van Tasmanisch hardhut), S. Van Ravensteijn. De Ingenieur, vol. 34, no. 11, Mar 15, 1919, pp. 197-200, 4 figs. Bluegum wood has been used for 380 yd. of quays at Dordrecht, and while it has not yet proved its durability, it is not expected that it will equal that of oak.

TIMBER ESTIMATING. A Formula Method for Estimating Timber, E. I. Terry. Jl Forestry. Soc. Am. Foresters, vol. 17, no. 4, Apr. 1919, pp. 413-422, 1 fig. Worked out by using merchantable form factor and ratio between average cubic and boardfoot contents of trees of each diameter class.

VARIA

EDUCATION OF ENGINEERS. Education and Training of the Engineer, A. P. M. Fleming. Tran. Inst. Mar. Engrs., vol. 31, no. 242, Apr. 1919, pp. 2-11 and (discussion), pp. 12-21. Considers as a matter of primary concern that a rigid selection be made among the larger supply of youths applying for entry into the engineering profession of only those boys who appear to have mental, moral and physical capacity for availing themselves to the utmost of the course of training provided.

ENGINEERING SCHOOL LABORATORIES. Mechanical, Physical and Chemical Laboratory of the Engineering School of Lausanne University (Le laboratoire d'essais mécaniques, physiques et chimiques de l'école de l'Université à Lausanne). Bulletin Technique de la Suisse Romande, vol. 45, no. 8, Apr. 19, 1919, pp. 70-74, 8 figs. Description of 50-ton oil press.

GLASS VESSEL MARKING. The Permanent Marking of Glass Vessels, Joseph C. Bock. Chem. News, vol. 118, no. 3077, Apr. 4, 1919, pp. 161-162. Proposes the use of glass color fused in the glass by means of ordinary burner. From Jl. Am. Chem. Soc.

PERPETUAL-MOTION MACHINES. Perpetual Motion Machines. B. F. Jakobsen. Jl. Electricity, vol. 42, no. 9, May 1, 1919, pp. 426-427, 6 figs. Absurdity implied in their conception.

TELESCOPE, 72-IN. CANADIAN. The Dominion of Canada's 72-In. Telescope, J. S. Plaskett. Nature, vol. 103, no. 2580, Apr. 10, 1919. pp. 105-108, 3 figs. Reflecting type; article deals with optical parts, on work being done and proposed to be done with the instrument.

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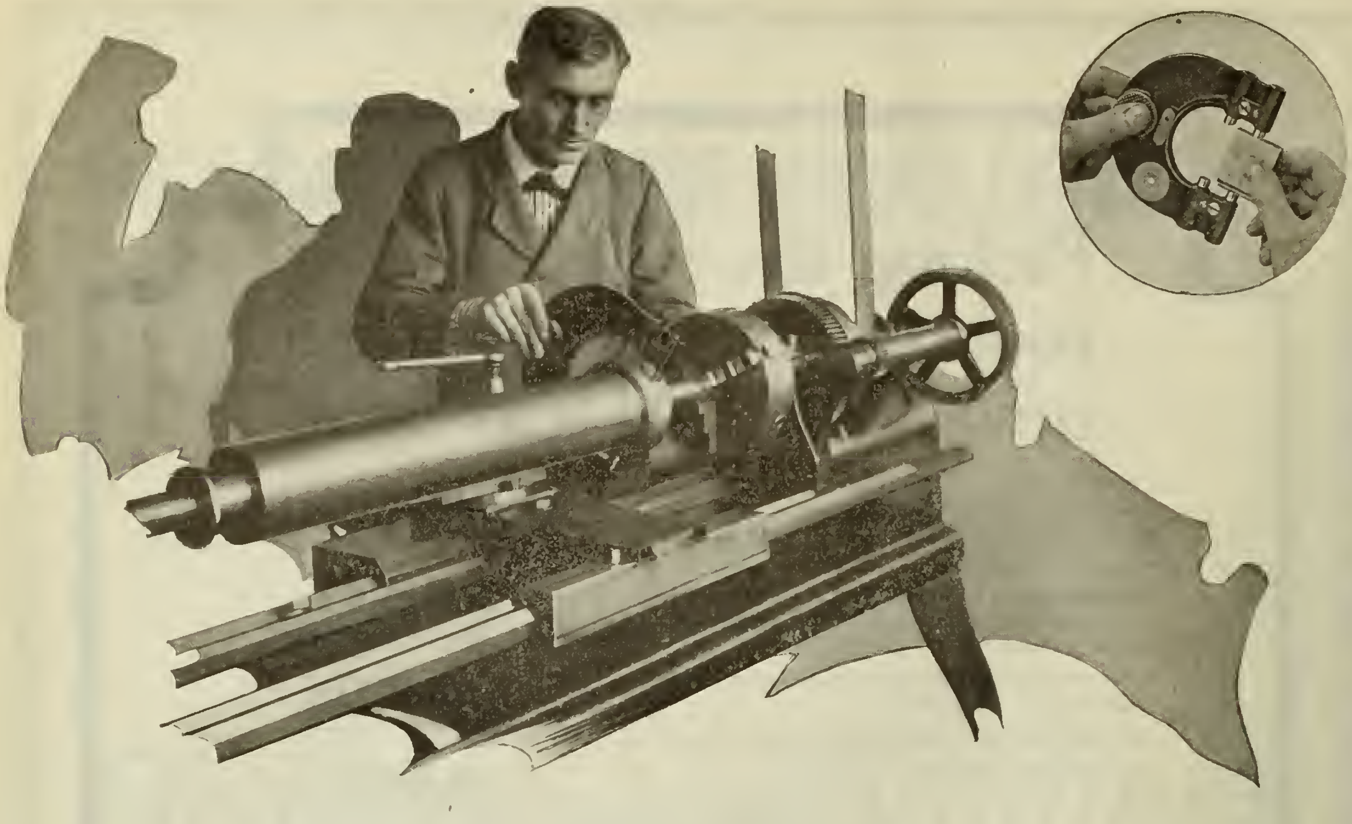


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The Operation of Railways as an Engineering Problem*

By V. I. Smart, M.E.I.C.

In writing this paper I do not wish in any way to belittle the work done by the men who have recruited, almost exclusively, the forces of the Transportation Department. For energy, loyalty to duty, and resourcefullness under most trying circumstances they stand second to none. But I do feel that the Canadian Railways have suffered by not utilizing the services of the trained engineers, who are already in their employ, in connection with the problems which come up in the actual movement of trains. An engineer is fitted by his training to solve these problems in the movement of traffic, which the man who has come up through the train service, the dispatching service, or the clerical staff is not as well qualified to do. To a great extent these men are influenced by what their predecessors have done, and their training has not tended to produce as a general thing an analytical mind. It is only fair, however, to say that men running a high speed machine, like a railway, whose whole attention is concentrated on the necessity of keeping it moving, very often have not the time or opportunity to thoroughly consider ways and means, and often continue to use methods which have been introduced as expedients and which have apparently been satisfactory but which are far from being the most efficient that could be devised, if more consideration had been given, and deductions made from more complete data. I only hope to be able to indicate some of the questions which could be investigated by the engineer with advantage to the train operation. I make no pretense of covering the field but hope to be able to show that the movement of trains is distinctly an engineering problem.

The commodity which a railway has to sell is transportation, or the moving of passengers and freight from one place to another. The possibility of increasing the volume of this commodity is dependent on being able to tie together the greatest number of localities, and transport the most diverse classification of goods at a minimum cost per ton mile. The means employed are: first, the permanent way on which the traffic is moved; second, the vehicles in which it is moved; and third, the locomotive which moves it.

Railway operating expenses are divided into five grand divisions, each of which are again subdivided into numerous sub-heads. The grand divisions are Maintenance of Way, Maintenance of Equipment, Conducting Transportation, Traffic and General. The proportional charges to each of these are about as follows:—

Maintenance of Way	20%
Maintenance of Equipment	20%
Conducting Transportation	52%
Traffic	5%
General	3%

*Read by the author before the Montreal Branch, on April 3rd, 1919.

The design, maintenance and, to some extent, the operation of the cars and locomotives is under the direction and control of the Maintenance of Equipment Department, a department employing engineers. The construction and care of the permanent-way is also under the control of an engineering department. The actual use of these several means of producing transportation, which involves over half the operating expenditures, has been generally considered, in Canada, as outside the purview of the engineer. What I wish to point out in this paper is that the actual use of the means of transportation is just as much an engineering problem as is the design, construction and care of the means of transportation, and that the railways are the losers in not utilizing, in the Transportation Department, the men from these two recognized engineering departments. I feel strongly that a leaven from the engineers would add materially to the efficiency of the train operation and give to the engineer an objective, for which to work, that he at present does not have.

The definition of an engineer is—"one who applies the principles of science to economic use," and his training is such as to cause him to build up only after he has analyzed a problem sufficiently to be sure of his foundations. When he meets a new question, his first instinct is to resolve it into its elements and, having determined the principles involved, builds up his structure to produce an economic result. The problem which confronts the transportation man is the movement of a maximum tonnage with the minimum number of cars and engines, in a minimum of time, with maximum use of permanent-way, at a minimum cost per ton mile. It can hardly be expected that in a paper of this kind a complete analysis can be made of the above problem, but the following will give some idea of its nature.

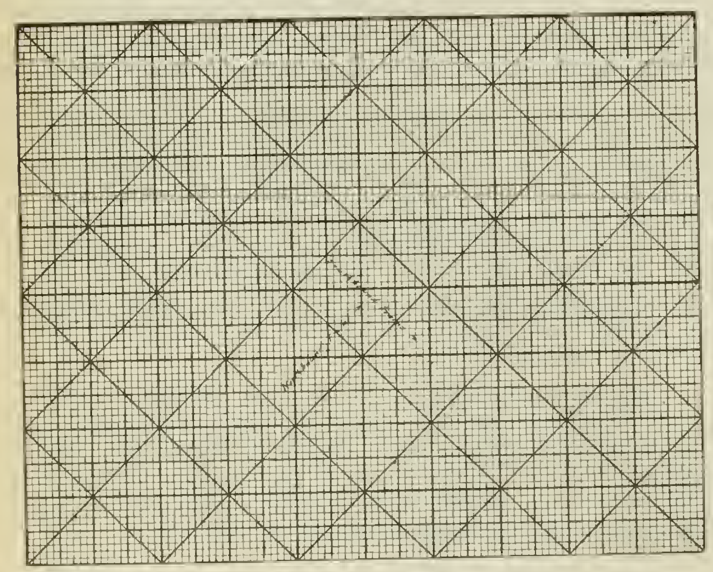


Diagram 1.—Passing tracks equally spaced as to time of running between them, for trains of one class. The leaving times between trains in one direction is the round trip time interval between any two passing tracks.

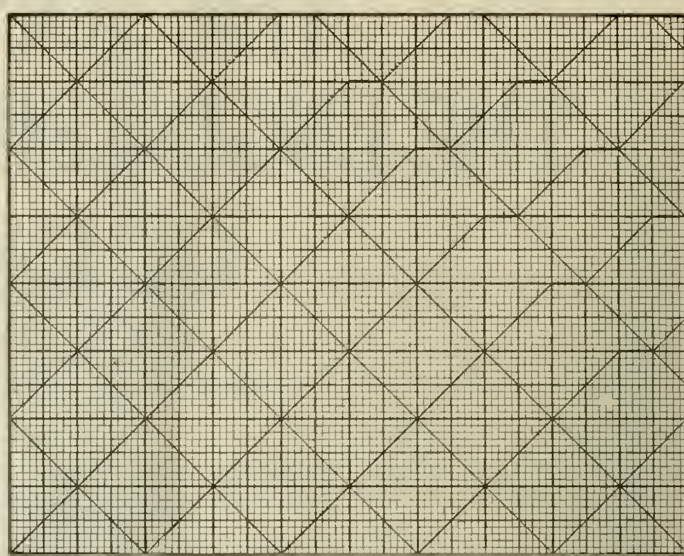


Diagram 2.—Indicates the delay to inferior direction trains, if trains are dispatched from terminals at greater intervals than the round trip time interval. All passing tracks being equally spaced.

Minimum cost per mile.

- Maximum tonnage..
  - Ruling grade.
  - Train loading.
  - Density.
- Minimum number of cars.............
  - Routing.
  - L.C.L. loading.
  - Car capacity.
  - Car movement.
  - Car service.
  - Demurrage.
  - Fast freight sy.
  - Car loading.
  - Yard facilities.
  - Car distribution.
- Minimum number of engines..........
  - Engine rating.
  - Engine distribution.
  - Engine crews.
  - Terminal delay.
  - Running time.
  - Round house service.
  - Repairs.
  - Density.
- Minimum time.....
  - Schedules.
  - Passing facilities.
  - Dispatching.
  - Coal and water.
  - Yard capacity.
  - Pass. train interference.
  - Freedom from wrecks.
  - Standard code.
  - Average grades.
- Maximum use of permanent-way per unit of time.
  - Single track.
  - Water tanks.
  - Passing tracks.
  - Yards and terminals.
  - Double track.
  - Additional tracks.

As part of the cost of operation is the fixed charges, it is essential that these be kept to a minimum. Expenditures for equipment and facilities, which are not being used to their maximum, is a serious economic waste. It becomes important, therefore, that, before, such expenditures are made for additions, the greatest efficiency has been obtained from the capital already invested. The most expensive improvement, and one which I think has been made in a great many cases without sufficient investigation, is the building of a second main track. Very often double track has been built because the superintendent was having difficulty in getting the trains over the division, and he concluded that if he had a double track these difficulties would disappear; whereas, the real difficulty was insufficient passing facilities, badly spaced passing tracks, badly located water facilities, or insufficient yard capacity. There is nothing in a double track to create new traffic. It gives a road added potentiality to move traffic if the traffic exists but, unlike branch lines into new territory, it does not necessarily bring new traffic to the line. It is therefore possible, or indeed quite probable, that the traffic which would pay the charges on the cost of the single track will not now meet the charges for the double track. It is important then that the maximum capacity be secured from the single track, and any improvements to increase this, which cost less than the second main track, should first be undertaken. There is the question of increased safety which is so often brought up as a justification, but with a modern block signal method of operation this claim loses its strength.

In operation, time is the essence of the contract. The rate of the ruling grade has the most direct effect on the tonnage which a given locomotive can haul, but in the actual operation it becomes necessary to determine the

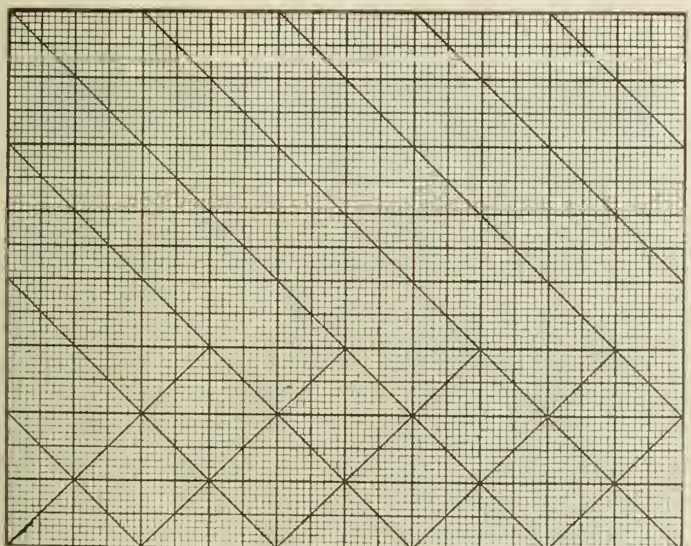


Diagram 3.—Indicates the impossibility of getting inferior direction trains over the road if the leaving times are based on anything but the maximum spaced passing tracks, where the passing tracks are not equally spaced.

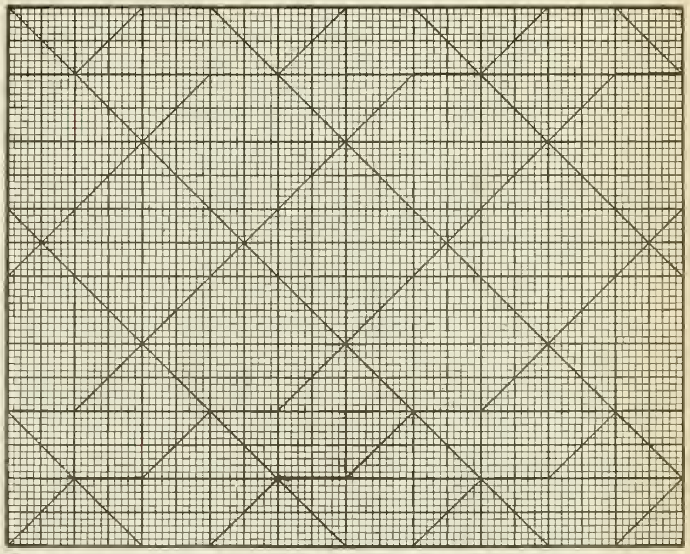


Diagram 4.—Indicates that with unequally spaced passing tracks, the leaving interval must be equal to the round trip time interval of the maximum spaced passing tracks.

speed which will produce a maximum ton mileage at a minimum ton mile cost. This involves a consideration of:—

Speed.
Weight of train.
Ton miles per trip.
Running time between terminals.
Actual time.
Average speed.
Cost of coal, water, lubricants, supplies, repairs and renewals per trip.
Pay of enginemen per trip.
Cost of handling per trip.
Interest allowance per trip.
Cost of train supplies, car repairs per trip.
Pay of trainmen per trip.
Cost of movement per trip.
Cost per ton mile.
Ton miles per month.

The density tends to modify the running time between terminals; therefore, the average speed affects the cost per ton mile and the ton miles per month.

As capital charges are part of the cost of moving the traffic, the fewer the number of cars necessary to handle a given business the lower the capital charges, and this depends on getting a maximum use, under revenue producing load, of the cars. The total loaded car mileage in Canada, in 1917, was 1,402,552,028, and the empty car mileage was 561,127.885. The total number of freight cars was 203,499, and therefore each car moved 6892 miles loaded and 2757 miles empty in the year, or about 20 miles per day loaded and 8 miles per day empty. At an average rate of 10 miles an hour loaded, the freight cars average earning time for the year would be about 30 days, or not quite 8½% of its time in revenue service.

The average capacity of all freight cars in Canada has increased, since 1907, 23%, and the average loading per car has increased 45%, while the ratio of load to capacity has increased only 11%. The net result of the above would seem to be that 5.6% of the earning capacity of the freight cars is obtained. This seems to be very low and would justify some investigation. The question also arises as to whether the increase in capacity of cars is justified when the average capacity has increased 23% and the load to capacity only 11%.

Capital charges are also affected by the number of locomotives needed to handle a given traffic. Summarizing the number of revenue freight locomotive miles of the Canadian railways for 1917, 3490 freight locomotives made 71,610,535 freight locomotive miles which is an average of 56 miles per day. This looks like a very small use of the individual locomotive and has a direct relation to the number of locomotives required to move the tonnage. From a series of reports on one of the American western lines, a study has been made of the average daily performance of locomotives with the following results:—

Roundhouse	6 hours 49 minutes	28.40%		
Running repairs	2 " 41 "	11.18%		
Class repairs	3 " 27 "	14.38%		
Total mechanical dept.			12 hours 57 minutes	53.96%
Terminal delay			4 " 2 "	16.80%
Actual running	4 " 16 "	17.28%		
Lost time between terminals	2 " 45 "	11.96%		
Total time between terminals.			7 " 1 "	29.24%
			24 hours 0 minutes	100%

A locomotive is therefore in the hands of the Mechanical Department, being made ready to move traffic, 12 hours 57 minutes or 53.96%; in the hands of the Transportation Department, ready to move traffic, 6 hours 47 minutes, or 28.3%; and actually moving traffic, therefore earning revenue, 4 hours 16 minutes, or 17.28%. At an average speed of 10 m.p.h. between terminals this would be equivalent to 71 miles per day. The time between terminals would be 7 hours 01 minute, which is 421 minutes, therefore, for every 421 minutes saved on the trains over the division one engine is saved, or the equivalent of one engine. The number of engines necessary to handle a given tonnage on a division in 24 hours would be, when:—

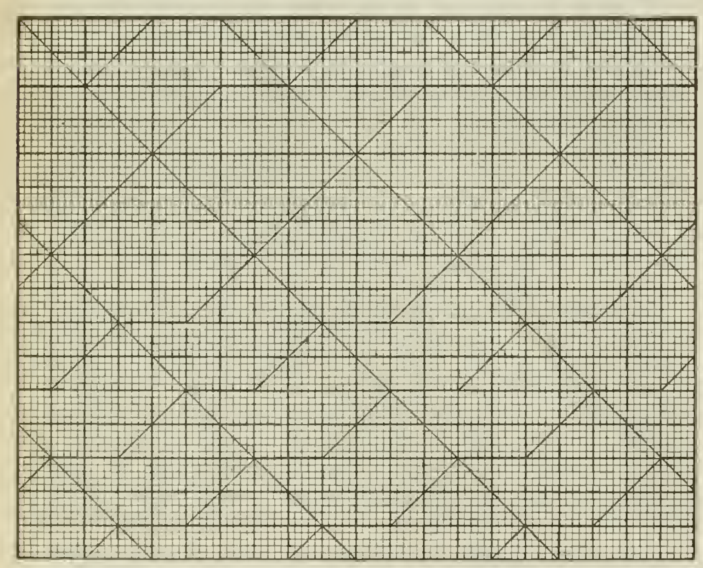


Diagram 5.—Indicates the delay at certain passing tracks due to unequal spacing of passing tracks, and is twice the difference between the maximum spacing and any other spacing.

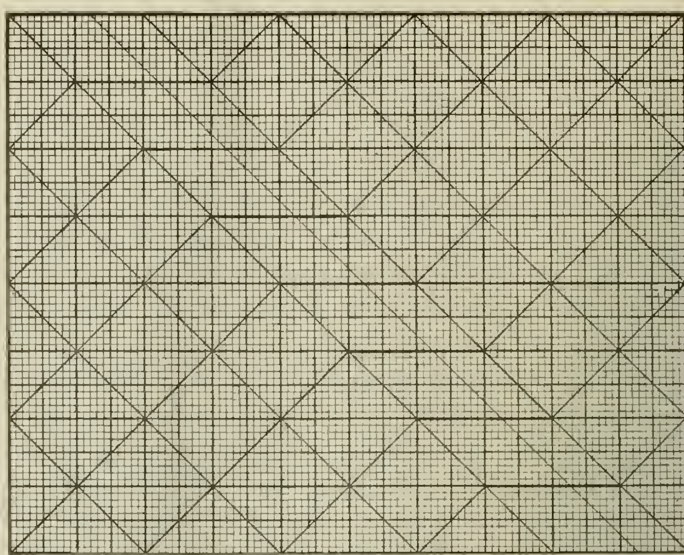


Diagram 6.—The effect of introducing a train into the schedule with less leaving interval than that determined by the passing track spacing.

$T = E.G.$ tons to be moved.
L = Length of division in miles.
E = Number of engines.
R = Average tonnage rating of available engines.
A = Average speed between terminals in m.p.h.

$$E = \frac{T \times L}{7.16 \times A \times R}$$

The delays which add to the total time of a train over a division may be tabulated under the following heads:—

Waiting at terminal for engine.
Waiting at terminal for crews.
Other terminal delays.
Defective roadway.
Defective equipment.
Engine not steaming.
Engine leaking.
Other engine failures.
Waiting for orders.
Meeting and passing trains.
Station work.
Taking coal and water.
Overloaded train.
Waiting for connections.
Miscellaneous.

In making up the schedules for trains, there are certain fundamental principles which cannot be overlooked. There is a distinct relation, on single track, between the schedule and the location of passing tracks, coaling plants, water tanks, yard capacity, and passenger train interference. Diagrams, Nos. 1 to 7, in which the abscissae indicate time, the ordinates represent distance between passing tracks in time of running, the diagonals represent the movement of trains in the two directions on single track, and heavy horizontal lines represent location of passing track, illustrate the relation between schedules and the number and location of the passing tracks, and from these we can lay down the following general principles:—

1. That the minimum time interval between freight trains leaving a terminal is equal to the maximum round trip time interval between two passing tracks.

2. That the maximum number of trains of the same class over a single track division in one direction is equal to 1440 divided by the maximum round trip time interval between passing tracks.

3. That with maximum capacity the delay to trains in the inferior direction at each passing track, other than at each end of the maximum round trip time interval, will be equal to twice the difference between the maximum round trip time interval and the round trip time interval between the passing tracks at which the delay occurs.

4. That passenger trains will have the effect of reducing the number of freight trains.

If L = Leaving time interval between trains from a terminal.

R = Round-trip time interval between maximum spaced passing tracks.

N = Number of trains.

Rl = Round-trip time interval at any other than the maximum spaced passing track.

D = Delay of inferior direction trains.

Then $L=R$

$$N=2\times\frac{1440}{R}$$

$$D=2\ (R-Rl)$$

R in the formulæ will be the sum of the eastbound time and the westbound time, plus the amount of time necessary to head into and head out of a passing track. Letting A represent this latter allowance, then

$$R=E+W+A.$$

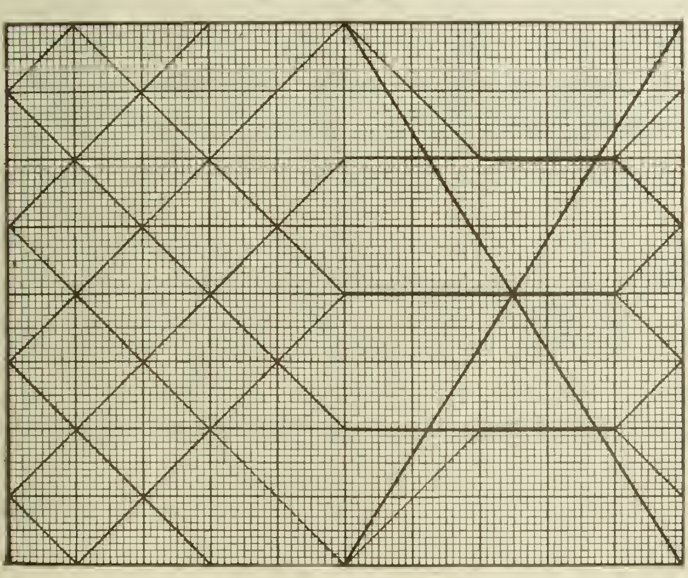


Diagram 7.—The effect of introducing high speed trains into the freight movement, passing tracks equally spaced, and freight train interval based on the passing track spacing.

Table of Running Time Between Sidings for Freight and Passenger Trains

Station	Freight			Passenger		
	East-bound	West-bound	Total	East	West	Total
"A".......						
"B".......	18	25	43	11	12	23
"C".......	15	20	35	7	10	17
"D" (Water)	15	18*	33	12	9	21
"E".......	25	16	41	11	7	18
"F" (Water)	25	15	40	11	12	23
"G".......	20*	22	42	12	12	24
"H".......	15	12	27	7	5	12
"I"........	20	15	35	10	9	19
"J"........	20	10	30	13	7	20
"K" (Water)	20	12	32	11	11	22
"L"........	20	30	50	10	15	25
"M".......	10	11	21	4	4	8
"N".......	15	10	25	6	6	12
"O".......	15	6	21	6	4	10
"P".......	25	16	41	15	9	24
"Q".......	15	10	25	7	8	15

It will be seen that the maximum round-trip time interval between passing tracks occurs between "K" and "L", and is 50 minutes for freight trains, allowing 10 minutes for heading in and heading out. The maximum possible number of trains of one class which could be run over the division would be,

$$N=2880\div 60=48\text{ trains,}$$

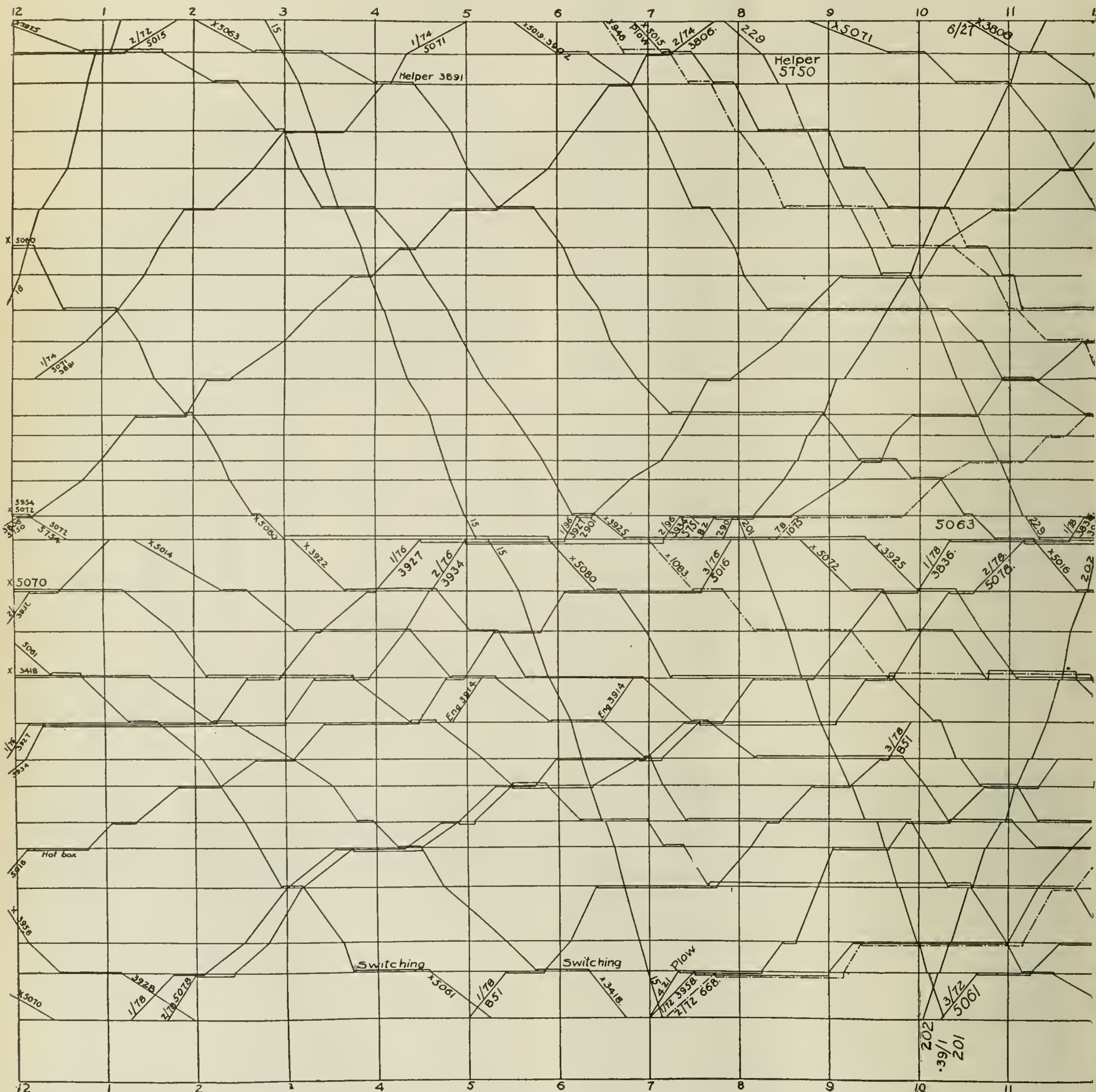
and the leaving times between trains in one direction would be

$$L=60\text{ minutes.}$$

There are, however, 10 passenger trains running on this division which would cause a reduction in the number of freight trains, which could be operated, as follows, where t is equal to the number of freight trains eliminated:–

$$t=\frac{(2+e+w+c+a)}{R}.\ C$$

In this formula e = eastbound running time of the passenger train between "K" and "L," w = westbound running time,


12
1
2
3
4
5
6
7
8
9
10
11
Helper 3891
Helper
5750
229
x5071
x5063
2/72
5015
1/74
5071
5063
x5014
x3922
1/76
3927
2/76
3934
x5080
3/76
5016
x5072
x3925
1/78
3836
2/78
5076
x5016
x5070
Hot box
Eng 3914
Switching
x5061
1/78
851
x3418
Plow
3/78
851
3/72
5061
202
201

Chart

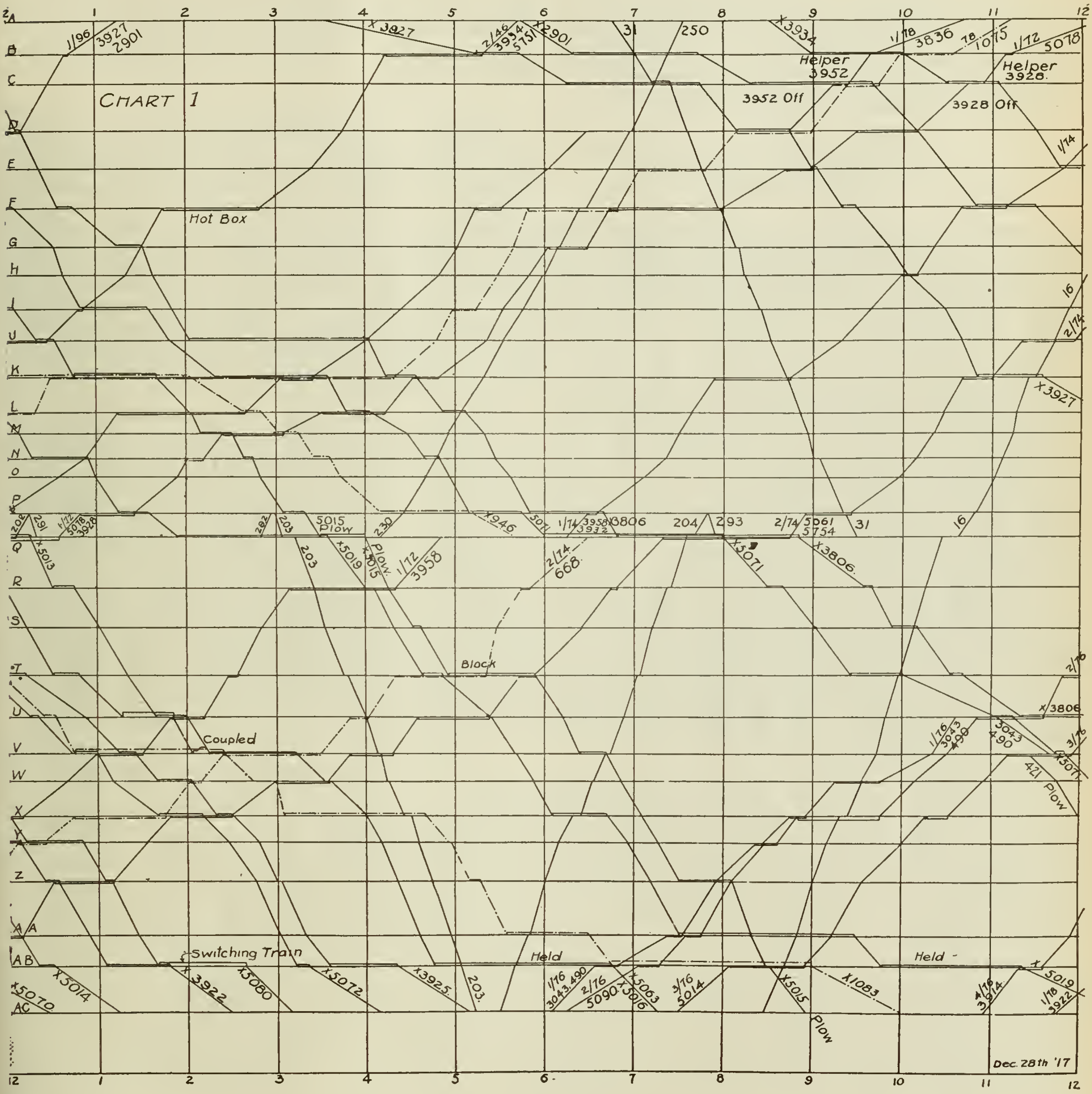


CHART 1
Hot Box
Helper 3952
3952 Off
Helper 3928
3928 Off
Block
Coupled
Switching Train
Held
Plow
Dec. 28th '17

No. 1

c = clearance allowance of freight trains over passenger trains, a = time heading in and out of passing track, and C = coefficient depending on the relative schedule of the passenger trains, in this case the value of the coefficient is 0.5. I have assumed a value of 5 minutes as clearance and 10 minutes for heading in and out of passing tracks.

The number of trains eliminated would be,

$$t = \frac{2+(10+15+5+10)}{60} \times .5 = 1.33$$

$$1.33 \times 10 = 13.3 \text{ trains.}$$

This would reduce the number of freight trains over the division to 34.7 trains. By putting in a passing track between "K" and "L," the running time between "A" and "B" would become the controlling element and the number of trains would then be 41, an increase of 20% in the number of trains, due to the addition of one passing track.

The location of the water tanks may modify the capacity materially. In the case of the division cited above, there is a water tank located east of the passing track switch on the main track, at "D," and westbound trains at this station will occupy the main track between "C" and "D" while they are taking water. At "F" there is also a tank similarly situated, except that it is west of the passing track, and eastbound trains taking water would occupy the main track between "F" and "G." The result of this would be, allowing 10 minutes for a train to take water, to increase the westbound time between "C" and "D" 10 minutes, and the eastbound time between "C" and "D" 10 minutes; thus making the round trip time interval R = 52 minutes, so that, in this case, the location of the water tanks becomes the controlling factor.

In a similar manner the effect on the train schedule of other elements may be determined, such as stops for "31" orders, way freight train movement, length and arrangement of passing tracks, terminal yard facilities, adverse grades, helper engines, &c.

It is quite true that we cannot get in practice the results obtained by a calculation based on certain known elements, but we are able to say that no better result than the calculated one can be obtained in practice, and also what are the most important controlling factors, and the percentage value of their modification. From the ratio of actual results to calculated results, we can arrive at an efficiency ratio which will allow a comparison of the operations on different divisions.

Generally it may be laid down as an axiom that no more trains can be operated over a division in a given time than can be operated through the throat of the division, whatever constitutes that throat. It may be the length of time necessary to operate between two passing tracks, or it may be the location of a water tank which requires a stop between passing tracks. It may be that the terminal yard, at one or both ends of the division, is too small to accommodate the arriving trains. Any, or all, of these may be affecting the operation detrimentally, and it is only after an investigation of all of them that economic remedies can be undertaken.

In order to illustrate in a concrete form one of the directions in which the engineer's services might be profitably employed in the Transportation Department, I quote part of a report made in connection with the investigation of an engine division of an American road. Difficulty was being experienced in operating and an investigation was made. The results of the investigation were partly as follows:—

The study was made of the operation on the 28th of December, 1916, which represented a fair average condition for the month. During December on this division, there was made, eastbound, 45,260,068 ton miles, and, westbound, 24,117,555 ton miles; or an average per day of 1,460,002 ton miles eastbound and 777,985 ton miles westbound. The actual ton miles for December 28th were 1,046,634 ton miles eastbound and 1,020,020 westbound. The actual performance was under the average eastbound, and over the average westbound, and slightly below the average for the total ton miles hauled, the average being 2,237,087, as against the actual haulage on December 28th, of 2,066,654. This day was the nearest to the average for the month and was therefore taken as a basis for investigation.

Chart No. 1 was then plotted from the despatcher's train sheet of December 28th, illustrating the movement of the trains on this date. There are, in all, shown on the chart, 17 freight trains each way, one way-freight train each way, one plow extra from "A" to "AC", one plow extra from "AC" to "V," and three passenger trains each way. The actual movement, for the day, of freight trains is equivalent to six freight trains between "A" and "Q" each way, and ten freight trains between "AC" and "Q" each way, trains of the 27th lapping over to the 28th, and trains of the 28th lapping over to the 29th. From this chart it is seen that at "Q" and "AB" there was serious delay, and also that the delays between "Q" and "AC" were greatly in excess of the delays between "Q" and "A." From the conductors' delay reports and wheel reports, the causes for these delays were determined and tabulated.

A table was then made showing the train, engine number, arriving and departing time, time consumed, and the delay. It also shows the number of orders issued to each train, the time during the 28th that each train was on the road, the train miles made by each train, and the cars handled by each train. It will be seen from the table that westbound trains consumed a total of 309 hours 20 min. between terminals, and of this 158 hours 20 minutes was on account of delay, or 52% of the time was non-productive. Eastbound trains consumed 277 hours 30 minutes between terminals, of which 135 hours 7 minutes or 47%, was non-productive. It will also be seen that the time during the 28th consumed by westbound trains was 190 hours and that the mileage made in the time was 1204.74 miles, or an average speed of 6.39 miles an hour, and for the eastbound trains 149 hours 10 minutes with a mileage of 962.79, or an average speed of 6.45 miles an hour. As the overtime for engine and train crews would be measured by the difference between the speed on which the rates are based, or 12.5 miles an hour, and the actual average speed, or 6 41 miles an hour, the overtime for each of the crews would be 6.09 miles per hour, or 48%.

The time allowance on the timetable for freight trains and the actual time made were as follows:—

Westbound

Time-table

"A" to "Q" 6 hrs. 10 min. "Q" to "AC" 3 hrs. 30 min.

Actual time taken

"A" to "Q" 8 hrs. 31 min. "Q" to "AC" 9 hrs. 33 min.

Eastbound

Time-table

"A" to "Q" 6 hrs. 35 min. "Q" to "AC" 4 hrs. 0 min.

Actual time taken

"A" to "Q" 9 hrs. 42 min. "Q" to "AC" 8 hrs. 16 min.

Differences

Westbound

"A" to "Q" 2 hrs. 21 min. "Q" to "AC" 6 hrs. 03 min.

Eastbound

"A" to "Q" 3 hrs. 07 min. "Q" to "AC" 4 hrs. 16 min.

WESTBOUND

Train	Engine	Helper	"A" Leave	"Q" Arrive	"Q" Leave	"AC" Arrive	Time "A" to "Q"	Delay at "Q"	Time "Q" to "AC"	Total Time Between Term.	Total Delay	Orders Issued 31	Orders Issued 19	Cars Moved	Time on 28th	Train Miles on 28th	Cars Handled: Leave "A"	Cars Handled: Arrive "Q"	Cars Handled: Leave "Q"	Cars Handled: Arrive "AC"	From Chart No. 2: Time on 28th	From Chart No. 2: Train Miles on 28th
Extra	3958	H1 DF 2901	*3-30a*	*1-25p*	*4-30p*	2-00a	9-55	3-05	9-30	22-30	11-49	......		15 33	2-00	9.99	0 33	0 30	15 30	10 29	2-00	9.99
"	5061	5951	*10-00a*	*6-30p*	*11-45p*	5-15a	8-30	4-15	6-30	19-15	9-07		3	24 9	5-15	44.74	24 9	24 9	18 4	1 1	5-05	44.74
"	5070	3952	*11-05a*	*7-30p*	*11-35p*	12-25a	8-30	4-05	12-50	25-25	15-21	2	6	18 28	12-25	56.26	8 25	8 24	18 28	18 28	7-25	56.26
"	3418	"G" to "DR" 3914	......	......	*7-55p*	6-45a	......	......	12-50	12-50	4-28		3	24 25	6-45	44.74	......	......	24 25	0 2	6-27	44.74
"	5014	"HI" "H O" 3932	*1-45p*	*11-30p*	1-20a	1-15p	9-45	1-50	11-55	23-30	11-35	2	4	15 33	13-05	63.10	2 31	2 31	15 33	13 33	7-50	63.10
"	5080	"H1" to "H O" 5752	*8-40p*	3-00a	5-55a	3-10p	6-20	2-55	9-15	18-30	10-34	2	7	22 20	15-10	101.40	12 15	12 15	8 15	22 20	11-18	101.40
"	5072	"H1" "H O" 5754	*5-15p*	12-35a	8-40a	4-10p	7-20	8-05	7-30	22-55	13-55	1	4	22 20	16-10	66.16	13 20	13 20	22 20	22 20	14-52	66.16
"	3925	"H1" "H O" 3897	*11-50p*	6-45a	9-25	5-10p	6-55	2-30	7-45	16-10	7-37	3	5	7 29	17-10	127.18	4 29	4 29	7 29	1 2	16-18	127.18
"	5063	3895	2-00a	10-50a	12-15p	7-15p	8-50	1-25	7-00	17-15	9-03	2	6	9 16	17-15	131.60	9 15	9 16	3 16	9 10	14-22	131.60
"	3922	"G" to "D R" 3914	......	......	3-05a	2-30p	......	......	11-25	11-25	6-43	1	5	25 16	11-25	63.10	......	......	25 16	24 16	6-18	63.10
"	5016	......	......	......	11-25a	7-15p	......	......	7-50	7-50	4-14	1	3	7 16	7-50	63.10	......	......	7 10	3 16	5-50	63.10
"	5019	3902	5-30a	1-55p	3-35p	*12-35a*	8-25	1-40	9-00	19-05	10-02	4	7	16 15	18-30	131.60	16 15	14 15	4 15	4 15	16-25	131.60
"	5071	......	8-45a	6-00p	8-00p	*5-50a*	9-15	2-00	9-50	21-05	8-47	2	6	10 30	15-15	100.96	3 30	3 30	10 28	10 4	14-05	131.60
"	3806	......	10-30a	6-50p	8-50p	*7-30a*	8-20	2-00	10-40	21-00	12-11	3	6	12 27	13-30	92.52	6 27	6 27	12 27	12 27	13-30	125.57
"	3927	......	3-30p	*1-35a*	*3-30a*	*1-10p*	10-05	1-55	9-40	21-40	9-27	3	4	9 30	8-30	52.09	2 29	2 29	9 30	9 30	8-30	68.50
"	2901	......	5-45p	*2-40a*	......	......	8-55	......	......	8-55	3-45	2	3	5 8	6-15	30.20	5 28	5 28	9 30	9 30	6-15	65.44
"	3934	......	8-30p	*4-55a*	*7-10a*	*4-30p*	8-25	2-15	9-20	20-00	9-42	1	1	20 11	3-30	25.00	19 6	18 6	20 11	20 11	3-30	38.31
......	......	......	......	......	......	......	......	38-00	......	......												
										309-20	158-20	29	73		190-00	1204.74					160-00	1332.39

Delay at "Q" on 28th. 20-55 Average 6.38 M.P.H. between terminals. Average 8.32 M.P.H.

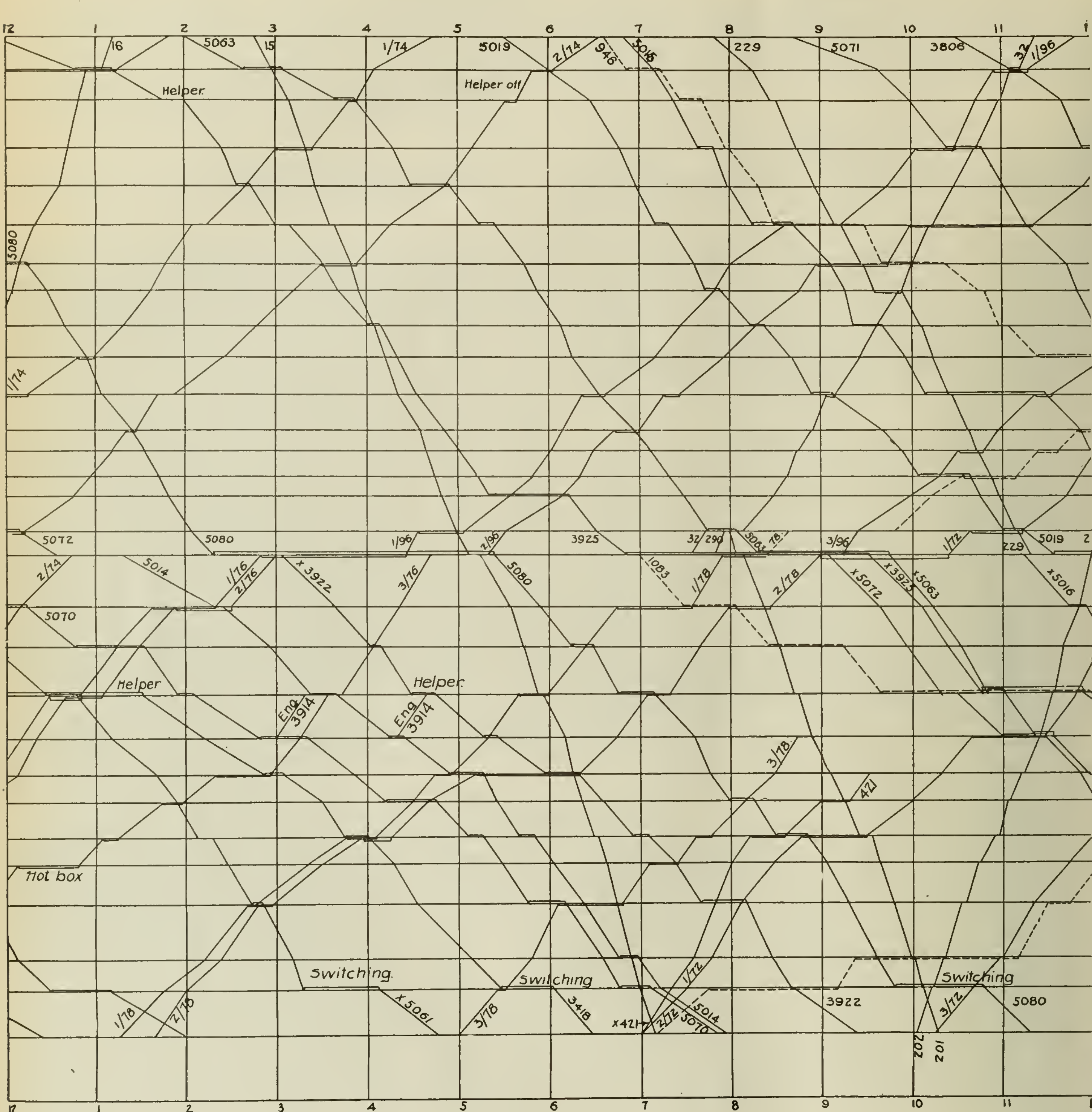
EASTBOUND

Train	Engine	Helper	"AC" Leave	"Q" Arrive	"Q" Leave	"A" Arrive	Time "AC" to "Q"	Delay at "Q"	Time "Q" to "A"	Total Time	Total Delay	Orders Issued 31	Orders Issued 19	Cars Moved	Time on 28th	Train Miles on 28th	Cars Handled: Ar. "A"	Cars Handled: Lv. "Q"	Cars Handled: Ar. "Q"	Cars Handled: Lv. "AC"	From Chart No. 2: Time on 28th	From Chart No. 2: Train Miles on 28th
1/72	5015	3897	*6-55a*	*2-55p*	*5-25p*	1-50a	8-00	2-30	8-25	18-55	9-40	....		36 1	1-50	4.42	35 2	36 1	29 4	28 2	1-50	4.42
1/74	3891	5071	*8-00a*	*5-50p*	*8-45p*	5-00a	9-50	2-55	8-15	21-00	11-59	....		34 2	5-00	47.38	34 1	34 2	36 1	33 1	4-45	47.38
2/74	3806	5750	*1-05p*	*7-10p*	*11-40p*	7-45a	6-05	4-30	8-05	18-40	8-29	....		39 2	7-45	65.44	39 2	39 2	27 2	28 1	6-35	65.44
1/76	3927	2901	*7-30p*	4-30a	6-05a	1-15p	9-00	1-35	7-10	17-45	7-44	9	1	33 1	13-15	92.52	30 1	30 1	33 1	28 1	11-53	92.52
2/76	3934	5751	*8-45p*	5-00a	7-10a	5-45p	8-15	2-10	10-35	21-00	10-26	6	2	30 1	17-45	97.37	30 1	30 1	19 1	18 1	13-15	97.37
3/76	5016	......	*10-05p*	7-55a	......	......	9-50	......	......	9-50	5-23	2	1	27 1	7-55	40.61			27 1	19 1	4-42	40.61
2/74	3922	......	*4-05p*	1-05a	......	......	7-55	......	......	7-55	3-43	....		27 1	1-05	6.84	......	......	27 1	19 1	-45	6.84
1/78	3836	3952	1-15a	10-20a	11-40a	10-45	9-05	1-20	11-05	21-30	9-66	9	2	36 1	21-30	131.60	36 1	36 1	28 1	28 1	15-25	131.60
1/76	3043	490	6-05p	11-35p	......	......	5-30D	r.	......	5-30	1-08	8		......	5-30	24.02	......	......	21 1	23 1	4-22	24.02
3/78	851	......	5-00a	9-55a	......	......	4-55 D	r.	......	4-55	2-23	3	1	......	4-55	24.02	......	......	17 1	17 1	3-45	24.02
2/78	3928	5078	1-40a	11-10a	12-35p	*12-20a*	9-30	1-25	11-45	22-40	10-40	4		31 1	22-20	128.60	31 1	31 1	26 1	26 1	15-45	131.60
1/72	3958	3932	7-00a	4-50p	6-15p	*10-50a*	9-50	1-25	16-35	27-50	16-05	26	6	30 1	15-00	116.75	30 1	30 1	30 1	21 1	11-43	128.60
3/72	5061	5751	10-15a	7-20p	8-45p	*6-30a*	9-05	1-25	9-45	20-15	10-34	6	1	42 1	13-45	89.20	40 1	40 1	42 1	39 1	13-45	116.75
2/76	5070	......	6-15p	*1-05a*	*2-50*	*11-45*	6-50	1-45	8-55	17-30	8-06	2		31 1	5-45	44.74	31 1	31 1	29 1	24 1	5-45	51.08
3/76	5014	......	7-30p	*2-15*	*6-15*	*3-10*	6-45	4-00	8-55	19-40	10-14	4		27 1	4-30	34.23	26 2	26 2	27 1	21 1	4-30	44.74
4/76	3914	5080	10-55p	*4-40a*	......	......	5-45	......	......	5-45	1-24	3		24 1	1-05	9.99	......	......	24 1	24 1	1-05	17.22
1/78	3922	5750	11-45p	*8-05a*	*9-35a*	*4-35p*	8-20	1-30	7-00	16-50	7-03	1		25 1	-15	6.06	28 2	28 2	25 1	21 1	-15	6.06
								26-30		277-30	135-07	83	14		149-10	963.79					120-05	1030.27

Delay at "Q" on 28th = 9-20 Average 6.45 M.P.H. between terminals. Average 8.58 M.P.H.

N.B.—Italic portions indicate movement on the 27th and 29th.

Table No. 1


12
1
2
3
4
5
6
7
8
9
10
11
1
16
5063
15
1/74
5019
2/74
946
229
5071
3806
32
1/96
Helper
Helper off
5080
1/74
5072
5080
1/96
2/96
3925
32/290
3/96
1/72
229
5019
2/74
5014
1/76
2/76
x 3922
3/76
5080
1083
1/78
2/78
x 5072
x 3925
x 5063
x 5016
5070
Helper
Helper
Eng 3914
Eng 3914
3/78
421
Hot box
Switching
Switching
Switching
x 5061
3/78
3418
x 421
2/72
5070
5014
1/72
3922
3/72
5080
1/78
2/10
202
201

Chart

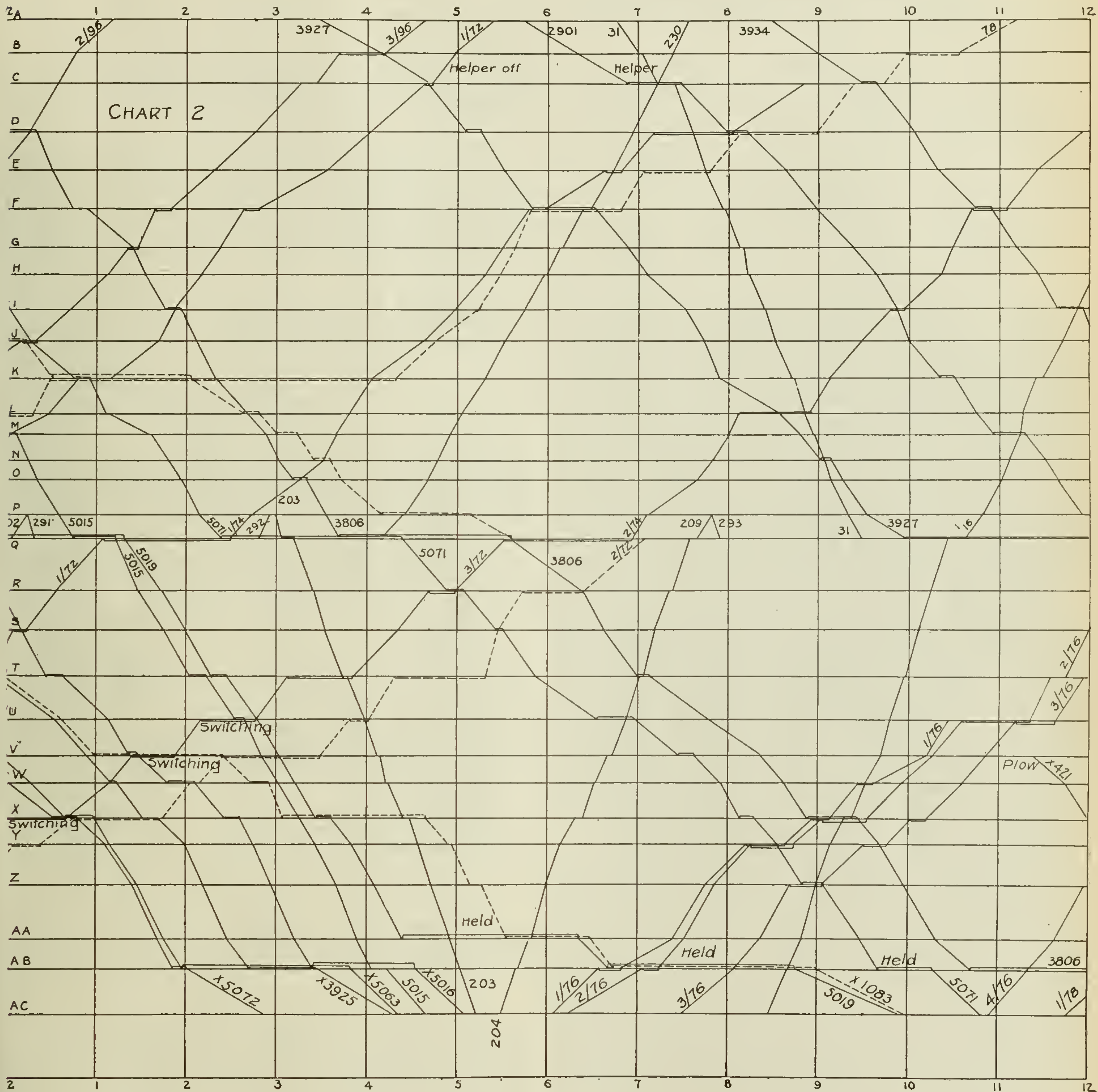


CHART 2
Helper off
Helper
Switching
Switching
Switching
Held
Held
Held
Plow
3927
2901
3934
5015
5071
3806
203
204
209
293
31
3927
5019
x5072
x3925
x5063
5015
x5016
x1083
5019
5071
3806

No. 2

Our attention is immediately attracted to the very serious discrepancy between the timetable allowance and the actual performance of trains. Referring to the wheel reports we find the following:—

	Pick up	Set out
	Westbound	
"A" – "Q"	0	6
"AC" – "Q"	24	150
	24	156
	Eastbound	
"A" – "Q"	1	2
"AC" – "Q"	56	3
	57	5

Out of 14 trains shown on the chart, westbound, between "A" and "Q", 4 trains picked up or set off cars, and 10 out of 17 trains between "AC" and "Q" picked up or set out cars. Out of 12 trains eastbound between "A" and "Q," 2 trains picked up or set out cars, and between "AC" and "Q" out of 17 trains 11 picked up or set out cars. This is evidently one of the reasons for the great difference in the times. A pick-up engine to handle this work and relieve the through trains would be justified; as the time lost by the trains due to this setting out between "AC" and "Q" amounted to 14 hours 3 minutes or 843 minutes; and, as the value of an engine in minutes is 421, an engine could be put on this service and still leave a balance in its favor equal to the value of an engine.

The delays at "AB," it was found, were due to inability to get into the yard at "AC". A tabulation of the cars handled in and out of this yard disclosed the fact that whenever the total cars exceeded 500 in the day this delay at "AB" occurred. The average delay per day at "AB" was found to be 4 hours 20 minutes, therefore, if this delay could be eliminated, there would be 4 hours 20 minutes of engine time which could be used to make additional earnings. The net earning capacity of this time on this division was found to be $31.50 per day or $9450.00 per annum, which, capitalized at 5%, would amount to $189,000.00 with which to make the improvements.

Chart II is drawn up to show the operation of the trains of December 28th under the Block System. The running time for the trains between stations is exactly the same as made by these trains on the 28th, all stops for switching, break-down of equipment, and delay getting into "AB" yard, are unchanged. The gain in the time over the division and the increase in train miles, is due to the elimination of time lost in the use of "31" orders and making "meets." The passenger trains and way-freights have been put on Chart II, the same as Chart I, it being assumed that the station delay of way-freights was due to necessary station work, which the Block method would in no way affect. The results obtained from Chart II are tabulated in the last two columns of Table I. The total saving in time as between Chart I and Chart II was:— westbound, 21 hours 54 minutes, and eastbound, 29 hours 5 minutes, or a total of 50 hours 59 minutes. With the Signal method the average speed has been increased to 8.45 miles an hour, so that the overtime would now be 4.05 miles, or a reduction of 33%.

It is seen from Table I that there were 112 orders issued on the "/31" form. If we allow an average of 10 minutes for the time necessary to deliver a "31" order to a train, and this seems to be the ordinary allowance made by despatchers, we would have an average per train of 17 min. westbound, and 48 minutes eastbound. Under the Block method the "31" order can be dispensed with: several of the U. S. roads have discontinued their use.

The saving in time of 50 hours 59 minutes should relieve 7.1 road engines. The average results obtained from engines, over a period, is 29.24% in revenue producing service between terminals, or 7.16 hours per day, therefore, 50 hours 59 minutes divided by 7.16 hrs. = 7.1 engines. If the engines cost $30,000.00, the annual charge would be:—

Interest @ 5%	$ 1,500.00
Depreciation @ 10%	3,000.00
Maintenance and Operation	10,000.00
	$14,500.00

$14,500.00 × 7.1 = $102,950.00

The overtime for the month of December averaged $187.54 per day and the saving due to a 33% reduction in the overtime would therefore be .33 × $187.54 = $61.87 per day or $18,561.00 per year.

The total saving due to the reduction of running time would therefore be:—

Engines	$102,950.00
Overtime	18,561.00
	$121,511.00

The Block system was estimated to cost $375,000 to instal; the annual charges would therefore be:—

Interest	$22,500.00
Depreciation, 7%	26,250.00
Maintenance and Operation	18,750.00
	$67,500.00

Therefore the net saving would be $121,511.00 less $67,500.00, or $54,011.00: this saving capitalized at 5% = $1,080,220.00

Is it not fair to conclude that the services of the engineer in the Transportation Department would be a decided advantage to all concerned; and that methods of increasing the loading of cars and engines, the saving of lost time on the road, the prevention of capital expenditures before they are strictly necessary, and the general increase in efficiency in means and methods, would result? It has been by the efforts of the engineering fraternity that the motive power, and the strength and safety of the permanent way has been improved. Is it then too much to say that some of this analytical reconstruction in the Transportation Department would not be beneficial?

The Resources of Western Canada*

By Doctor R. C. Wallis, Commissioner for Northern Manitoba.

You will permit me, before discussing the subject for which I am responsible, to present the greeting and good-will of the Manitoba Branch of the Canadian Mining Institute. We realize that in the constitution and aims, *The Engineering Institute* and the Mining Institute are somewhat dissimilar. We feel, however, that each serves a purpose which the other cannot well fulfill. We feel that there is every reason why there should be the most harmonious co-operation, and that co-operation, we are assured from headquarters, exists and will continue to become more real, in the future. Our local Branch of *The Institute* is relatively youthful, but is undoubtedly vigorous, and can see ahead a future of important service. In so far as it is your desire, and in so far as it is within your power, because of your constitution, to achieve a fuller recognition of the engineering profession and its value in the life of the community, you have the most unqualified support of the Mining Institute and of our local branch. While it is almost self evident that Western Canada has been moulded by the work of the engineers, it is perhaps also no less evident that full recognition will not come until engineers individually and collectively play a larger part in public life and particularly in our legislative assemblies. Unfortunately, the exigencies of the profession and the inadequate remuneration have made it almost impossible for engineers to give their time to this service. They are involved in a vicious circle from which they can extricate themselves only by the real sacrifice of some of their numbers at the altar of political service.

The subject which has been placed against my name is not of my choosing. When your secretary invited me to speak before you he also supplied the text. I protested, as best I could, that the subject was somewhat wide, and that it might be to greater advantage, as well as more to my liking, to handle a smaller corner of this immense vineyard and present to you the fruits thereof. Secretaries of programme committees are, however, somewhat strong minded, and I appear before you under protest, with regard not to myself but to my subject. After reviewing the matter I concluded that it would be unwise to deal with this subject in any great detail. There is a danger that details will overwhelm. With your permission, therefore, I shall discuss, rather, some of the more general considerations in connection with our western public domain, in the hope that some suggestions may be offered which will at least give rise to discussion, and in all probability to difference of opinion.

It may be well, at the beginning, to present a short sketch of the plan on which our western territory was built. A clear idea of the geological and topographical frame work is undoubtedly of asistance in grasping the salient features of our natural resources. On the foundation of a complex of granites, gneisses, greenstones and conglomerates, which are to-day to be seen fringing our Western Provinces, to the east and the north of Manitoba and the north of Saskatchewan and Alberta, were laid down layer by layer, in a horizontal position, first limestone and later shales and sandstones. The traveller passing westwards crosses the exposed edges of higher and still higher beds of these rocks. In the three so called prairie provinces little disturbance has taken place since these beds were laid down. The surface, it is true, has been covered with a silt or till from Glacial Lake or Glacial Sheet, and the rivers, with an easterly or northerly trend, have cut deep into the soft clay rock. Apart from the fact that the metal bearing granite complex is to be found mainly in Manitoba, the differences in the underground resources in the three provinces are due mainly to the depths of the clay rocks in the west and their shallowness and the frequent exposures of their edges in the east. To this is due the extensive coal beds of Alberta, the gas reservoirs, and the possibility of oil in that same province. The surface fertility is as much a matter of topographical features and consequent climatic conditions, as of the soil itself. The north-westerly trend of the wheat belt is due as much to the influence of the Rocky Mountains as to any peculiar virtue in the soil.

At a late geological period in the history of the building of the provinces, a pressure movement set in from the west. There resulted folding and breaking, and an eastward movement of fault blocks over a considerable distance. The movement closed, as is usually the case with intense volcanic activity. Thus were formed the parallel ranges of the Vancouver Coast, Gold and Rocky Mountains, the influence of volcanic action being felt more particularly in the Coast and Gold Ranges. To this activity is to be ascribed the metalliferous deposits which have made it possible for British Columbia to contribute, to so large a degree, in the output of copper, silver, lead and gold within the Empire. And, in the deep sheltered valleys which lie between the parallel mountain ranges, even after the planing down of geological ages, there is being established an important fruit growing industry.

A review of the history of our western territory will assist us to appreciate more fully the present situation and the future outlook. There is little reason to doubt that, but for the resources in fur and big game, the territory would not to-day have formed part of the British Empire. The Hudsons Bay Company confined their attention at first to the coast line of the bay, and were able to induce the Indians to travel from the inland trading grounds to their posts with the furs. The pressure of the competition of the free traders on the Saskatchewan River, later to be known as the Northwest Company, compelled the officers of the company to work towards the interior, and in a very few years the main waterways of the west were dotted with the posts of the company or its rivals. Some names deserve special mention in the story of the expansion of the west. Anthony Henry penetrated into the country of the buffalo and mounted Indians in a journey from Hudson Bay, in the middle of the 18th century. His description of what is now Central Alberta was only in part believed by the traders, but it lead to a new policy of penetration of the fastnesses of the interior.

*Read by the author before the Manitoba Branch on April 17th, 1919.

Samuel Hearne, a few years later, reached to the mouth of the Coppermine River after two unsuccessful attempts, and gave to the world the first description of a copper deposit, the value of which is even yet only imperfectly estimated. Alexander MacKenzie, the founder of the Northwest Company, reached the Arctic Sea by way of the river which bears his name, and later penetrated to the Pacific Coast, thus opening up by discovery an extent of territory such as few men can place to their credit; while David Thompson, of the Hudson's Bay Company and later of the Northwest Company, by his careful mapping, laid the foundation for the work of the topographers, surveyors and geologists of the last half century.

It is noteworthy that the earliest industry, if the fur trade be not considered in that category, was mineral development. A quarter of a century, at least, before the arrival of the Selkirk Settlers on the Red River, the freemen, or former employees of the Hudson's Bay Company who had earned their discharge, extracted salt by evaporation from the salt springs on the shores of Lake Winnipegosis and Lake Manitoba and the industry continued till transportation by rail from the east became effective. In British Columbia, the placer deposits on the Fraser and Thompson Rivers were responsible, half a century later, for the initial movement in the development of the western provinces. Since the time when immigration into the prairie territory became so pronounced, the resources of the soil have been the dominant factor in the development of the prairie provinces. Only in the last decade has the necessity of a wider industrial outlook led to the development of resources which are not strictly agricultural.

There is a certain individuality in the resources of the four western provinces which will doubtless lead to a distinctive industrial development within each area. There are some features common to Manitoba and British Columbia which the other provinces do not possess. Both have a sea frontage, though the strategic value of the Manitoba seaboard will not at any time compare in importance with that of British Columbia. The development of the water power and the fish industry will be the special care of both provinces. In neither case will more than a relatively small percentage of the total area be utilized for agricultural purposes. In both cases important cities have been established, in which the wheels of industry will turn when markets are established and raw materials are supplied at a low price. There the similarity ends. Reckoned in terms of actual production, Manitoba's wealth lies in its soil. In comparison with Saskatchewan, or even Alberta, however, Manitoba is, in terms of arable acreage, to a limited extent an agricultural province, and must look forward to the fostering of her resources if she is to hold her own. The fisheries, already valuable, will become much more important when the whitefish and salmon of Hudson Bay are available for transportation to Winnipeg and the southern markets. The Province is fortunate in the possession of immense water-power, well distributed both for Winnipeg and for future metallurgical operations in the less accessible districts of the Province. It is, however, to the mineral fields of the future that the Province must look for revenues to supplement those derived from wheat, oats, livestock and dairy products. With structural materials, building stone, cement material, gypsum and lime, Manitoba is liberally supplied, and in the precious and other metals the promise of production is good. There may be years of waiting and times of disheartenment but, if the necessary exploration and development work be done, there is little doubt that much of the reward that Ontario already enjoys will be the portion of her sister province.

Saskatchewan is *par excellence* the agricultural province, and it is indeed almost exclusively agricultural. True, there are somewhat extensive areas of lignites in the south and west which, with a successful briquetting system, will become increasingly important, not only for Saskatchewan but for the coalless province of Manitoba. But the wealth lies, and will continue to lie, in the soil. Some thirteen million acres are under cultivation. It is estimated that sixty million acres are capable of cultivation. The whole population of Canada could be maintained in the province at the present moment. When the total available acreage has been placed under cultivation, all wheat farming will have disappeared, and the live-stock industry, already developed in the park country of northern Saskatchewan, will have in a large part replaced the present method. The Province possesses valuable timber north-west of Prince Albert, while there are possibilities in the northern areas in minerals which have not yet been put to the test of systematic exploration.

In Alberta there is a greater variety of wealth. It possesses a remarkably elongated wheat belt, stretching northwards into the Peace River country, and the irrigation works, in which already thirty million dollars have been expended, have displaced the cattle ranch country towards the International Boundary Line. It would nevertheless be erroneous to consider Alberta as a strictly agricultural province. The very extensive resources of lignitic, subbituminous, bituminous and anthracite coals, estimated at somewhat over a million million tons, possess the greatest significance for Alberta's future; the more so because the supply from the United States will sooner or later be cut off from Western Canada. In the gas fields of Medicine Hat, Bow Island and Viking there are possibilities of the development of the industries which follow in the wake of this cheap fuel. Moreover, notwithstanding the comparative non-success of the Calgary and Pincher Creek venture in the search for oil, no one, who has carefully estimated the whole situation, can fail to believe that there is yet a future for Alberta as an oil country. Whether or not the centre of the industry is to be located as far north as the Peace River has yet to be demonstrated. The vast extent of the oil sands—estimated at 5½ cubic miles in volume— are an impressive memorial to the oil resources which have already been lost into the atmosphere.

British Columbia came into being as a mineral country and the mineral wealth is still dominant to-day. While in actual mineral production it cannot compete at the present time with Ontario, it possesses the three largest copper smelters in the British Empire, two of them in the hands of one company, and it is an important source of supply of lead and zinc, apart from the production of gold, on which foundation the province was actually built, and apart from its resources in coal and iron. The coal is well distributed both for industry and for trade, the deposits of coking coal in the southern interior being utilized for the copper smelters at Trail and Grand Forks, while the supplies on Vancouver Island and Queen Charlotte Islands are ideally situated for transportation. But, British Columbia does not now depend on its mineral wealth alone. The annual value of the fisheries is approximately fifteen million dollars, and, while this is mainly salmon, Prince Rupert will yet become the centre not only of an extensive halibut industry but also of an important cod and herring fishing trade. The value of the annual fruit yield is over one million dollars, and the business is only now beginning to reach the state of productivity. It has been estimated that there are three thousand million feet of merchantable timber in British Columbia; with an annual growth much greater than an annual cut. Owing to the deeply indented coast line, the timber is very well placed for water transportation.

Such are some of the distinctive features in the natural wealth of the provinces. At this time when the problem of utilization of all avenues through which wealth may be obtained is so pressing, the fact is not to be lost sight of that, if the total available acreage of wheat growing land in the west produced a crop with an acreage yield equal to that of 1915, Western Canada would practically be in a position to supply the worlds demand; that the vast fuel and power resources are almost untouched; and that it is yet impossible to state how extensive are the metallic deposits, not only of British Columbia, but of Manitoba, Northern Saskatchewan, Northwest Territories and The Yukon. To what extent will the possession of this material wealth facilitate the growth of industrial life throughout the West? It is evident that there is a desire to promote industrial development, and it is equally clear that, with the establishing of industrial life in the west, the misunderstanding between the east and west would in large measure be removed. Today the two sections face different conditions of competition; then they would face similar conditions. The chief centres of industrial development will doubtless be Winnipeg, Vancouver and Calgary; with Lethbridge and Medicine Hat strategically placed, owing to the supply of natural gas. The conditions in Winnipeg and Vancouver are very different. Winnipeg, on the main artery from the west, with the cheapest power and the most abundant water supply, is well placed to develop a variety of industries for which electricity may be used as motive power and for which cheap coal is not essential. Besides, it not an idle dream that the Saskatchewan River may yet be made navigable, and, like the Volga in Russia, be the artery of trade and traffic through a densely populated country, and carry barges laden with coal to the gates of Winnipeg. Only thus will it be possible to supply Winnipeg with the much needed coal at reasonable cost. At Vancouver, so admirably placed with regard to coal, electric power, lumber and transportation facilities, the one desideratum, from the point of view of industrial development, is an iron industry. On coal and iron, nations have risen to industrial greatness. While much energy has been spent in assembling facts with reference to the iron deposits of the coast and the feasibility of an iron smelting industry, the matter rests at present with Dr. Stansfield's conclusion that unless a new process of electric smelting can be perfected it is not possible to establish an iron industry at the Coast. To what extent the substitution of oil for coal as a motive power will affect the industrial future of Alberta and British Columbia, and to what extent the wider use of electric power will shift the balance from the larger cities to the sources of the raw materials, it is not yet possible to say. At any rate, smelteries must be established where the ore bodies are found, even though it be in the far north. This will doubtless lead to the wider use of electric power for the smelting of ores, where fossil fuel is not available. The development of electric power will, in turn, pave the way for the establishing of electro-chemical industries, such as the manufacture of fertilizers by fixation of atmospheric nitrogen, where the question of transportation facilities is relatively of secondary importance. There is no doubt, to take an illustration, that Manitoba should manufacture the fertilizers for the western plains, when such are needed, but it is not necessary, or even probable, that the industries be established in, or near, Winnipeg. For the full development of the varied resources of the west, it is, indeed, very improbable that a few industrial centres will suffice. In view of the wide distribution of water power in Manitoba and British Columbia, and of coal in the central provinces, one may safely prophesy an industrial activity in the future, widely scattered over the provinces.

Two incidents of recent occurrence have served to draw attention to the authority of the state—that is, the people—over the public domain. I refer to the withdrawal of the native copper territory of the Coppermine district from exploration, and the attempts of the Shell Transport and Trading Company to obtain exclusive rights over a large territory in northern Alberta in order to prospect for oil and to develop oil prospects. There have been many mistakes in respect to western resources in the past. A wholesale policy of alienation has led in some cases to the squandering of resources and in other cases to an attitude of refusal to develop, against which the state is helpless. It is, indeed, open to question, whether the state has a moral right to alienate at any time any source of national wealth in its capacity of trustee, not for any single generation, but, for all generations to come. The attitude of the Federal Government, in the direction of a leasehold of resources, is undoubtedly the correct one. The misfortune is that there is a divided control in Canada, and a leasehold system, in certain areas, cannot exist side by side with a freehold system in other similarly situated areas. That has recently been seen in connection with the quartz mining regulations, which place Manitoba at a decided disadvantage, in comparison with British Columbia or Ontario. Such a regulation can only be successful when it can be made applicable to the whole of Canada. It would indeed be very desirable to have a general law governing the public domain throughout Canada; and in handing over the resources to the provinces it would have been well had the Federal Government maintained this jurisdiction. The feeling is growing that the public domain is the property of the people, and that a system which makes possible the amassing of fortune out of the public domain by some, while others go empty handed, can no longer continue. The Federal Government has realized that the Coppermine deposits should be operated for the state and it will, doubtless, also realize that no company, unless directly representative of the people themselves, may obtain exclusive rights over any territory which may yet disclose its riches to the seeker in overwhelming abundance. The lesson has already been learned: there will be no need to repeat it.

When capital again becomes mobile we shall face a period of intensive development of our resources. The necessity for this policy cannot be too strongly emphasized, and a wide vision of the necessary expenditure, in transportation facilities and in equipment, must be cultivated by all thoughtful citizens. To assist development, promotion enterprises are essential. There is a danger, which none will appreciate more keenly than that profession which has to do with the development of the natural wealth and which has had occasion to observe how frequently moneys have been diverted from the development of resources for which they were obtained to the private pocket, that a strong agitation will be directed towards the removal of public safeguards, with no sufficient substitutes introduced in their place. We are facing a time when every dollar invested in developing our domain should have a chance to give a return. Is it not our duty to see that there be maintained an adequate protection for that willing army of investors, whose faith in the wealth of our country is supreme, but, whose knowledge can hardly be expected to equal their enthusiasm? If this is made the public concern of the men who possess an expert knowledge of the situation, the confidence which is in some quarters so sadly lacking will be restored; initiative in development enterprises will be supported on every side; and the west will become, what nature has planned it to be, a great manufacturing community deep-rooted in the stable resources of the soil.

Water-Powers of British Columbia

The report on the water-powers of British Columbia, which is about to be published by the Commission of Conservation, places the total estimated 24-hour horsepower of the water-powers of that province at about 3,000,000 horse-power, in round figures.

This report completes the series of water-power reports which the Commission in 1910 undertook to publish. The investigation of the water-powers of British Columbia, of which the present report is the result, was commenced in 1911 by the engineers of the Commission, as stated in the report.

Referring to the difficulties experienced in obtaining the data in the report, and to the conditions affecting water-powers in the province, the report says:—

"The season available for such reconnaissance water-power investigations as were made in British Columbia is comparatively short. One of the chief difficulties encountered is that it is almost impossible for observers to avoid over-recording in their notes the power possibilities of stream observed during high-water. Young engineers are impressed by the quantity of water coming down the rivers, and have not the advantage of having observed the same streams at their low-water stages, nor have they always the knowledge of measurements of the flow of similar streams to temper their judgment.

"The conditions affecting powers in the province are unique, and do not closely correspond to those existent in other portions of Canada. This is especially true of the mainland Pacific coast. One cannot but be impressed with the fact that coastal water-powers in British Columbia, which to the casual observer appear to be of comparatively small amount, nevertheless may, when economically and fully developed, yield several-fold the estimate of power, if appraised upon the same basis as similar streams in Eastern Canada. Glaciers, snowfields, and heavy rainfall abound, and, with many storage possibilities, constitute unique factors which contribute to enhance the values of powers. These conditions, on the other hand, emphasize the necessity of special and very careful engineering investigation and expert handling."

Power site tables giving summarized data with regard to the water-powers are given in the report, which says, in reference to these tables:—

"Owing to the topography of British Columbia and the relative small extent of territory covered by detailed topographic and hydrometric surveys, it is practically impossible to make anything like a close estimate of many of the water-power possibilities. Both the confines of the watersheds of many of the available streams and their run-off are unknown. In such cases any figure purporting to give the available amount of power is at best only an estimate indicating possibilities.

"The power tables contain summarized statistical data regarding the water-powers. It is not practicable to indicate any details of information upon which the tabular estimates are based, but all available data have been used. Effort has been made to keep on the conservative side, and totals for the province, based on the tabulated estimates, can only fairly be compared with estimates for other large territories by taking into account the conservative character of the deductions. . . . . Estimate quantities are on the basis of 24-hour horse-power 80 per cent efficiency. If comparison is made with other estimates of horse-power giving theoretical quantities, then our estimates should be increased 25 per cent."

The report gives 610,000 24-hour horse-power as the amount available on the Columbia River and its tributaries, 740,000 horse-power for the Fraser River and its tributaries, 270,000 horse-power for the Vancouver Island water-powers, 650,000 for the mainland coast and coastal islands, and 250,000 horse-power for the Mackenzie River and its tributaries. In round figures, the total estimated power, including about 400,000 horse-power not counted in the above estimates, because there are economic reasons against its development for an indefinite time, is placed at about 3,000,000 horse-power.

Quebec's Forest Expenditure

The legislature of Quebec has appropriated $100.000 for the provincial forest service and the inspection of lands for the fiscal year ending June 30, 1920; also $7,000 for the maintenance of the provincial forest nursery at Berthierville. These amounts are very materially supplemented by the expenditures on forest fire protection incurred by the Ottawa River, St. Maurice, Laurentian and Southern St. Lawrence forest protective associations, which patrol the great bulk of the licensed and privately owned timber lands in the province. The expenditures of these four associations on fire protection during the past year total $177,729.

Effects of the Halifax Explosion on the Telephone Plant and Service*

By F. A. Bowman, M.E.I.C.

The following paper is an attempt to record the effects of the explosion of the 6th of December, 1917, at Halifax, on the plant of the Maritime Telegraph & Telephone Company, Limited, and the steps that had to be taken to carry on the service. The best way to do this will be first to describe the plant as it existed in the early morning of the 6th of December; second, to note the traffic conditions and some special conditions that existed; third, the effect of the explosion on the plant; fourth, the traffic conditions that resulted from both the loss of plant and the effect of the explosion on business, relief work, etc.; and last, the measures taken to meet these new conditions and restore the plant and the service.

The telephone system of the Maritime Telegraph & Telephone Company, Limited, covers the whole length and breadth of the Province of Nova Scotia from Sydney to Yarmouth and from the Atlantic Coast to the New Brunswick Boundary, where it connects with the lines of the New Brunswick Telephone Company, and through them with the New England Telephone & Telegraph Company.

The central position of Halifax, combined with the fact of its being the chief business city of the Province, results in its being not only the principal toll centre, but also the most important switching office for connection between the northern, eastern and western lines. The northern and eastern lines meet at Truro and then follow approximately the line of the Intercolonial Railway to Bedford where they are joined by the lines from the Annapolis Valley. From this point they follow the Bedford Road into Fairview to the city limits, from which point they, at that time, followed the Lady Hammond Road, Duffus Street and Barrington Street to Jacob Street, where they went into underground cable to the old St. Paul office on Salter Street. The lines from the south-western shore came in round the head of the North West Arm and along Quinpool Road and Bell Road to Sackville Street and then by cable to the same office. One circuit along the eastern shore came in through Dartmouth, by submarine cable across the harbour, and underground cable to the St. Paul office.

The Halifax exchange consists of three office districts. The St. Paul office served the business sections and the southern and part of the western residence areas. The Lorne office on North Street served the northern and the remainder of the western areas. The Harbour office took in all of Dartmouth and was connected to Halifax by two submarine cables. These cables were each a 25-pair, No. 19 B. & S. gauge, paper insulated, lead covered cable, steel wire armoured, and about 2500 feet long. They were laid from the northern end of the dockyard straight across to the Dartmouth shore.

The plant in Halifax consisted of 8.45 miles of underground conduit containing 39.21 miles of ducts, and 40.09 miles of aerial cables, but the only part that needs to be described here is that affected by the explosion. On Barrington Street from the railway bridge, just north of the North Street railway station, to the corner of Duffus Street there was a pole line occupied jointly by the Telephone Company and the Western Union Telegraph Company. This carried the toll lines, already referred to, and a 50-pair, No. 22 B. & S. gauge, lead covered cable ran on it as far as Rector Street. Another aerial cable lead ran north on Gottingen Street as far as Duffus Street.

The St. Paul office was situated in a building on Salter Street, erected in 1892 and extended in 1904, which housed a 10 section, 28 position, No. 1 switchboard, No. 49 jack type, arranged in a horse-shoe curve. The original set of storage batteries were replaced by a new set in 1905 but these had so nearly reached the end of their life that they required constant charging and really were only used for the night loads.

The Lorne office was situated at 145 North Street on the northern side of the street and a short distance west of Agricola Street. It was an old-fashioned wooden house, two and a half stories high with pitched roof and dormer windows. The switchboard consisted of 6 sections of 2-position, No. 1 switchboard, No. 49 jack type, arranged with 2 sections in a straight line along the back wall and two sections making a turn along the east wall. The Chief Operator's desk was near the front windows.

The Harbour office was a small brick building on Water Street. Dartmouth, much too small for the purpose and equipped with a private branch exchange type of switchboard of 4 sections on the first floor, and the terminal and battery room on the ground floor. The whole equipment was of an inconvenient type and very much cramped.

On Sackville Street, in Halifax, a new and thoroughly up-to-date Central Office had been constructed, equipped with an 11 section, 33 positions, No. 1 switchboard, No. 92 jack type. It is not necessary to give any further details of this except to mention that all the windows in the two sides of the building were metal frames with wired glass. The building and equipment were complete and the latter was undergoing its final tests preparatory to being cut into service on Saturday the 8th of December. In Dartmouth a new Central Office on Wentworth Street was in course of erection but no equipment had been installed.

It will be necessary next to mention some special traffic conditions that existed at this time and which added materially to the difficulties of keeping up service. On the 2nd of December an exceedingly severe storm of wet snow and rain swept the northern shore of the Province from Amherst to New Glasgow and cut off all lines between Truro and New Glasgow. In the old St. Paul office there was absolutely not a spare line on the switchboard and the traffic had risen to 13.48 calls per line. Owing to the limited number of positions the operators were working with an average of 140 lines per position, which is over the standard for good operating under calling rate conditions at that time. In the Harbour office the conditions were equally bad.

*Read by the author before the Halifax Branch on November 14th, 1919.

This was the condition of the plant when at 9.05 A.M. on Thursday the 6th of December the *Mont Blanc* with her cargo of 5000 tons of explosives, of which 3800 was T.N.T., blew up. The joint pole line on Barrington Street from the bridge to the corner of Duffus Street was absolutely destroyed. Not a single pole was left standing and the cables and wires were torn to pieces. Up Duffus Street some poles were left but the wires were destroyed. Some poles and cable were left on Gottingen Street but the wires leading off to the cross streets all went down. In all, 8275 feet of cable, 99220 feet of twin rubber covered wires and 86668 feet of bare wire were destroyed. This cut off all telephone communication with the eastern, northern and more than half of the western part of the Province.

At the Lorne office every window was destroyed, the L was wrenched several inches away from the main building, and the roof and walls were so damaged that probably nothing but the stout old framing saved it from collapsing. The equipment was practically not injured. Simultaneously with the explosion, the switchboard leaped into light, with lamps showing lines out of order. Owing, however, to the destruction wrought in the building and the havoc created, it was some time before the board could be got at for operating purposes. When access to the board was obtained it was found that, notwithstanding some damage done to the battery cells, it was possible to carry on. Service was in operation by 1 P.M. and the operators held to their duties, although the office was not safe and was very far indeed from comfortable. The north wall had to be shored up and canvas had to be stretched beneath the ceiling to minimize, as far as possible, danger from plaster or woodwork that might fall. Picture to yourself what were the conditions in this building during the next day's blizzard.

At the St. Paul office the damage done to the building was comparatively slight, but the windows were blown to pieces and the doors wrenched off their hinges. The shape of the switchboard, which was carried around the room, apparently protected the operators as they escaped with a few small cuts, and prevented any serious injury to the equipment.

In the old Harbour office, in Dartmouth, the windows were smashed and a partition badly wrenched, but no damage occurred that endangered the building, and the injuries to the operators were slight. The two submarine cables were badly damaged but one of them continued to give service for several hours before it finally parted. They were so seriously damaged, that, when taken up and overhauled, only enough good parts were secured from the two cables to make one length and it required eight splices to do this.

The new building on Sackville Street escaped wonderfully. The metal window frames were bent and broken but the wired glass did not fly seriously.

We will now consider the special conditions that resulted from the explosion. Strangely enough the Lorne office, aside from the destruction of the building and the difficulty of protecting the employees and equipment from the inclemency of the weather, presented no very special conditions. About two-thirds of the lines connected to it were put out of operation, but this was more than made up, as far as operating was concerned, by the rush of traffic. The storage batteries were in good condition, were not seriously injured and, fortunately, had just been charged, so that they were able to carry over the period during which the Power Company's lines were down.

At the St. Paul office the operators were returning to the switchboard and service was getting under way, after the explosion, when the military order came to vacate all buildings and go to open spaces, which, of course, necessitated the entire shutting down of the switchboard. The Power Company also shut down their station. It was over an hour before notice was given that all was safe and by that time the employees had scattered to see after their relatives, many of whom were dead, wounded, or missing. However, they came back one by one. The storage batteries in this office, as previously mentioned, were very old and worn, and, consequently, when it was attempted to begin operating again they had not charge enough in them to perform the work. The Power Company could not turn on the power until they received instructions from the City Electrician that it was safe to do so. Automobiles were started out in different directions to find this official, and at 1 P.M. the power was turned on and the operating began. The same condition of rush calls obtained here as in Lorne.

Conditions in the Harbour office were about the same. The batteries were all right but the heavy load soon told on them. The Power Company was serving the Town of Dartmouth from the Halifax station by a submarine cable, which was so badly injured that the service was cut off. The steps taken to recharge the batteries will be noted further on.

Turning now to the toll traffic, it will be remembered that all lines north and east, and half of those west, were cut off. Direct communication with Truro and Amherst was impossible. Points east of Truro were cut off from any service by the damage from the previous storm. The lines along the southwestern shore were all right, and a circuit to Bridgetown, which ran to Bridgewater and across country to Middleton, gave some service to the Valley, and as far as Windsor. Every known method of pushing traffic over these lines was employed.

The first effort towards restoring service was to get the operators back to work on the switchboards. A very large proportion lived, or had relatives, in the devastated area and these, naturally, had to leave for a time at least. Many went and found out the conditions at home and then came back to work. Some had to stay away to lead the search for the missing or to help the injured, but, to their eternal credit be it said, the great majority came back as soon as they could, many of them with very sad hearts. Everyone, man or woman, among the office staffs or other employees who knew anything about operating was called to the boards and somehow the service was kept up, though the traffic in the next two or three days went to 120 per cent. above the normal. A regular commissarial department was organized by the clerical staffs and the working employees were fed and housed in the Central offices. There were 165 operators on the payrolls, two of whom were killed. Their house was right in the center of the blast of destruction and they were never found. No male employee was killed or even seriously hurt. The Chief Operator at the Lorne office was badly cut, but came back to duty the next day.

The first demand for special service came from the railways. The Richmond railway yards were just a mass of debris and dead bodies, and despatching offices had to be established at Fairview, just outside the area of wreckage. Fortunately the cable lead serving Fairview, Rockingham and Bedford was far enough west to escape destruction, which permitted service to be given to the railways at these places and also enabled some of the toll lines north to be worked by connecting the toll lines at Fairview to exchange lines coming in through this cable. By this means one or two toll lines were working on the Friday evening and connection established with St. John and other outside points. O. J. Fraser, General Superintendent of the New Brunswick Telephone Company, came in on the first available train from St. John, and on Saturday, by the co-operation of his company and the New England Telephone & Telegraph Company, a composite telegraph circuit, superimposed on one of the through toll lines, was working to Boston, and the Associated Press was able to send out the first reliable reports of the disaster.

In the Harbour office in Dartmouth a serious situation developed on Friday morning. The batteries were running down and there was no means of recharging them because the Power Company's cable serving Dartmouth was cut. Fortunately a small Delco Lighting Plant, driven by a gasoline engine, was found and set up.

Up to December 16th, 338 line orders, including 135 installations for various relief committees, were handled. Special lines were placed at the City Hall for the relief committees, and were working on the evening of the day of the explosion. Four P.B.X. switchboards were installed during the first week at various relief or transportation offices. Fortunately there was on hand a new 50-pair submarine cable, and work was started at once to get this laid, to give service to Dartmouth. The succession of storms that occurred at this time caused much delay but the cable was successfully laid. On Friday the 7th work was begun erecting a new pole line on Longard Road.

This line was part of a diversion of the main toll line route on Barrington Street previously described, and was intended to carry the toll lines into the new Sackville office. Fortunately, the line had been staked out and material was on hand. Poles and wire were erected as far as North Street and the circuits connected there to spare conductors in the underground cables feeding the Lorne office. These were cross-connected on the Lorne main distributing frame to outgoing underground circuits down North Street to the corner of Barrington Street where they were connected to the undestroyed part of the lead to the St. Paul office. This was completed about December 20th.

In the description of the old St. Paul office we referred to the congestion on the switchboard and the cramped operators' quarters and terminal room space. This condition was bad enough under normal conditions, but when the struggle came to keep up service after the explosion, it was found to be impossible. The cut-over to the new office had been arranged for Saturday night, the 8th of December, so as to give an opportunity to settle down a little before the rush of the Christmas-week traffic came on. The old board was, as has been already stated, of the No. 49 jack type, whereas the new one is No. 92 jack type, which meant that even the most experienced operators would have to relearn much of their work. It is customary in the case of such a change to take the operators in groups to the new board before the cut-over and give them an opportunity to familiarize themselves with it, but owing to the delays in the installation of the new equipment it was not possible to do much of this. It was felt that, in view of the fact that many of the operators were practically homeless and all were more or less under a severe strain from what they and their relatives had suffered and the severity of the work, the best thing would be to get them into comfortable quarters, and that the doing of this would result in a quicker betterment of the service than trying to straighten matters out in the old building and then upset them again by the move later on. The move was made on Saturday night the 21st of December. The result, as was expected, was tremendous difficulties for a few days, but these were battled through and the ultimate result justified the move.

Then came the reaction. Nobly as the staff had stuck to the work in the crisis, they had sooner or later to consider themselves. Some of the operators came from the country and they went back to their homes, while others who were homeless and had relatives outside of Halifax went to them. Other operators broke down and resigned. The situation became very serious and every means had to be taken to get operators. Advertisements were put in the papers asking former operators to come back and help out and many did so. This, however, was only a temporary relief. As previously stated, the operating staff numbered 165 the day of the explosion. Eleven months later it numbered 180 but in the meantime 107 had passed through the school. Of this 107, the increase in the staff took 25; the other 82 represented changes in the original staff.

Much the same difficulty was met among the men in the maintenance staff. Here the call for military service took away a large percentage whose places had to be filled with young and inexperienced boys.

Reference has been made to the faithfullness of the employees, but this paper would not be complete without a tribute to assistance received from outside. The Northern Electric Company, who were installing the Sackville office equipment, placed their whole staff and facilities at the disposal of the Telephone Company and worked night and day on the reconstruction and emergency installation work.

O. J. Fraser, General Superintendent of the New Brunswick Telephone Company, arrived on the scene by the first available train, and by the co-operation of himself and of his company, gave great assistance. The New England Telephone & Telegraph Company sent H. A. MacCoy, one of their District Plant Superintendents, on the relief train from Boston, to do whatever he or they could. The Bell Telephone Company of Canada through their President, L. B. MacFarlane, telegraphed offers of any assistance they could give.

The employees of the Bell Telephone Company of Canada, the New Brunswick Telephone Company, the New England Telephone & Telegraph Company, the Aroostock Telephone Company, and outside districts of the Maritime Telegraph & Telephone Company poured in subscriptions for the relief of the employees bereaved and afflicted.

The Industrial Possibilities of Waterproofed Paper Products*

By Judson A. DeCew, A.M.E.I.C.

The substitution of paper products for wooden products, which is gradually taking place, is a development largely dependent upon the ability to make the paper products as strong and resistant to destructive agencies as the special product requires. Great strides have already taken place in this direction, in spite of the fact that the methods used in imparting the special properties to the paper products are yet in a relatively undeveloped state.

Owing to the increase in cost and lower quality of lumber now obtainable, there is a strong incentive to use the inferior woods and waste papers to make products that will replace the ordinary wooden products with which we are familiar. For example, pasted paper products are used extensively as boxes to replace the ordinary wooden box. Paper barrels are now made, by special machinery, by winding up and pasting a roll of paper into suitable cylindrical shapes and attaching heads to them. Paper pails are made by pressing wet pulp into a solid pail, or by winding the paper into a pail while pasting it together. Wall-board is a product which is made by pasting layers of paper together and which is used for walls, ceilings and interior finishing, in place of high grade lumber. The uses of this product will be greatly extended as soon as the methods of making it waterproof are sufficiently perfected to enable it to be used in places exposed to the weather. Pulp products are now made, in the shape of board, which are fairly water resistant and very light in weight, and these are used as insulating materials.

Waterproof papers have been used recently to a great extent in lining cases, where products are exported. One of these is made of two sheets of thin paper with a layer of pitch between them. Many papers are used either waxed or oiled, because the methods of making paper waterproof on the paper machine are not yet sufficiently well known. Waxing paper is an expensive process for the original paper takes up from 10% to 40% of wax in the process, and the strength of the product is generally reduced about 20%. Oiled paper has a limited use owing to the difficulty of keeping the oil in the paper after it is put there. This paper is used a lot in the packing industry, but its uses are limited as it is an unpleasant product.

Paper Cans

Paper packages which have been waxed after being made are very familiar to all, but such packages are unsuitable for some uses. Waxed containers are not suitable for holding greases such as butter and lard. They are also unsuitable for canning, as they cannot be heated. During the late war there was a great demand for paper cans that could be substituted for metal ones, but a paper can that would stand the heating process, to which the metal can is subject, was not produced.

*Read by the author before the Montreal Branch on April 10th, 1919.

The Engineering Features of Paper Products

The engineering features connected with the future development of paper products may be considerable, and it may be of interest to note some of the tendencies at the present time and the problems that affect their development.

During the rush period of the war, a large amount of paper wall-board and plaster-board was used in government construction for cantonments and other temporary buildings. Perhaps some of the paper-board was, at first, improperly made or improperly used, but, if disappointment occured, it does not follow that satisfactory fibre board products cannot be produced for these many purposes of construction. Pasted board has some properties that make it desirable for special conditions.

Wall-board has also been used as a substitute for lumber when made into forms for concrete, and it may be used in constructions, not only to act as ceiling but also as the bottom of a concrete floor above. At the present time, manufacturers of wall-board seem to be content to develop the markets for interior use only, although it is known that a really waterproof product can be made, as a result of improvements in the present processes. Newer developments and applications, therefore, will follow the production of a standardized product, which will withstand the influences of the weather and which can be safely used by engineers for outside construction. There are manufacturers preparing, at the present time, to produce such a material, and, as it can be made from either ground wood or old paper stock, it is evident that there will be no limit to the possible production of lumber substitutes.

Methods of Production

There are three problems to be solved if it is desired to make the pasted board entirely waterproof. First, the paper, as it comes from the paper machine, must be made thoroughly water resistant by the use of special sizing materials, which are added to the pulp in the beating engine; second, these layers of waterproof paper must be pasted together by means of a water-soluble material, which becomes insoluble on drying; and thirdly, but of less importance, the surface of the pasted board may be coated with a water resistant material. Some manufacturers do not attempt either to size the paper product or to use a waterproof binder, but depend entirely on a small amount of surface coating to retard the penetration of water, in the form of vapor. Other manufacturers do their best to waterproof the original paper product but, like all of the others, paste these layers together by means of silicate of soda, which is a strongly alkaline material, and the manner in which it is used injures the water resistance of the paper itself.

The use of surface coatings is more varied in practice but is limited in its application, owing to the fact that if waxy or oily coatings are applied to any extent then the product, when used for interior decoration, will not take the proper surface sizing before paint is applied.

Owing to the improvements in methods of waterproofing paper, by treating it before it is formed on the machine, and also the development of special organic products for pasting it together, which will become insoluble on drying, we can now safely say that the problem of making a thoroughly waterproof board has already been solved and merely awaits the application of these processes which are now perfected.

With regard to the properties of this new board product, I may say that it is possible to make it sufficiently waterproof so that it will not absorb over 20% of moisture after several hours immersion in water. This means that it will never take up sufficient water to weaken its structure so that it will fall to pieces and, consequently, will be a satisfactory substitute for lumber. We must remember, on the other hand, that lumber is easily wetted until it has doubled its weight by the absorption of water and that under these conditions it loses about 50% of its original strength. While absorbing this water it will expand considerably, and during the drying process will suffer considerable distortion. In considering the properties of paper board, therefore, we must compare it with the more or less unsatisfactory material that we commonly use, whose factors of distortion are greater than the artificial product.

Painting does not keep lumber dry any more than it will be an absolute protection for a lumber substitute. In the manufacture of a paper product, however, it is possible to incorporate waterproofing materials into the fibrous mass so that the product, when dried on the machine, is exceedingly water repellent, which property does not exist in natural woods. In the artificial product the strength factor may be less but it will be subject to less variation under normal conditions.

Waterproof Paper

There are many coming uses for a waterproof wrapping paper which is also strong and pliable in character. The greatest possibilities are in connection with the substitution for canvass and cloth. Such papers are already being made by treating specially strong paper with impregnating or coating materials. These paper products are, of course, expensive but this is due to the fact that valuable products and heavy coatings are required to make paper so that it does not take up any moisture at all. Paper which will hold water for many hours, and in this sense may be called waterproof, can be made on the paper machine and this may also be very strong and pliable in character.

A crimped paper that is waterproofed, by impregnation, and sewed into bags is very serviceable for many purposes and is already on the market in considerable quantities. A similiar paper can be made, with like waterproof qualities, by special sizing materials incorporated in the paper stock during manufacture. Such a product, however, is not yet in general use.

Summary

It is very difficult to make a paper product that will not absorb moisture and thus expand and contract to some extent. Paper and board can, without difficulty, be made so that it will resist the further penetration or absorbtion of water after its fibres have taken up a small quantity of moisture, equal to about one fifth its weight. The manufacture and use of these latter products should greatly increase as they are sufficiently waterproof for most commercial uses.

The Search for Oil in Scotland

The West Calder district of Midlothian, where the Government have authorized a syndicate to search for oil, and where boring operations have been started, contains extensive shalefields which have been worked for a long time by Young's Oil Company. The shale measures in which the bores are being put down, and on which the present oil industry depends, form part of the calciferous sandstone series of Mid and West Lothian.

This calciferous sandstone series forms two subdivisions. The upper, known as the oil shale group, is over 3,000 ft. thick, and contains in its higher parts beds of coal, usually of an inferior quality, and farther down about a dozen seams of oil shale, interstratified with sandstone, marl, limestone, shale and fireclay. The lower or cement stone group, in which no oil shales have yet been found, consists of white sandstones and shales, passing downwards into gray, green, and red shales, sandstone, etc.

Although the calciferous sandstone series is well developed in other parts of Scotland, it has not hitherto yielded any oil shale of economic importance beyond the limits of West Lothian, Mid Lothian and a small area in Fifeshire near Burntisland. Oil shale has been found in other formations, such as the coal measures and the carboniferous limestone series, and has been worked together with seams of coal and ironstone. At present none of these shales is considered workable.

Liquid petroleum or crude oil has been found in the Lothian shale field at different times—on the surface and deep underground. It was found in 1886 at the Sandhole Pit, near Broxburn. While a level was being cut through inclined strata there was a constant oozing of petroleum and brine. A well was made, and the petroleum collected at intervals for over a year, over 200 barrels being obtained in all. On analysis the oil was found to compare favourably with the crude oil obtained by destructive distillation. On another occasion, while a surface drain was being cut on the estate of Niddrie, the workers found oil capable of being filled into barrels. Then again, a dolerite sill of unknown thickness, in the cavities of which liquid petroleum and solid bitumen were found, was discovered at a depth of 16 fathoms under one of the shale seams near the Broxburn Oil Company's Albyn Works. The existence of crude oil has also been proved by bores put down in the same field. At one bore to the north of the Albyn Works the rods were found to be thickly coated with crude petroleum of semi-solid consistency.—*The Times Engineering Supplement.*

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Professional Meetings

As announced in the July *Journal*, it was found necessary, on account of conditions existing in the West, to postpone the Western Professional Meeting, planned to be held at Edmonton, July 10th, 11, and 12th, until a later date. The Western Branches are now discussing the question of a suitable date, to be ratified later by Council, and are also considering whether it might be advisable to postpone this meeting until next year. It is expected that a decision will have been reached before the September *Journal* goes to press.

In the meantime the Halifax and St. John Branches are continuing arrangements for the Professional Meeting in St. John, September 11th, 12th, and 13th, and it is anticipated that, at that time, the greatest gathering of engineers ever assembled in the East will be held.

Federal Status of Engineers

Parliamentary activities during the closing days of the last session of Parliament were the center of interest for a large number of the members of the engineering profession in Canada. It was anticipated that the Act under preparation for the past year, dealing with the reclassification of the Civil Service, would be passed, and no small amount of disappointment was expressed when it was learned that the Act had been held over until the next session. The salient features of the Act as effecting the engineering profession are outlined under a separate heading in these columns.

Considering the dissatisfaction that has been expressed over awards to engineers occupying positions of responsibility, it may be fortunate that it was not finally dealt with at the recent session. An opportunity is being given to all, who feel that sufficient consideration has not been given to the importance of their positions, to take up the question with the various heads of the departments, who in turn are being given an opportunity of laying individual cases before their Ministers. While several months will elapse before any definite action can be taken by Parliament, no time should be lost by all concerned, and, in this connection, it is felt that the great majority of the members of the engineering profession in Canada will be affected either directly or indirectly, inasmuch as the recognition of a higher standard of the engineering profession by the Federal Government will enhance the standing of all salaried engineers.

The columns of *The Journal* are open for a free and full discussion of this subject.

The Council of *The Institute* has already taken an active constructive part in assisting the Civil Service engineers, and the work of the splendid committee of the Council is universally appreciated. To enable this committee to do further effective work copies of all memoranda from individual members dealing with their own specific cases should be forwarded to the Secretary. In the meantime members of the profession employed by the Federal Government are assured that the influence of *The Institute* will be used on their behalf and the personnel of the Special Committee is ample evidence that the case is in good hands and will be followed to a satisfactory conclusion.

The Civil Service Bill

Following the Government resolution which is quoted in the July *Journal*, page 511, the Bill to amend the Civil Service Act, 1918, was introduced in the House of Commons and given its first reading on June 10th. The Bill itself is very brief, and is notable principally for the extensive powers which it gives to the Civil Service Commission.

Clause 42 of the amended Act reads in part as follows:

"(1) The classes of positions, including the several rates of compensation in the classification of the Civil Service of Canada signed by the Commission and dated the day of , one thousand nine hundred and nineteen, and submitted to Parliament, are hereby ratified and confirmed, and the Civil Service shall, as far as practicable, be classified in accordance therewith.

"(2) The Commission shall hereafter, as it may from time to time deem necessary, establish additional classes and classify therein new positions created or positions not included in any class established in the said classification and may combine, alter, or abolish existing classes. Each such class shall embrace all posi-

Members having copies of the May number of The Journal, which they do not wish to keep the reference, would confer a great favor by mailing them to the Secretary. About twenty copies are required.

tions similar in respect to the duties and responsibilities appertaining thereto and the qualifications required for the fulfilment thereof, and shall be given a classification title indicative of the character and rank of the employment.

"(3) Where the change in a position is such as in the opinion of the Commission to make it necessary to reclassify it, such position shall be abolished, and the Commission shall create a new position for such duties which shall be classified under this section."

From this it will be seen that changes, which may become necessary, can be made in the classification from time to time without the necessity for having special legislation, and the Civil Service Commission have stated that they do not consider the present classification as final or complete but will gladly receive all pertinent suggestions, either from individuals or groups, and will make such changes as are shown to be necessary.

The classification itself, and the report on it, both prepared by Arthur Young and Company of Chicago, were tabled in the House a few days after the Bill, and should be given careful study by all members of *The Institute* as they effect engineers throughout Canada.

Discussion of the Bill and Classification has been postponed until the next session of Parliament so that ample time is afforded for consideration and suggestions. The report of transmittal should first be studied as it describes the schedules for the classification of positions and the standardization of compensation, explaining their need, basis, use, and the method of their preparation. As a basis for the classification, the following principles were agreed upon:—

"(1) That the duties and responsibilities appertaining to a position should be the criteria for determining the classification of the position because these attributes constitute the fundamental characteristics that distinguish the position from other positions and because all of the purposes of classification will be served by a grouping that will bring together positions involving substantially the same duties and responsibilities.

"(2) That positions involving substantially the same duties and responsibilities call for practically the same qualifications as to education, experience, knowledge, and skill in their incumbents and that for this reason such qualification requirements, dependent as they are on the work to be performed, constitute an auxiliary basis for determining the proper classification of a given position.

"(3) That neither the degree of efficiency with which the duties of a position are being carried out by the person who may be filling it, nor the qualifications such person may possess or lack, nor the pay he may receive, nor any other fact dependent solely on his individuality, shall be considered as having any bearing on the classification of the position in question.

"(4) That the simplest practical grouping of positions should be adopted that will serve the purposes for which the classification is needed; that in conformity with this principle the unit of classification should be a group (called a "class") embracing all those positions in the service, regardless of departmental lines, that involve duties and responsibilities which are substantially the same."

Information as to the duties of an office was obtained by means of questionnaires, and organization charts were prepared to show the general arrangement into branches, divisions and sections. After all the available information regarding a position had been obtained a tentative classification was adopted for each position in the service. At this stage departmental lines were eliminated from further consideration and all classes in the various departments were grouped in general divisions on a basis of the line of work involved. After due consultation these tentative drafts were perfected and the final schedule of positions was drawn, as published. The preparation of the schedules of compensation for each position was then undertaken.

The following are the main principles on which the schedules of compensation are founded:—

"(1) That rates of compensation should be uniform for the same work.

"(2) That rates of compensation should be relatively right for different classes.

"(3) That the pay for each class of employment should be equitable, that is, fair to the employee and fair to the taxpaying public.

"(4) That the schedules of compensation should provide for an absolute minimum and an absolute maximum and intermediate rates in this range.

"(5) That the salaries proposed should not be based on the depreciated value of the dollar of the present time as measured by the abnormally high costs of the necessities of life that have developed as a result of the war.

"(6) That, for certain classes at least, a special war bonus should be paid to employees in addition to the salaries provided by the schedules."

It is important to note that the proposed rates of pay are based on a normal increase in the cost of living and do not take into account the abnormal increase caused by the war. It is for this reason that an annual bonus is recommended to cover this abnormal cost, and to continue until conditions become more stable.

Turning now to the classification, one is struck, at first sight, by the large number of positions enumerated, some 1,600 altogether, and the great diversity in the schedules of compensation, both maximum and minimum. It is noticeable also that technologists when they leave college, armed with their degrees, begin their career at widely differing rates of pay according to the subjects in which they have graduated.

Many classes of engineers are specified, some for particular positions in one department, others applicable to various grades which are uniform throughout the service.

The classification as published has been widely criticised, and there are undoubtedly many changes which should be made. It must be admitted, however, that it marks a great step in advance and if carefully revised in the light of more detailed information and intelligently applied to the personnel, it should greatly improve the status of engineers throughout the Dominion.

Ballot Regarding Legislation

At the first meeting of Council. that of July 22nd, following the closing date for the ballot issued to secure an opinion regarding proposed legislation, scrutineers were appointed, and their report will be made available as soon as an adjourned meeting of Council has been held. It was anticipated that this information would be available for the August number. Pending the announcement in this connection in the September *Journal*, the Branches will all be notified of the result as soon as the returns are officially known.

Winnipeg Engineers' Archievement

Possibly nowhere in the world does the engineering profession occupy a prouder position than at Winnipeg, at the present time, because of the public-spirit and the ability of the members of the Winnipeg Branch of *The Institute*, who, in the dark days of the early stages of the strike, kept the necessary public utilities of the city in operation and thus averted what might otherwise have been a pestilence. As a member of the Executive Committee consisting of fifteen of the Citizens' Committee of fifteen thousand, Geo. L. Guy, M.E.I.C., Secretary-Treasurer of the Branch, loyally assisted by the officers, executive and other members, organized the various departments so successfully that there was no interruption of the water, gas and electric light supply, as was intended by the grim devils who engineered the strike.

So modest are the men in Winnipeg that it has been impossible to secure details of all they did, but it is known that some worked twenty-four and thirty-six hours at a time to ensure the health and safety of the citizens of Winnipeg. Lacking the practical knowledge of engineers no other body of men could have accomplished this and it is hoped that when the full details are secured the story will be told to the entire world.

Lignite Utilization

A Memorandum on the present situation of Lignite Investigation and Development as undertaken by the Lignite Utilization Board of Canada.

R. A. Ross, M.E.I.C., Chairman,
Lesslie R. Thomson, M.E.I.C., Secretary.

1.—Results of Investigatory Trip

At the commencement of the Board's activities on October 1st, 1918, it was decided that every briquetting and coal treating plant in the United States and Canada, where information pertinent to lignite carbonization might be available, ought to be visited by the Board's engineers, in order that the last word on carbonizing and briquetting might be obtained. At that time it was hoped that, as a result of this investigation, the Board's engineers would be able, on their return, to recommend that such-and-such carbonizers be adopted, such-and-such mixers, and such-and-such briquetting presses. It would then have been possible to proceed immediately with the erection of the plant and purchase of machinery. It should be noted that a great deal of published information had led the Board to believe that the carbonization of lignite had advanced further than actual personal investigation proved to be the case. Their expectations, therefore, in regard to carbonizing of lignite were not realized, and it became necessary for the Board to develop a special type of carbonizer that might be suitable for the low grade Saskatchewan deposits.

The results of the investigation of crushers, dryers, mixers and presses were, however, much more encouraging. It became evident that various commercial machines could be obtained in the open market that would be suitable for the Board's needs with but slight alterations. These results are also touched upon under paragraph 4.

2.—Present Programme

The present programme may be briefly summed up as follows:—The Board is developing a special type of carbonizer, and within a couple of weeks the preliminary trials of this apparatus will be made. In the event of success, the Board's plans will permit it to start the erection of a plant during this coming autumn. In the event of this carbonizer not being successful, further designs will be made, but the Board is determined that not one dollar will be spent on large retort equipment until it is absolutely certain of the ground now being explored.

In addition to its own researches, the Board has arranged with a number of investigators in Canada, the United States and Great Britain, to undertake certain experimental programmes. In this way, the Board is sure of having at its command the best scientific information along these lines that can possibly be secured.

3.—Site of Proposed Plant

The Board has collected as much data as possible on the physical characteristics of the whole Souris field. This data includes information on depth, width, quality and ash content of the seams in each mine, the stratification of the whole area, water supply, topographical characteristics, approximate values of land, quantity of slack available in mines, population of the various towns, and railway facilities. In addition, the Board has come to an arrangement with the Department of the Interior whereby no new mining lease within a radius of 20 miles of Estevan will be granted without the Board's certificate that such lease will not conflict with the future operations of the Board. In this way the interests of the public are safeguarded. No immediate decision, however, will be announced as to the exact location of the proposed plant.

4.—Difficulties and Scope of Board's Programme

The main divisions of the process of producing a carbonized and briquetted domestic fuel from raw lignite are as follows:—(a) crushing, (b) drying, (c) pulverizing, (d) carbonizing, (e) mixing, (f) briquetting, (g) waterproofing, and (h) cooling. These steps will be discussed briefly, in order that it may be clearly seen what the Board is attempting to do. It must be noted that the following remarks are applicable specifically to the Saskatchewan lignites.

(a) and (c). Enough information regarding crushing and pulverizing is at hand to know that these processes can probably be carried out by means of some type of standard apparatus at present on the market. In any event only slight changes will be necessary in order to make existing machinery practicable.

(b). Certain technical difficulties exist with the drying. Standard machinery that can be purchased in the open market, however, will probably be suitable.

(d) As mentioned above, the question of the commercial carbonization of lignite is one that presents, at the moment, the most difficulty to the Board. It is also at this point that the Board's objectives differ most widely from those of so many firms in the United States that are retorting coal on a large scale. The latter have in mind the production of the maximum quantity of by-products, while the defined objective of the Lignite Board is the production of the maximum number of heat units in the residue, in order that it may be available as a domestic fuel. These differences are the more marked when it is remembered that the successful coal treating firms of the United States are dealing with a much higher grade of fuel than the Lignite Utilization Board. There is no question that the carbonization of the lignite *can* be accomplished. The only point is, how cheaply can it be done on a commercial scale with commercial apparatus and with commercial quantities. In order to solve this specific problem, the Board, through the courtesy of the Department of Mines, Mines Branch, has been erecting a small experimental plant at Ottawa, which is, however, to be supplied with units that, though small, may still be regarded as commercial. In this plant the new carbonizer is one toward which the Board is looking with great hopes.

Mention has already been made of the fact that the Board has not only its own investigations under way, but has arranged with a number of well-known scientists to undertake special research work on carbonization.

(f) The question of briquetting is one that is practically solved, and the Board's present objective is to discover the minimum quantities of those binders which are available in commercial quantities in the West. It is interesting to note that the amount of binder necessary for carbonizing lignite is very much in excess of the quantity of the same binder necessary for briquetting anthracite. Enough information with regard to briquetting and binding, however, is now in the Board's possession to enable it to state that, for briquetting presses, it will probably be able to utilize existing commercial machinery with but slight alterations.

(g) In order that the briquettes may be smokeless, it will be necessary to subject them to a heat treatment, and it only remains to determine whether this heat treatment can be made sufficiently cheap to warrant its adoption.

(h). Cooling. This is purely a commercial detail.

5.—Probable Schedule of Future Construction

At present the Board wishes to guard against any absolute promises, because future construction is entirely dependent upon the results of the experimental investigations now going on at Ottawa and elsewhere. The Board has plans and layouts sufficiently advanced to proceed at the earliest moment with the letting of contracts, purchase of land, machinery, etc., provided the experiments are successful. The Board hopes that erection of the plant itself may be started by October or November, 1919. If the experiments are not successful the whole matter must wait until success is achieved, because the Board will not under any circumstances spend public funds for one dollar's worth of capital equipment that might afterwards prove unsuitable.

Town Planning Institute of Canada

The Town Planning Institute of Canada held their first general meeting on May 31st, 1919, in the Russell Hotel, Ottawa, at which Thomas Adams, Chairman of the Provincial Council presided. The following members were present: Thomas Adams, Dr. E. Deville, Dr. O. Klots, N. Cauchon, A.M.E.I.C., J. B. Challies, M.E.I.C., F. D. Henderson, C. P. Meredith, H. L. Seymour, R. H. Millson, W. D. Cromarty, D. M. Ewart, B. E. Parry, F. C. Todd, Thomas Fawcett, M.E.I.C., A. H. Hawkins, S. E. Farley, A. Buckley, E. T. B. Gillmore.

Sir Lomer Gouin and Hon. H. E. Rowell were elected Honorary Members and the following were elected Associate Members, subject to the completion of certain formalities in connection with the forming of applications.

Associate Members

Architects: Richard H. Millson, James P. Hynes, William D. Cromarty, David Ewart, George A. Ross, W. Herbert George, Charles H. C. Wright, M.E.I.C., Ramsay Traquair, Percy E. Nobbs, Arthur A. Stoughton, Robert H. Macdonald, Edward Maxwell, Colborne P. Meredith.

Engineers: R. S. Lea, M.E.I.C., William M. Tobey, M.E.I.C., George H. Ferguson, A.M.E.I.C., Horace L. Seymour, A.M.E.I.C., William H. Powell, M.E.I.C., Charles A. Bigger, A.M.E.I.C., John L. Rannie, A.M.E.I.C., Christopher J. Yorath, A.M.E.I.C., Arthur G. Dalzell, A.M.E.I.C., George Phelps, A.M.E.I.C., James A. Walker, A.M.E.I.C., William A. McLean, M.E.I.C., Percival H. Mitchell, A.M.E.I.C., Noulan Cauchon, A.M.E.I.C., James White, M.E.I.C., John B. Challies, M.E.I.C., Lionel C. Charlesworth, M.E.I.C.

Surveyors: Francis D. Henderson, Thomas Fawcett, M.E.I.C., Edouard Deville, Wilbert H. Norrish, Jr. E.I.C., William A. Begg, A.M.E.I.C., Ernest B. Hermon, Thomas A. McElhanney, Albert H. Hawkins, Carl Engler, Athos M. Narraway, S.E.I.C., Sidney E. Farley, Otto Klots.

Landscape Architects and Town Planners: Frederick G. Todd, Alfred F. Hall, H. B. Dunnington-Grubb, Thomas Adams.

Legal Associate Members: Thomas B. McQueston, James A. Ellis.

Associates: G. Frank Beer, Dr. W. H. Atherton, A. Buckley, E. T. B. Gillmore.

The chairman presented a report on some features of the City Planning Conference held at Niagara Falls during the last week of May. The Institute, he said, had been well represented at the conference considering the existing small membership. The conference was called under the auspices of the cities of the Niagara frontier and was international in its purpose and significance. It had fallen to his lot to present a paper on "The Regional Survey as the Basis for Regional Planning and Regional Planning as the basis for Town Planning." The subject dealt with the district twenty miles on either side of the Niagara River covering an area of 1,000 sq. miles and, with the aid of seven or eight diagrams, the paper set forth the basic conditions that require to be considered with regard to the whole district. He thought that the consideration of the subject might lead to the formation, on both sides of the river, of an International Town Planning Commission dealing with the whole of that region. This would mean a big scheme and one of world-wide value. The scheme should have special interest to professional men as it would enlist the services to a large extent of surveyors, engineers and architects.

A discussion took place on the question of the formation of local branches and local representation. Mr. Todd suggested that the provisional council seemed to be largely composed of Ontario men and that Montreal was not very well represented. On that ground he foresaw some difficulty in the formation of a Montreal branch.

The chairman explained that this point had been discussed, that the provisional council was appointed to carry on the work of organization for the first year and that it had seemed necessary that the membership should be largely drawn from Otawa in order to make it possible to conduct business. He also explained that the organization was started in Ottawa and they had no assurance that anyone in Montreal would join them. The council, however, was merely provisional and at the end of the first year it would be easier to elect a wider representation. Local Branches would have to be formed in Montreal and Toronto, and proper representation given on the Council.

The Prospects of a Town Planning Institute in Canada

Thomas Adams addressed the meeting upon "Prospects of Town Planning Institute in Canada." He referred to the progress made in forming Institutes in Britain and the United States, and to the special difficulties Canada had to meet in attempting to create any organization on the basis of conditions in these countries.

In Great Britain there was practically no such thing as a "town planner" prior to 1909. In that year the Town Planning Act was passed by the Government and there arose a need for men as town planners. In 1913, the Town Planning Institute was formed. It consisted of the architects, surveyors and engineers in Great Britain who were prominently identified with town planning.

They have an advantage over us, as Great Britain is a relatively small place and therefore meetings can be held more frequently and they have therefore been very successful. They hold about eight meetings yearly, and they have presented papers which are published and form very interesting and valuable literature on the subject. An annual volume is issued with a subscription of two guineas for members and one guinea for associates.

In Britain, when a town wishes to have a scheme prepared, if it has not an engineer who is also a town planner, then an expert town planner is asked to assist. The city engineers of the chief cities are prominent members of the Institute. It is strictly a professional institute and there has been no difficulty in separating the associate from the professional members. Some of the associates, however, have studied town planning for many years but are not professionally qualified. These include Henry Vivian, Chairman of Copartnership, Ltd., H. R. Aldridge— who has written a very comprehensive book on the subject—and Ewart Culpin, Secretary of the Garden Cities and Town Planning Association. None of these men were eligible as professional members but were elected as associates. The Institute was formally established as a professional organization and has brought into existence a definite scheme of instruction in town planning. An examination syllabus has been issued, and the aim was that no one should become a member without examination. They have also a school of civic design in Liverpool University and a professorship of town planning in London. In regard to professional work they have issued a scale of charges for town planning work. Members of the Town Planning Institute were recently elected Housing Commissioners. Raymond Unwin, an ex-president, is now Chief Architect of the Government in its housing schemes that involve an expenditure of $600,000,000 to $1,000,000,000. G. L. Pepler, a vice-president and first secretary is Town Planning Inspector to the Local Government Board. Professor Abercrombie, Librairian of the Institute, is editor of the Town Planning Review and head of the Liverpool School of Civic Design, and Professor Adshead, the President, is Professor of Town Planning in London, and adviser on town planning to the Prince of Wales.

Starting out with small anticipation the Institute is becoming very much alive and its members are benefitting while contributing their services to their country. In the Institute we had Professor Geddes, as first Librarian, whose collection of town planning material was sunk by on of the German raiders on its way to India. He had collected material costing $12.500 which was all lost. The Institute immediately set to work to collect duplicates as far as possible and these were sent out to him in India. Professor Geddes is not an architect or a surveyor but has high academic qualifications as regional planner. He has done great work in India and has published several large volumes on town planning in India through the Indian Government. His son, Alister, was trained as a town planner. Passing through Edinburgh University, he took up town planning with his father and went across to Dublin to assist in the organization of an exhibition. In 1914, as the holder of a scholarship, he wished to finish his studies in India. When the war broke out he came back to help his country. Owing to his study of topography and his facility in drawing and his acquaintance with regional development he was selected in France as a balloon observer and became one of the most competent on the staff. He was killed in 1915.

The Town Planner in the United States.

The development of the town planner in England has proceeded rapidly. The beginning in the United States was not so satisfactory from a scientific point of view. It came about in a different way. In Britain we started to promote a school of town planning with a view to creating a trained class of professional men. In the United States there has been no deliberate objective of that kind, until very recently.

The National Conference on City Planning in the United States was first held twelve years ago. The Chairman is F. L. Olmsted, who is an able landscape architect and a man whose name is widely honoured. He has been chairman for twelve years. That itself has been a weakness. A chairman should not hold an office more than one year. The organization is weak in its architectural and engineering membership. There has been a tendency, probably quite unconscious, rather to confine town planning to landscape architects and there is now a good deal of lee-way to make up in order to interest the engineer and the architect. Two years ago it was suggested that a city planning institute be formed. This year a step has been taken to separate professional functions from propaganda. But the council of the Institute is the same as the council of the Conference which is engaged in what may be termed propaganda.

In Canada, we have started out in the right way. The chief question to deal with is what prospect is there for those of us who are interested professionally in the subject that there will be sufficient scope for using our knowledge of town planning? We have the great difficulty of planning for a small population in an immense area. Great Britain has about 50,000,000, United States over 100,000,000. We have our 8,000,000 scattered over a larger territory than the United States. We shall have to be content to grow slowly as a profession. A small population means a smaller number of practitioners. There will be the difficulty of getting sufficient reward for professional work in Canada to make it practical for men to train for the profession. But, while we are a small country, we are a growing country and a town planner has to deal with growth. Our Government has promoted the best housing scheme of all the Governments. In Great Britain they are spoon feeding the population with their housing schemes which has dangers and is not so sound economically as ours. Mr. Campbell, a member of the Town Planning Institute and City Engineer of Edinburgh, has just written to say that he is satisfied that the Canadian scheme is based on sounder economic principles than the Scotch scheme which had been made for Scotland by the English Government. Mr. Tayor, of the firm of Mann and MacNeille of New York, says in a letter:—"We wish to express our unqualified admiration for the completeness, practicability and simplicity of the administration methods outlined in the data received from you. We believe this to be the most practicable step toward the provision of good housing by Federal co-operation which has yet been taken in any country."

We have opportunities here because we are beginning at an early stage in the development of the country. On the other hand we have the disadvantage of a smaller population and lack of appreciation of professional capacity.

The other day I was going over the deep cut being laid between the Rapids and Queenston by the Hydro Electric Commission and was informed by the engineer that somebody had applied to him for a job. He had said to him, "Well, I could give you $80.00 a month." The young fellow had looked rather glum. "Well if you thing that is not enough that is the best I can do. Is there anything else you can do?" "I have been accustomed to boring," said the applicant. He was referred to the engineer in charge of the boring. Later the engineer met him and said: "Have you got something?" "Yes," was the reply. "I am boring at $130.00 a month." There was a man with a university training. He had to take the work of a skilled labourer in order to get a decent salary.* What encouragement is there for a youth to go to the university and learn a profession? Railway men are earning up to $3,000 a year. Many of the engineers have to be content with $2,000. If a man is to be a town planner he has to take his four years course in Architecture and Engineering and then a post-graduate course of a year in town planning. You get a man to take a five years course and then you meet this difficulty of having his services valued as a skilled labourer who can learn his job in a few months. But there is no question town planning will come to be appreciated. There are some hopeful signs of this fact. First we have the surveyors who almost to a man are now recognizing that they have to take up the question of topographical survey in a more extended way. Then we have also to consider that regional planning is a thing that has come to stay in England and the United States and that it is one of the things that is very much needed in this country. Many industries are spreading over areas that have no reference to municipal boundaries at all. You cannot town plan even Ottawa with 100,000 inhabitants unless you take in about half a dozen municipalities. If you wish to zone Ottawa or to insist upon proper building by-laws it cannot be done unless Westboro and Eastview have the same restrictions; otherwise people would skip the boundaries and build as they like. In the regional planning, which I hope we may take up as a subject of special study, we require the surveyor and the engineer to prepare the regional survey as the basis for the regional plan. The surveyor should become our chief man in the regional survey. You cannot town plan unless you know what the existing conditions are. You have to find out what is the basis on which you wish to build your town planning. The engineer comes in to assist the surveyor with the collection of data concerning roads, railway transportation, sewage disposal and water supply. For this we need a regional survey in which we shall need specialists in the future. We need the regional survey to present us with the exact data we require to prepare our plan.

We had a survey made in the Niagara district. We wanted the facts and there was need to obtain correct information and the surveyor and engineer supplied us with such information. We have information collected regarding railways, water-ways, high-ways, sewage disposal, power, etc. One municipality may have its sewage disposal on higher level than another and become a water shed sending down polluted sewage to the other. When you have finished with your survey you must bring in the landscape architect. The engineer and the landscape architect present us with the regional plan as the basis for general development. The landscape architect will deal with the park system in a general way. The Niagara district should have a park way from Buffalo right down to Lake Ontario. Along the Niagara River it would touch five or six municipalities.

When the regional plan is prepared, then Town Planning Commissions have to be appointed for the municipal areas within the region. The different towns

* *The engineering job offered in this case was of course wages for a beginner on engineering work, and the applicant might have been able to have obtained a larger salary had there been an opening.*

will each have their own local engineer to fit in his plan with the regional plan. He will know where the other plan touches his. Then the architect will finish the job commenced by the others, fix residential areas, group buildings, arrange the minor street system and bring to a climax a definite scheme, when the lawyer also will appear and an Act of Parliament will follow.

All this needs considerable organization and professional talent of varying degree. There is a field big enough for all the talents. We can bring it to bear if we get the teaching we require in the universities and we can also show that such money is well spent. If the services we are able to give are properly appreciated we shall be able, as we apply courage and vision, to convince the people of Canada that we have a big contribution to make in the application of science to the making of a strong country, and the building of a strong race, living in houses not only comfortable but in right relation to industries, means of recreation and sources of power. Then proper organization and planning will help to give the people the right foundation and build up this country in such a way that there will be less to regret.

* * *

Since the above meeting was held two additional members of the Council of the Institute have been elected. Dr. Emile Nadeau, Director of Housing in Quebec, has been appointed as a representative of the Council of Honorary Members, and J. P. Anglin of Montreal has been appointed as Associate Member of the Council, thus increasing the representation of Montreal. It is hoped to further increase the professional representation from Montreal as soon as an amendment can be made in the rules. The next meeting of the Institute will be held in the second or third week in October at Ottawa. On that occasion a joint conference will be held between the American City Planning Institute and the Canadian Town Planning Institute. The Conference is being called at the instigation of the American Institute, the Chairman of which is, this year, an eminent engineer, Nelson P. Lewis, Chief Engineer of the Board of Estimates and Apportionment, New York. An attractive programme is being prepared, and the subject chosen for discussion is "Principles of Town Planning."

Directory of Chemical Industries

The Dominion Bureau of Statistics has just issued a Directory of the Chemical Industries in Canada, listing the names, addresses and products of nearly five hundred Canadian firms manufacturing chemicals, or other products in which the processes used are essentially dependent upon the agency of chemical change.

This publication will undoubtedly fill a long felt want and should be of considerable value to the general public as well as to the trade. It has come to be a well accepted truth that scientific progress is essential to the true development and material welfare of any country, and in Canada, where many of our natural resources are as yet almost unknown, the importance of laying sound foundations cannot be over-estimated. Some of the possibilities of industrial chemical development were made apparent by the remarkable accomplishments along these lines in Canada during the war, and consequently popular sentiment now favours the idea that this country should, to a large extent, be freed from dependence upon other countries for our chemical needs. In order that this idea might be guided along well advised lines, it was essential that a survey of our chemical industries should be made, and the bulletin now referred to represents the first phase of this work.

The Directory is in two divisions: (1) an alphabetical list of the various concerns, the head office address of each, together with a detailed list of their products, including in the latter chemicals and products resulting from chemical processes; (2) a list alphabetically arranged of the chemical products manufactured in Canada showing the names of the various firms engaged in their manufacture.

The Directory has been published in a limited edition, and as a geat number of requests for copies have already been received, it is probable that the available supply will soon be taken up. Requests from those interested should be addressed to the Dominion Bureau of Statistics, Ottawa.

Commercial Value of Musk-Ox

Following up the proposal of Mr. Stefansson, the Canadian explorer, that musk-ox and reindeer should be raised in the Canadian Artic and sub-Artic regions, making these vast areas of economic value, the Government is likely to establish a station on Melville Island (which is 650 miles north of the Artic Circle) for the domestication of the musk-ox.

In a recent address before a gathering of Members of Parliament and Senators the explorer outlined his plans.

He said that both these animals would furnish a meat and milk supply, and in addition the musk-ox would furnish good quality wool. He pointed out that in the summer there is abundant vegetation, which forms nutritious and good grazing for the animals for winter as well as summer. He estimated that there are at least a million square miles of such grazing grounds in Northern Canada. The winter is too severe for ordinary domestic cattle, but the musk-ox and reindeer can graze there in the open all the year round. In regard to musk-ox meat he said that for a year when he was in the north this meat constituted 90 per cent. of the party's food supply, and that they found it indistinguishable from beef.

In view of these circumstances Mr. Stefansson claimed that the Canadian North can be utilized to help to solve the problem of the present and future food shortage of the world, and in addition the development of this industry would expedite the development of mineral and other resources. He referred to what has already been done in raising reindeer in Alaska by Americans. The Canadian North was much larger and more suitable. In Mr. Stefansson's opinion the development of the musk-ox is more important than that of the reindeer. This is the only important animal of which Canada has a monopoly, as it has been exterminated in the rest of the world. The musk-ox, he said, is three times the size of the domestic sheep and would produce three times as much wool and three times as much meat. It needs neither barns, nor shelter, nor hay. He estimated that some four thousand were left on Melville Island, and perhaps 20,000 on other Canadian Islands. — *The Times Engineering Supplement.*

CORRESPONDENCE

Legislation

Editor, *Journal*:—

It is with very much regret that I find I shall be unable to be present at the meeting of the Branch on Thursday evening next, when the important matter of proposed legislation will be discussed, and I, therefore, hasten to write a few lines giving my personal views on some of the controversial issues raised.

The effect upon the present *Institute* is a point raised by the most prominent members of the Managing Board of the *E.I.C.*, and their views are rather pessimistic in this regard. The intention of the Special Committee in framing the Model Act was to limit as much as possible the activities of the Provincial Associations to the strict business of administering the legislation. It has been said that this cannot in practise be done, and that the Associations will do just as they like once they are formed. The chief safeguard against this is the good sense and intelligence of the members of the profession, who will undoubtedly see the advantage and strength of continuing loyal support to *The Institute*, which is Dominion wide and equally all embracing in its scope. It is said that when members can get all the recognition of their status as engineers from their registration in the provinces that they no longer feel a need for supporting the *E.I.C.*, with its larger annual fee. I venture to say that all those members who have loyally supported it all the years when it was practically no good at all to them will continue to support it in the future when it is, as now, launched upon a large sphere of usefulness by the organization of its Branches and the publication of its *Journal*. The *E.I.C.* will always have by reason of its organization and Head Office Permanent Staff a great advantage over any possible provincial association which might develop in opposition to it. It may be that the present rate of growth in membership of the *E.I.C.* may suffer a check but that will, I think, be but temporary. The young member of the profession will continue to find that membership in the *E.I.C.* will give him increased standing in the profession, according to the grade he occupies, and that for his own advancement in knowledge and experience and for the opportunities it will give for social and professional intercourse with his brother members, his membership will still be desirable. The older members will view the matter in the light that their continuation of membership in the *E.I.C.* is too important and beneficial to both themselves and the profession itself to be lightly thrown up simply because they are obliged to pay a provincial registration fee of very moderate dimensions. All members of the profession will soon realize that the advantages of having obtained a legal status as professional engineers will be really worth the annual fee alone.

Some of the fears and objections set out in the June issue of *The Journal* by members of the Council appear to me to be due to a wrong impression of the proposed intentions of the Model Act and the direct objects in view. It is said that some objections and opposition will be encountered from corporations and Government departments employing engineers, as they will object to being refused the right to employ whom they like. The act in *no way* restricts an *employer*, but only the *employee*. It is I think unlikely that employees would sympathize with any employee who deliberately wished to flout the law by not registering when to do so does not impose any appreciable hardship upon the employee, so long as he is qualified. If the employee is not qualified, then the employer could hardly put up the argument to the Legislatures that they wished to employ him as a professional engineer, in face of his inability to pass by virtue even of his experience alone. Compulsory written examination *is not* required in all cases by the Act. It may be argued that there are many instances of valuable employees who could not pass an examination. It will, I think, be found that in most of these the man is not performing the duties of a professional engineer, as defined in the Act at all, but rather is a superintendent of construction, or is an *operator* of a machine or engine. It should be noted that there is a distinction between operating duties and professional duties, and this distinction is generally not very hard to draw.

Again, the plea is made that the form of legislation proposed is not going to financially benefit any considerable number of the members of the allied engineering professions. This point is made by several influential critics, and is, I think, a very weak argument. I hesitate to believe that any member who has advocated legislation up to the present time has ever had any idea that any such direct result could possibly come about as compulsory increase in wages by legislation, and to tell us that that can not be done is an affront to our intelligence. We all realize that an improved general status will eventually react favourably on our rewards of service, and it is this that we want to effect as soon as possible.

Again, the critics say that the inclusion of all branches of engineering weakens the Act. That the fact that registration is the same for all branches will give the public the impression that any registered man is qualified to practise in all branches. This idea is ridiculous as under no circumstances with or without legislation is a man engaged to perform responsible work without reference to his training or experience, unless it be in some very corrupt circumstances. The fact should be borne in mind that with the vast majority of engineers their immediate superiors are engineers themselves, and it is usually on the recommendation of some superior engineer that they were originally engaged. In the few cases where engineers are engaged by persons who have no knowledge of the extent of the profession, it seems foolish to suppose that they would even then be engaged without any other reference than the fact of their provincial registration as professional engineers. To claim therefore that the public will not be protected for this reason is misleading. There will be an absolute protection to the public from the fact that all registered professional engineers have shown qualifications, and it will then be up to the employer to ascertain that those qualifications are of the kind required by the employment. The public will also be protected by the fact that any registered man has shown evidence of trained intelligence along certain lines and as such can reasonably be expected to know his limitations.

Another criticism of the Bill is that the present *E.I.C.* is not included or made use of. This was considered to be necessary by the Committee in order to overcome the opposition from other organizations, and is, I think, advantageous in other ways. As members living away from Montreal, we wish to have home rule in matters affecting our own livelihood, and I think, that too great power and responsibility would be placed in the hands of a few persons in Montreal if the *E.I.C.* were in sole control of the profession throughout the whole Dominion. It is a fact that representative government is really impossible in an organization such as the *E.I.C.*

The matter of legislation has been under consideration in Canada for over twenty years, and it has been strikingly evident that the management of the *E.I.C.* was never competent to undertake legislation for the profession at large. What attempts have been made have met with disastrous failure, and this is I believe due to the narrow outlook which has been in evidence. Partial legislation is vicious, it must be all or nothing. If legislation is enacted at all, it must be of such a nature that it can not be ignored. It is not right to extract fees from some persons, and then fail to collect from others, and thus fail to give the results for which the fees are paid.

If our critics would endeavour to draw up some legislation along the lines they speak of, such as restriction to public works, and by certain kinds of engineers only, they would soon see the impossibility of any such course. Some critics suggest that the legislation should be to prevent provinces or municipalities from employing engineers who are not members of the *E.I.C.*, or its equivalent. This is not governing the engineering profession at all, but is governing other parties, and cannot help the profession as a whole.

It is suggested that the effect of the Bill would be to enable only one registered engineer to be employed in certain cases, and others be unregistered. This would surely not come about through the collusion of the employer, and it will in no way be advantageous to him. If the engineers encouraged such a situation, then they themselves are at fault, and if the Act cannot be administered by the members of the profession, it is useless for us to attempt it.

As regards the phase of creating "technical clerks" my letter to Mr. Chapman gives my views, as this all hinges on extent of responsibility.

C. C. Kirby, A.M.E.I.C.

Legislation

Editor, *Journal*:—

Whilst the proposed Act respecting the engineering profession, as published in *The Journal* for May, is generally satisfactory, it embraces some features which have already called forth strong protests, particularly from engineers in salaried positions, for whom the Act as drafted would probably be of little or no benefit, and might be to their disadvantage. When it is considered that fully nine-tenths of the Profession belong to this class, it is imperative that its interests should be guarded, in order to obtain united action.

Moreover, the term "Professional Engineer" is undignified and foolish; for all persons who earn a livelihood by any particular vocation or trade are professionals, such as: Professional hair-cutters, professional prize-fighters, professional golfers, etc. A legal definition of the profession of engineering is first required; the public will then learn to distinguish between engineers and "locomotive engineers," " stationary engineers," "sanitary engineers," etc., etc. The term "Registered Engineer" is a sufficient distinction, and it could not be adopted by mechanics who style themselves as engineers and who are really professionals in their particular trade. No claim for originality is made in connection with the definition of engineering, herewith; it is founded upon a definition published in *The Journal* for July, page 509.

The suggested revisions, given below, are intended to meet the objections hitherto raised, and to do away with the objectional term " professional engineer."

First paragraph. Whereas it is considered advisable to establish by legislation the qualifications necessary to permit persons to act or practise in the Profession of Engineering.

Section 2 (a). "Engineering" is the art which applies science and scientific methods to develop and control the resources of nature for the use and convenience of man; it involves ingenuity in directing forces, utilizing materials and organizing human efforts for the fabrication of machines, the erection of structures, the provision of transportation facilities, the invention of processes and the production of articles of commerce. An "Engineer" is any person who practises engineering, as defined herein.

Section 2 (b). A "Registered Engineer" is any person registered as such under the provisions of this Act; and his practice embraces advising upon, making measurements for, designing and supervising of the construction, enlargement, alterations, improvements or repairs of public and private utilities, railways, bridges, tunnels, highways, roads, canals, harbours, harbour-works, river-improvements, lighthouses, wet docks, dry docks, dredges, cranes, floating docks, and other similar works, steam-engines, turbines, pumps, internal-combustion engines, and other similar mechanical structures, air ships and aeroplanes, electrical machinery and apparatus, chemical and metallurgical machinery, and works for the development, transmission, or application of power, mining operations and apparatus for carrying out such operations, municipal works, irrigation works, water-works and water-purification plants, sewerage works, sewage-disposal works, drainage works, incinerators, hydraulic works, and all other engineering works, the value of which exceeds one thousand dollars ($1000.00). The execution as a contractor of work designed by a Registered Engineer, or the supervision of the construction of work as a foreman or superintendent, or as an inspector, or as a road-master, track-master, bridge or building master, or superintendent of maintenance shall not be deemed to be the practice of Engineering within the meaning of this Act.

Section 2 (*c*). "The Association" means the Association of Registered Engineers of the Province of . . . .

Section 7 (*a*). Only such persons who are Members of the Association hereby incorporated and registered as such under the provisions of this Act, or who have received a license from the Council of the Association as hereafter provided, shall be entitled, within the Province of . . . . to take and use the title of Registered Engineer or any abbreviation thereof, or to practise as such.

Section 7 (*b*). Persons residing in the Province of . . . . at the date of the passing of this Act, and who at that date have been for five years previously practising Engineering as herein defined, and Members and Associate Members of *The Engineering Institute of Canada*, as well as members of equivalent rank in recognized engineering societies of other countries, residing in the Province at the time, shall be entitled to be duly registered as Members of the Association, without examination, provided that such persons shall produce to the Council, within one year of the passing of this Act, satisfactory credentials of his having so practised, or of qualifying membership in such recognized engineering societies.

Section 7 (*e*), (*g*) *and* (*i*). Change the term "Professional Engineer," where it occurs in these sub-sections to "Registered Engineer."

Section 7 (*h*). Delete the word "Professional."

Section 8. In the case of two or more persons carrying on an engineering practice in co-partnership, only such members of the firm who are registered or licensed under this Act shall individually assume the functions of a "Registered Engineer." A firm of engineers cannot be deemed to be a Member of the Association or be licensed to practise.

Section 10 (*a*). The Council may, in its discretion, reprimand, censure, suspend or expel from the Association any engineer guilty of unprofessional conduct; for negligence or misconduct in the execution of the duties of his office; for engaging in a branch of the Profession in which he may be proved to be entirely unqualified; or if convicted of a criminal offence by any Court of competent jurisdiction.

Section 11. Delete the word "Professional."

Section 11 (*a*). Practises as an engineer, within the meaning of this Act; or

Section 11 (*b*). Usurps the functions of a Registered Engineer; or

Section 11 (*c*) *and* (*e*). Substitute "Registered Engineer" for "Professional Engineer."

Section 18 (*b*). Candidates for admission to practise who, for any reason, have been unable to take advantage of an academic engineering course must have served at least six years under one or more engineers of recognized standing.

Yours faithfully,

W. Chase Thomson, M.E.I.C.

"Made in Canada"

The Canadian Trade Commission at Ottawa made the following announcement on July 15th:—

"A cablegram from the Canadian Mission requests that Canadian goods shipped to the United Kingdom bearing trade-marks or descriptions should bear words showing the country or origin. Cases have been brought to the Mission's notice where goods from the Dominion have been detained by the customs authorities because they do not comply with the requirements of the Merchandise Marks Act. It is understood by the Commission that the words 'Canada Product' or 'Made in Canada' will sufficiently meet requirements. The Trade Commission points out that such a mark to designate Canadian goods can be made one of the most potent advertising factors for our producers and manufacturers if the quality of material shipped overseas is kept on a high level. For shipments made under the direction of the Commission it has definitely adopted the trade-mark 'Canada Product' as being most distinctive.

"As trading with Germany and German-Austria is now allowed, export permits to these countries will be granted freely by the Trade Commission on the same terms as to other countries. A cablegram received on July 15 from the Canadian Mission states that a 'trading with the enemy license' has been issued in Great Britain and that all goods not on the conservation list are allowed to be shipped without individual export licenses.

"This is supplemented by the information forwarded to the Trade Commission from Washington that a general enemy trade license has been issued by the United States Government enabling 'all persons to communicate and trade with persons residing in Germany' subject to a few specific limitations. Hungary and Bolshevik Russia are not included in the permission.

"Another cable from London to the Commission states that the importation of goods into Great Britain from other former enemy countries is permitted, as it was not found possible to establish working machinery for certifying the percentage of German, Austrian, or Hungarian manufacture in the importation."

United States Iron Ore Production

A decrease of 7.4 per cent. in the production of iron ore in the United States is reported by the Geological Survey in its preliminary estimate for 1918, the quantity being 69,712,000 tons as compared with 75,288,851 tons in 1917. The estimated shipments were 72,192,000 tons last year against 75,573,207 tons in 1917. Disturbed industrial conditions, an uncertain labour supply, and inadequate transport facilities all combined to curtail the output, while the Government control of the steel supply, which became effective in June, 1917, undoubtedly helped to regulate the demand for ore. Stocks at the mines decreased from 10,628,908 tons on December 31, 1917, to 8,139,000 tons on the corresponding date of last year, and the supplies at the lower Lake ports were also reduced somewhat, so that the actual consumption remained at approximately the same figure in both years.—*The Times Engineering Supplement.*

Report of Council Meeting

At a meeting of the Council held on Tuesday, July 22nd, at 8.15 P.M., in addition to other matters, a ballot was opened and the following elections and transfers effected:—

Members

Harold W. Buck, Ph.B. (Yale Univ.), E.E. (Columbia Univ.), of Hewlett, N.Y., vice-president of Viele, Blackwell & Buck; Allison Robert Chambers, B.Sc. (McGill Univ.), of New Glasgow, N.S., assist. manager, ore mines and quarries dept., N. S. Steel Co.; George Percy Cole, B.Sc. (McGill Univ.), vice-pres., Montreal Metallurgical Assn., Montreal; Frank O. White, B.Sc. (C.E.), (Univ. of Maine), of Temiskaming, Que., i/c designs, Kipawa Fibre Co., Limited.

Associate Members

John R. Black, of Sault Ste. Marie, Ont., sr. asst. engr., D.P.W.; John Leslie Charles, Major, D.S.O., of Toronto, Ont., previous to enlistment, res. engr., H. B.Ry., at present, ch. engr., 13th Bn., Can. Ry. Troops; Francis Way Clark, of Niagara Falls, Ont., asst. ch. field engr., Hydro Electric Power Comm'n.; George Andrew Colhoun, S.P.S., of Hamilton, Ont., designing and estimating dept., Hamilton Bridge Works Co.; Clayton Dewitt Dean, B.A.Sc. (Univ. of Toronto), of Toronto, Ont., tech. and process advisor, Imperial Oil, Limited; Lionel Leslie Jacobs, of Sault Ste. Marie, Ont., purchasing agent, Algoma Steel Corp.; Andrew Charles Loudon, B.Sc. (McGill Univ.), of Montreal, acting asst. ch. engr., Locomotive Super-heater Co.; Harry Donald Macaulay, of St. John, N.B., asst. engr., P.W.D., on staff in chg. of St. John Harbor; Joseph Arthur Henri Marchand, B.A.Sc. (C.E.) (Polytechnic School), of Three Rivers, Que., asst. engr., P.W.D.; Ernest Smith Martindale, B.A.Sc. (Univ. of Toronto), D.L.S., of Ottawa, Ont., Topographical Surveys Branch; Herbert Ross McClymont, E.E. and M.E. (Glasgow Univ.), of Toronto, Ont., principal asst., Kerry & Chace, Ltd.; Charles Ross McColl, B.Sc. (Queen's Univ.), O.L.S., of Sandwich, Ont., in private practice, also Town Engr. of Sandwich; William Lawrence McFaul, B.A.Sc. (Univ. of Toronto), of Sault Ste. Marie, Ont., City Engineer; Harry Burton Pickings, of Halifax, N.S., member of firm Pickings & Roland; Frederick Leeds Richardson, B.A.Sc. (Univ. of Toronto), St. John, N.B., res. engr. on construction at Courtenay Bay; Kenneth George Ross, S.P.S., of Sault Ste. Marie, Ont., member of firm Lang & Ross; Herbert Nason Skolfield, B.S. (Univ. of Maine), of New Glasgow, N.S., previous to enlistment with Eastern Car Co., at present with U.S. Army; Francis Stidwill, B.Sc. (Queen's Univ.), of Cornwall, Ont., member of firm Magwood & Stidwill; Charles William Stokes, B.Sc. (E.E.) (McGill Univ.), of Montreal, Que., general manager, Siemens Company of Canada, Limited; George Mason Tripp, of Victoria, B.C., supt., Victoria Branch, B.C. Electric Ry. Co., eng. supt. in chg. of all eng. work on Vancouver Island, Vancouver Island Power Co.; William Daniel Walcott, B.A.Sc. (Univ. of Toronto), of Toronto, Ont., asst. laboratory engr., Hydro Elec. Power Comm'n.; Claude Stafford Whitney, of Niagara Falls, Ont., res. engr., Hydro Electric Power Comm'n.; Dwight Stanley Wickwire, of Halifax, N.S., with Pickings & Roland, on survey of Halifax.

Juniors.

Peter Burton Buckley (Capt.), B.Sc. (McGill Univ.), of Montreal, Que. (military service, 3½ yrs. with R.E. in France and on Italian front.) With Soldiers' Civil Re-Establishment, Montreal; Cecil Roy McCort (Capt.), B.A.Sc. (Univ. of Toronto), of Montreal, Que., i/c professional and business occupations section, Dept. Soldiers' Civil Re-Establishment; Rowland Chapman Moore, B.Sc. (N. S. Tech. College), of Halifax, N.S., asst. engr. Foley Bros., Welch, Stewart & Fauquier; William Henry Stewart Richardson (Capt.), of Belleville, Ont., transitman, G.T.R.; Stanley Oxley Roberts, of Ottawa, Ont., dftsman, in Radio Branch, Naval Service; Bruce Napier Simpson (Lieut.), B.A.Sc. (Univ. of Toronto), of Toronto, Ont., asst. in hydrometric work, Hydro Electric Power Comm'n.; George Oliver Vogan, B.Sc. (Queen's Univ.), of Toronto, Ont., design of hydraulic structures, Hydro Electric Power Comm'n.; Clyde Oliver Whitman, of Sault Ste. Marie, Ont., instrumentman, Algoma Steel Corp.

Transferred from class of Associate Member to Member

Arthur Edward Caddy, of Campbellford, Ont., asst. engr. Dept. of Railways & Canals, Trent Canal; Judson Albert DeCew, B.A.Sc. (Univ. of Toronto), of Mount Vernon, N.Y., President, Process Engineering; Laurie Benjamin Elliot, B.Sc. (Dalhousie Univ.), of Edmonton, Alta., dist. engr., P.W.D.; Burton M. Hill, B.Sc. (Univ. of N.B.), of Fredericton, N.B., Prov. Road Engr., P.W.D.; Sydney B. Johnson, of Ottawa, Ont., asst. engr. i/c Ottawa River Storage, P.W.D.; Norman Berford McLean (Major), (R.M.C.), of Ottawa, Ont., res. engr., Ship Channel; Gilbert Gray Murdoch, of St. John, N.B., in private practice; Augustine V. Redmond, B.Sc. (Queen's Univ.), of Winnipeg, Man., dist. engr., Can. Nat. Rys.

Transferred from class of Junior to Associate Member

Louis Charles Dupuis, of Levis, Que., div. engr., Saguenay div., Can. Nat. Rys., Quebec; Joseph Alexander Keefer (R.M.C.), of Victoria, B.C., asst. engr., P.W.D.; Alexander M. Kirkpatrick, B.Sc. (C.E.) (Queen's Univ.), of Ottawa, Ont., asst. engr., P.W.D.; Allan Gordon McLerie, of Toronto, Ont., res. engr., C.N.R.; John Nichols Stinson, B.Sc. (Queen's Univ.), of Ottawa, Ont., acting first asst. highway engr., Dominion Parks Branch; Lewis Wynne Wynne-Roberts B.Sc. (London Univ.), of Toronto, Ont., Capt., Royal Engrs. in Persia.

Transferred from class of Student to Associate Member

Charles Ruglas Avery, M.A.Sc. (Univ. of Toronto), of Toronto, Ont., Feb., 1915, to Mar. 1st, 1919, on active service; Joseph Henri Arthur Emile Drolet, of Quebec, Que., supt. of Foundry, La Cie F. X. Drolet; Joseph Edmond Heroux, C. E. (Laval Univ.), of Quebec, Que., supervising gen'l. of road constrn., P.W.D.; Rex Phillips Johnson, B.A.Sc. (Univ. of Toronto), of Niagara Falls, Ont., sr. draftsman and asst. office engr., Hydro Electric Power Comm'n.; Paul Chester Kirkpatrick, B.Sc. (C.E.) (McGill Univ.), of Ottawa, Ont., asst. res. engr., Fraser, Brace & Co.; Charles Crawford Lindsay B.Sc. (McGill Univ.) (Capt.), of Quebec, Que., 4 years active service with Royal Engrs., returned and at present unemployed; John Earl Ratz, B.A.Sc. (Univ. of Toronto), of Ottawa, Ont., geodetic engr. and geodesian, Geodetic Survey; William E. Stephens, B.Sc. (Queen's Univ.), of London, Ont., asst. in office, Chipman and Power; Athol Choate Wright (Capt.), of Ottawa, Ont., Captain and adjutant, Can. Engrs., Halifax.

Transferred from class of Student to Junior

Robert Douglas Galbraith (Major), B.A.Sc. (Univ. of Toronto), of Toronto, Ont., professional and business occupations section, Dept. of Soldiers' Civil Re-Establishment; William Brighthelm Redman, B.A.Sc. (Univ. of Toronto), of Toronto, Ont., i/c of all engr. work in Toronto armories and other military buildings.

New Mail Route to Canada

The Canadian Government are being urged to abandon the St. Lawrence route for the transmission of mails and passengers in favour of a new route including Sydney as a port of call. Sydney (Cape Breton Island) lies directly in the line of the ocean highway between Great Britain and Canada. Its harbour is one of the finest on the Atlantic seaboard, large and well sheltered, with deep water and good anchorage, and easy and safe to enter and navigate. As it is also the most easterly port in Canada it would naturally appear to be the logical port of call for Eastern Canada.

Government tests in 1905 and 1907 proved that mails transferred at Sydney and forwarded thence by rail reached their destination a day earlier than by the St. Lawrence route, and that passengers for the Maritime Provinces effected a saving of 48 hours in their journey.

It is apparent that Eastern Canada is no longer content to be treated as a backwater portion of the Dominion in the arranging of routes for the subsidized ocean steamers plying between Great Britain and Canada. It is held that the present arrangements are unfair and prejudicial to Nova Scotia, New Brunswick, and Prince Edward Island. At least one ocean liner, inward and outward, per week, should during the season of navigation in the Gulf of St. Lawrence be required to call at Sydney for the landing and taking on of mails and passengers.

The Sydney Board of Trade is using all its efforts to induce the Government to sanction the new route, and only the superior influence of opposing interests can prevent the granting of this demand. — *The Times Engineering Supplement.*

BRANCH NEWS

St. John Branch

A. R. Crookshank, M.E.I.C., Sec'y.-Treas.

On June 26th, the St. John Branch sent out the following circular letter and salary questionnaire:—

ENGINEERING INSTITUTE OF CANADA
St. John Branch

To all Members of the Engineering Profession in New Brunswick.

Dear Sir:—

The St. John Branch of *The Engineering Institute of Canada* has recently formed a Committee to study and report upon the question of salaries and remuneration for Engineers. This action is following the example of other Branches of *The Institute* throughout the Country who are actively interesting themselves in this very pertinent and vital question.

In order to thoroughly understand the present situation in this Province, the Committee is sending to you herwith a Questionnaire on this subject with the request that you will furnish the information asked for. All information received by the Committee will be treated confidentially and no details will be published..

Kindly address your reply to A. R. Crookshank, Esq., Secy., St. John Branch, *E.I.C.*, Box 1393, St. John, N.B.

Your early attention to this matter will oblige,

Yours sincerely,
C. C. Kirby, Chairman,
G. G. Murdock,
A. R. Crookshank,
Salaries Committee.

ENGINEERING INSTITUTE OF CANADA
St. John Branch
Salary Questionnaire

A. Name......................................
B. Address......................................
C. Name of Employer..............................
D. Official title or position..........................
E. General description of duties and extent of responsability.
....
....
....
F. Present salary...................................
G. Salary of position in August, 1914..................
H. Salary of predecessor in same position..............
I. Year of appointment to present position............
J. Length of service with present employer............
K. What do you consider should be a fair and proper remuneration for the duties of your position?........
....
L. Reason in brief for increased remuneration..........
....
M. Can you give instance in your personal knowledge of apparent discrimination against Engineers in matters of salaries or unfair comparison with other employees?
....
....

A meeting of the St. John Branch of *The Engineering Institute of Canada* was held on July 3rd, A. Gray, M.E.I.C., presiding. The meeting was called for further discussion of the Act Respecting the Engineering Profession so that all the members would have an opportunity to fully discuss and understand the subject before registering their opinion in regard to it.

The matter of legislation has been given a great deal of attention by the engineering profession during the last year, as it is felt that both the engineer and the public should be better protected than at present.

Should the act become law, each engineer in the province will have to apply for registration and prove to the examining board, either by credentials or by examination, or by both, that he is qualified by special education and by practise in one or more branches of engineering to be registered as a "professional engineer." Penalties are provided for those men who are not qualified or who do not register, yet pratise as *professional* engineers.

The committee appointed to confer with the Civil Service Commission have notified the Branch that the Civil Service Act will not be passed this session, as there has been considerable protest from various employees in regard to their classification, which would work unjustly in their cases, and the government, realizing that the preparation of the act has been rushed, has decided to hold it over to the fall session and so give every person who may be discriminated against under the present proposed schedule a chance to state their cases.

The following resolution was passed:

Whereas the people of Canada are confronted with the problem of carrying the very heavy national debt incurred by their participation in the great war for humanity, and

Whereas this burden can be borne only through the greatest thrift and industry on the part of the nation, through the conservation and development of our human and natural resources, so that we may be able to share in the world's markets against the strong competition that we shall have to meet, be it therefore

Resolved that the St. John Branch of *The Engineering Institute of Canada* do hereby declare their heartiest support of the establishment by the Government of Canada of a National Research Institute, which shall carry on and direct research into such industrial, agricultural, commercial and medical problems as will best promote such conservation and development of Canada's resources, and that copies of this resolution be sent to the Council of *The Institute* to be forwarded to the Government.

Montreal Branch

Frederick B. Brown, M.E.I.C., Sec'y.-Treas.

At a meeting of the Montreal Branch Executive, held on July 10th, the matter of a National Research Institute was discussed and the following resolution was passed:—

"The Officers and the Executive Committee of the Montreal Branch of *The Engineering Institute of Canada* do hereby declare their heartiest support of the establishment by the Government of Canada of a National Research Institute which shall carry on and direct research into such industrial, agricultural, commercial and medical problems as will best promote true conservation, use and development of Canada's human and natural resources so that we as a nation may be able to fully share in the world's markets and develop a strong and healthy people in Canada."

Ottawa Branch

M. F. Cochrane, A.M.E.I.C., Sec'y-Treas.

The activities of the Ottawa Branch have recently been engaged chiefly in connection with the new Civil Service Bill and the classification authorized by it. This is a matter of special importance to the local members, as more than 80 per cent of them are directly affected by it.

In order to be in readiness for the bill when it should be presented, a special committee, of which O. S. Finnie, A.M.E.I.C., is convenor, set to work some months ago to lay before members of the House of Commons the value of the work done by the various classes of technical officers employed by the Dominion Government, and the necessity for their more adequate recognition. For this purpose a memorandum was prepared showing, by concrete examples, the importance and value to the country of the work done, the meagre salaries paid as compared to those enjoyed by other classes of the community, and the great increase in earnings received by those who had left the government service for private practice and corporation employment. This memorandum was intended to cover all classes of technical professions so as to secure the support of other technical societies in Canada, and was sent by the General Secretary to about fifty members of Parliament, all of whom had previously been approached by members of *The Institute* and who had expressed themselves as being in sympathy with the general question of placing the engineers in the public service on a better footing.

In this work all the other branches of *The Institute* co-operated most effectively with the Ottawa Branch, and it is felt that good work has been done the results of which will be apparent when the classification is under discussion at the next session of Parliament. Copies of the memorandum were supplied to the press through the Publicity Committee and considerable support has been promised.

Through G. Gordon Gale, M.E.I.C., close contact has been maintained between the committee of the Ottawa Branch and the Committee of Council which has been in touch with the Minister in charge of the Bill and the Civil Service Commission with a view to presenting the just claims of the engineer. The members of *The Institute* will better appreciate the great service rendered the engineers in the Government service, and the profession as a whole, when informed that the members of the Committee of Council came up to Ottawa on short notice several times during the past six months. Now that the bill and classification have been made public it will be possible to made definite recommendations, and for this purpose the Ottawa Branch issued a notice, which is printed on page 524 of the July *Journal*, asking for particulars of omissions and inconsistencies as they effect individuals or classes.

Niagara Peninsula Branch

R. P. Johnson, S.E.I.C., Sec'y.-Treas.

The Niagara Peninsula Branch is vitally interested in the Civil Service re-classification, as many of its members are employed on the Welland Canal. The Branch proposes taking an active stand on behalf of its members employed by the government.

A trip to the Lackawanna Steel Company of Buffalo, is being planned for sometime in August.

Sault Ste. Marie Branch

Newton L. Somers, A.M.E.I.C., Sec'y.-Treas.

The Sault Ste. Marie Branch of *The Engineering Institute of Canada*, at their regular meeting on April 24th, heard the Model Act read, which was proposed by the Special Committee on Legislation, together with the letter of transmittal appended thereto. On account of the difficulty of clearly grasping the importance and co-relation of the different sections without a study of the Act as a whole, it was decided to postpone discussion until the regular meeting of May 29th, before which date each member would have received *The Journal* containing a copy of the Proposed Act.

In the fully attended May meeting the proposed Act was reread and discussion held in which the principle of the Act was kept constantly in view while the details were discussed and analysed. It was the unanimous opinion of the Branch that the Act was correct in principle and with the probable polishing up of a few minor details was very desirable from the standpoint of the professional engineer, and would very soon prove itself to be of great value to the community at large. In view of this complete agreement with the Act, the Sault Ste. Marie Branch put itself on record by the following unanimous resolution:—

"Resolved that the Sault Ste. Marie Branch of *The Engineering Institute of Canada* is in favor of the principle of the Model Act respecting the engineering profession as drawn by the Special Committee on Legislation, at Headquarters, in Montreal, early in April, 1919, that the desire of the Branch is for all possible effort to be put forth to speedily bring this Act before the Legislatures of the several Provinces and that nothing be left undone to insure its passing those Legislatures to become a lasting benefit to the profession of engineering and to the community and State.

"Resolved further that the Sault St. Marie Branch hereby stands ready to do anything in its power to assist in the bringing into operation of this Act as it will be revised for the Province of Ontario and will be glad at anytime to support in any way possible sister Branches in other provinces to attain the same end."

Border Cities Branch

G. C. Williams, A.M.E.I.C., Sec'y.

The regular meeting of the Border Cities Branch was held on April 25th, in the offices of The Canadian Bridge Company, Ltd., Walkerville, Ont., when the Branch By-Laws, as drawn up by the Executive Committee, were adopted with a few minor changes. The meeting was then addressed by W. J. Burns, Chairman of the Committee on Town Planning for the Border Cities Chamber of Commerce. Mr. Burns in his address outlined the ideal which promoted the formation of this committee, and he requested that the Border Cities Branch of *The Engineering Institute* appoint a small committee to work with him on this problem as the subject was a purely engineering one, and he believed that it would be a great help to him and his committee.

The question of affiliate membership in the Branch was discussed at length. It was moved by H. Thorne, M.E.I.C., seconded by A. J. Stevens, M.E.I.C., and carried, that a membership committee of three members be appointed by the chairman, that all canvassing for membership be carried on through and by the direction of this committee, and that nobody be approached or canvassed for affiliate membership without the approval of the Executive Committee.

At the close of the meeting refreshments were served by the ladies of the Canadian Bridge Company's dining service.

* * *

The regular meeting of the Border Cities Branch was held in the rooms of the Border Cities Chamber of Commerce on Friday evening, June 6th, 1919.

The Chairman announced that for a half hour the meeting would be considered informal in order to listen to a Committee from the Border Cities Safety League. This Committee, with G. A. Kuechenmeister as Chairman, called to explain the object of their new league and to ask our assistance in connection with the selection of a business manager or secretary for their Association.

After a lengthy discussion of the matter the Secretary was instructed to take the matter up with the General Secretary of *The Institute* at Montreal, with view to procuring, if possible, a suitable returned Engineer for the position. The Secretary promised to turn over all information procured in this way to the Safety League Committee for their information and use. This Committee, after thanking us for our interest and endeavors in their cause, were excused and the meeting reverted to the formality of *Institute* Branch business.

J. J. Newman and L. T. Venny, two new Associate Members of *The Institute* who were proposed by J. E. Porter, A.M.E.I.C., and A. J. Riddell, A.M.E.I.C., were given a hearty welcome.

At this meeting in accordance with a resolution passed on April 25th, the following membership committee was appointed:—H. Thorne, M.E.I.C., R. A. Carlyle, A.M.E.I.C., and M. E. Brian, A.M.E.I.C. A Town Planning Committee was also appointed consisting of the following members:—A. J. Stevens, M.E.I.C., A. J. Riddell, A.M.E.I.C., and J. J. Newman, A.M.E.I.C., and the Secretary was requested to notify the Border Cities Chamber of Commerce of the appointment of this committee to act with them in this work. A committee consisting of J. S. Nelles, A.M.E.I.C., and L. T. Venny, A.M.E.I.C., was appointed to canvas members for available material and to prepare a list of papers or talks.

In future a portion of the time at each meeting will be devoted to an informal discussion of problems or subjects confronting the different members.

Personals

Chas. E. Henderson, M.E.I.C., has recently been appointed Principal Assistant Engineer of the United States Housing Corporation.

*

Galliot de Cardaillac, Jr. E.I.C., who has been serving with the French Army since September, 1914, has recently returned from overseas.

*

D. G. Calvert, A.M.E.I.C., has severed his connection with the Dayton Wright Airplane Co., and has accepted a position as Executive Superintendent of the Proctor & Gamble Co., Cincinnati, Ohio.

*

Professor E. G. Matheson, M.E.I.C., assistant engineer on the staff of the University of British Columbia and acting head of the Department of Civil Engineering, has been appointed, under A. D. Swan, M.E.I.C., to take charge of the surveys and borings in connection with the contemplated development of the Harbor of Vancouver. This work it is expected will be completed about the middle of August, this year.

*

Robt. H. Parsons, M.E.I.C., who, previous to the war, was in charge of the water works of the City of Edmonton, has been overseas since the early days of the war. Mr. Parsons was with the Royal Engineers and later with The Production of Munitions, and is now in Canada in the interests of John Birch & Company, Ltd., London, with whom he has accepted a position as sales engineer. Mr. Parsons will make his headquarters in London.

*

Geo. K. McDougall, M.E.I.C., announces that he has taken into partnership, Major E. Raymond Pease, D.S.O. The name of the new firm will be McDougall & Pease. They will carry on the business of Consulting Engineers formerly conducted by Mr. McDougall, specializing in industrial applications of electricity, illuminating engineering, electric power stations and high voltage power transmission.

*

J. F. Rowlands, A.M.E.I.C., who previous to the war, where he served for two years, was connected with the Water Rights Branch of the Department of Lands in the Province of British Columbia, has left for England. His address is: "Wakefield," Ballards Lane, Finchley N.12, London, England. Mr. Rowlands is planning to associate himself with commercial activities in representing British industrial firms in Egypt or India.

*

J. Davis Barnett, A.M.E.I.C., has recently moved from Stratford, Ontario, where he has resided many years, to London, Ontario. Mr. Barnett has been a deep student all his life, and has obtained a reputation in literary circles throughout the country. Recently Mr. Barnett has placed his valuable library, containing some rare books on early transportation and all past issues of *The Institute's* publications, in the library of Western University, London, Ontario, and has advised the Secretary that these volumes are available for the use of members of *The Institute.*

*

The many friends of William Archibald Duff, M.E.I.C., throughout Canada, and particularly in the West where he was so well known, will be sorry to know that, at the present time, the condition of his health is giving serious anxiety to his immediate family. About a year and a half ago Mr. Duff suffered from a nervous breakdown, but, after a year's rest, he returned to his office as Western Manager of the Canadian Westinghouse Co. He was, however, able to attend to his duties a short time only. Mr. Duff was, until recently, chairman of the Manitoba Branch.

*

Major Norman Macleod Hall, B.Sc., O.B.E., A.M.E.I.C., received a hearty welcome on arriving at his home in Cornwall, Ont., on July 21st, being the last of four sons of Mrs. John Hall, of Cornwall, to reach home from overseas. Major Hall graduated from McGill University, in 1907, in mechanical engineering and served an apprenticeship course in the G.T.Ry. shops. Going to Vancouver, he became associated with the firm of Ducane, Dutcher & Company, where he was engaged in various engineering work until the spring of 1915, when he proceeded overseas, enlisting with the Royal Engineers as a lieutenant. He went to France in December, 1915, and was with the Royal Engineers throughout the entire war, winning his majority in the field. In January, 1916, he was wounded by shrapnel at Bethune, but shortly returned to the front. At the time of the armistice as a reward for his gallant service he was given the Order of the British Empire.

*

Robert G. Weddell, A.E.I.C., and R. G. Saunders, A.M.E.I.C., have recently formed a partnership and will carry on an engineering and contracting business under the the firm name of Weddell & Saunders, with head office at Trenton, Ont. Their Toronto office is at 312 McKinnon Bldg. They will specialize in harbor work, in which class of work, both partners have had wide experience. Mr. Weddell was formerly connected with R. Weddell & Co., who did a large amount of harbor work on Lakes Erie and Ontario, and also for the Toronto Harbor Commissioners. He is now head of the Weddell Dredging & Contracting Company and the Weddell Bridge and Engine Works, both of Trenton. Mr. Saunders recently returned from overseas, where he was staff captain, 2nd Brigade, Canadian Engineers. At the time of his enlistment he was with the Toronto Harbor Commission as assistant superintendent of construction, and previously had been a partner in the firm of Wilson, Townsend and Saunders, contractors.

*

Lieutenant Edward W. Francis, R.A., S.E.I.C., elder son of Vice-President Walter J. Francis, has recently returned home, having served with distinction in France, Egypt and Palestine. He left Canada, in 1917, at the conclusion of a special preparatory course at the Royal Military College, Kingston, and received an Imperial commission. After serving for some time in England and France, he was sent out to take part in the Palestine campaign in charge of a trench mortar battery. Outside Alexandria his ship was mined and he was the only survivor of his battery, in addition to which all the equipment was lost. Following his convalescence, after an illness brought on by his ten mile swim to the shore, he went through General Allenby's Palestine campaign, attached to the 10th Irish Brigade, up to the capture of Damascus, when he was invalided to Egypt and later to England.

His superior officers speak very highly of him and his record is a most enviable one. He is now well recovered and hopes to re-enter the university in the autumn to complete his education.

OBITUARIES

Word has recently been received by Mr. and Mrs. William Lennox, Owen Sound, informing them of the death of their only son, Victor J. Lennox, S.E.I.C., at the Ontario Military Hospital, Orpington, England, on June 30th, from pleurisy and pneumonia following an attack of influenza.

Late Sapper Victor J. Lennox, S.E.I.C.

Previous to his enlistment for overseas the late Mr. Lennox was instrumentman, under L. J. Devereux, A.M.E.I.C., of the Grand Trunk Pacific Railway with headquarters at Prince George. He was elected to *The Institute* on October 30th, 1917, being then twenty-six years of age.

He was a young man of sterling character and splendid ability, held in the highest esteem by all with whom he came in contact, and had already given promise of a useful and successful career. He was a Presbyterian and a member of the Independent Order of Oddfellows.

* * *

Thomas E. Hillman, M.E.I.C., whose death took place at Whitestone, Long Island, N.Y., from influenzal pneumonia, was born at Worthington, Sussex, England, on October 24th, 1848.

Mr. Hillman was one of the founders of *The Institute*, in 1887, and for 21 years was on the Engineering Staff of the Grand Trunk Railway. From 1889 to 1891 he was Engineer-in-Charge of the St. Clair Tunnel, with supervision of trial borings, location, the construction of the tunnel, approaches and connecting lines of railways. Later, as chief engineer, he located and constructed several electrical railways and hydraulic plants in Ontario, including the hydraulic system from the Welland Canal to DeCew Falls for electrical power, which was known as The Dominion Power & Transmission Co., of Hamilton, Ont. In 1910, he had sole supervision of test borings on the Bow River, Alta., for the foundation of the Canadian Pacific Railway Company's irrigation dam, which is regarded as one of the most important structures of its kind in the Dominion.

Late Thomas E. Hillman, M.E.I.C.

From 1910 to 1912 Mr. Hillman was in private practice as a civil engineer in Hamilton, Ont., and from 1912 to 1914, when he retired from active work, he was in private practice as a consulting engineer in New York city. Mr. Hillman is survived by Mrs. Hillman, one son, and one daughter.

Employment Bureau

Situations Vacant

Civil Service

The Civil Service Commission of Canada hereby gives public notice that applications will be received from persons qualified to fill the following positions in the Civil Service of Canada:—

A Senior Construction Architect for Calgary Public Building, Salary, $250 per Month.

1. A Senior Construction Architect for the Calgary Public Building, Department of Public Works, at a salary of $250 per month. Applicants should be thoroughly competent architects with from 6 to 8 years experience as principal of an architectural firm or should have practised for themselves for a similar period, and should be accustomed to superintendence of construction. Applicants should be residents of the Province of Alberta.

An Assistant Engineer for the Trent Canal, Salary, $2,100 per annum.

2. An Assistant Engineer for the Trent Canal, during the construction of the Trent Canal, with head office in the City of Peterborough, Ont., Department of Railways and Canals, at an initial salary of $2,100 per annum. Candidates should have education equivalent to graduation in engineering from a recognized Canadian University or Engineering College. They should have at least 8 years of experience in general engineering work, including construction of works of considerable magnitude; it is desirable that this experience should have been, to a large extent, in canal and general hydraulic work; it should include surveys, preliminary estimates, construction, final estimates, designing, drafting, and general office work. Candidates should be accustomed to handling men and should be, at least, 30 years of age.

An Assistant Astronomer, Dominion Observatory, Salary, $1.800 per Annum.

3. An Assistant Astronomer for the Dominion Astronomical Observatory, Department of the Interior, at an initial salary of $1,800 per annum. Candidates should be graduates of a university of recognized standing, with specialization in astronomy, in mathematics and in physics. They should have at least three years experience as an observer or as a post-graduate student in astronomical research. They should have enthusiasm in their work, good constitution and good eyesight.

An Investigator, Division of Road Materials, Dept. of Mines, Salary, $1,600 per Annum.

4. An Investigator, Division of Road Materials, Mines Branch, Department of Mines, at an initial salary of $1,600 per annum. Candidates should be graduates in science or engineering of a recognized university and have had special training in highway engineering and the examination of road materials. They must have a practical knowledge, gained by several years of experience, in field and laboratory investigation, of problems in the use of naturally occuring road materials in their relation to factors and conditions affecting the highway construction situation in Canada. Reference to any reports the applicants have written should be given.

Three Forest Assistants, Department of the Interior, Salary, $1,320 per Annum.

5. Three Forest Assistants, Department of the Interior, at initial salaries of $1,320 per annum. Candidates should have education equivalent to a university course at a recognized school of forestry and should be well recommended by the staff of the school or by men who may have employed them in connection with forestry work. They must be between the ages of 21 and 45 and be physically fit for enduring hardships incidental to bush work. The appointees will be assigned to positions in the four western provinces.

A Photographer for the Welland Canal Head Office Staff, Salary, $1,200 per Annum.

6. A Photographer for the Welland Canal Head Office Staff, Department of Railways and Canals, at an initial salary of $1,200 per annum. Candidates should have had a public school or equivalent education. They should have had at least seven years experience in photographic work, and have a thorough knowledge of the use of the camera, developing plates and printing. Preference will be given to candidates who have had experience in taking views of public works for the purpose of recording the progress of the work and in the photographic and blue printing department of a large Railway, Bridge, or Engineering Construction Company's office. Candidates must be at least 30 years of age.

Note

In the case of positions numbers 1, 2, 5 and 6, preference will be given to residents of the provinces in which the vacancies occur.

Application forms properly filled in, must be filed in the office of the Civil Service Commission not later than August the 8th. Application forms may be obtained from the Dominion-Provincial Employment Offices, or the Secretary of the Civil Service Commission, Ottawa.

Ottawa 10th July, 1919.

Second List

A Designing Mechanical Engineer for the Welland Ship Canal, Dept. of Railways and Canals, Salary, $300 per Month.

1. A Designing Mechanical Engineer for the Welland Ship Canal, Department of Railways and Canals, at a salary of $300 per month. Candidates must be graduates in mechanical engineering of a school of applied science of recognized standing and should have at least ten years of experience in the design, estimate and construction of mechanical equipment and apparatus, three years of which shall have been in responsible charge of such work. Candidates should have ability to make thorough examinations, investigations, tests and reports upon various existing or proposed mechanical installations or apparatus.

A Mechanical Draughtsman for the Welland Canal, Dept. of Railways and Canals, Salary, $125 to $150 per Month.

2. A Mechanical Draughtsman for the Welland Canal, at a salary of $125 to $150 per month. Candidates must be, at least, 25 years of age. They should have a High School education or equivalent. They must have had at least four years' practical experience in the work

shops of a recognized engineering construction company, including two years' experience on erectional and outside work supplemented by two years' experience in the drawing office of a large bridge company in the preparation of designs, estimates, plans and specifications. Preference will be given to graduates of a recognized School of Engineering and particularly to applicants with experience in works involved in the construction of canals, harbours and hydro-electric plants.

A Chief, Organization Branch, Civil Service Commission, Salary, $2,800 per Annum.

3. A Chief, Organization Branch, Civil Service Commission, at an initial salary of $2,800 per annum. The duties of this officer are to be responsible, under the Secretary, Civil Service Commission, for the conducting of investigations and surveys and the preparation of plans of organization for the various departments and subordinate units thereof in the Dominion Government; to have charge of the making of investigations in connection with the efficiency of processes or operations or of individuals or groups of individuals within departments; to administer and keep up to date the classification of the Civil Service; to direct the staff of the Organization Branch; and to perform other related investigational and administrative work as required.

Candidates shall be not less than twenty-five and not more than forty years of age and must be of good address, tactful, able to meet the public and departmental officials and to judge people. They must possess education equivalent to graduation from a university of recognized standing in accounting, economics, engineering or science and at least five years of experience in accounting, engineering, shop or business management, or similar work, of which at least two years shall have been in an administrative capacity. Applicants must be familiar with Civil Service administration or the organization and methods of large business concerns. Experience in investigation or organization work is very desirable.

The examination will consist of three parts, rated as follows:—(1) Education and experience, 40; (2) a thesis on a problem in office management, accounting, industrial operation, or organization, to be chosen from a list established by the Commission, 30; (3) Oral interview, 30. Applicants will not be assembled for the statements of education and experience and for the thesis, but may do this work at their own homes. These will be received only from those candidates who show that they possess the minimum qualifications in education and experience. Those successful in the first two parts of the examination will be assembled later at one or more points for oral interview.

An Investigator, Organization Branch, Civil Service Commission, Salary, $2.200 per Annum.

4. An Investigator, Organization Branch, Civil Service Commission, at an initial salary of $2,200 per annum. The duties of this officer will be, under the supervision of the chief, Organization Branch, to make investigations and surveys and to prepare reports thereon in connection with the organization of departments or in connection with the efficiency of processes or operations, or of individuals, or groups of individuals within the several departments of the government; to assist in administering and maintaining the classification of the Civil Service; and to perform other related work as required.

Candidates must possess education equivalent to graduation from a university of recognized standing; two years of business or engineering experience; ability in investigational work, supervisory ability; initiative, tact, and good judgment; good address.

The examination will consist of three parts, rated as follows:—(1) Education and experience, 40; (2) A thesis on a problem in office management, accounting, industrial operation, or organization, to be chosen from a list established by the Commission, 30; (3) Oral interview, 30. Applicants will not be assembled for the statements of education and experience and for the thesis, but may do this work at their homes. Theses will be received only from those candidates who show that they possess the minimum qualifications in education and experience. Those successful in the first two parts of the examination will be assembled later at one or more points for the oral interview.

An Editor and Statistician, Department of Trade and Commerce, Salary, $2,100 per annum.

5. A male assistant to undertake editorial work, chiefly in connection with the Canada Year Book, in the Dominion Bureau of Statistics, at a salary of $2,100 per annum. Applicants should be university graduates of economic and statistical training and should have editorial experience. The appointment will be made on a temporary basis, but the position may eventually be made permanent.

General Directions.

The salaries for the above positions will be supplemented by such bonus as may be provided by Parliament.

Selections for eligible lists of applicants qualified to fill similar vacancies which may occur in future may be made from the applications for these positions.

According to law, preference is given to returned soldier applicants, possessing the minimum qualifications. Returned soldiers must furnish a certified copy of their discharge certificates, or in the case of commissioned officers, a certified statement of their military services.

In the case of positions numbers 1 and 2 preference will be given to residents of the provinces in which the vacancies occur.

Application forms properly filled in, must be filed in the office of the Civil Service Commission not later than August 15th,.

Situations Wanted

Civil Engineers

Civil Engineer—Ex-soldier, seventeen years experience on Investigations, Design, Construction, Sewerage, Sewage Disposal and Water Works. Box 8-P.

Civil Engineer, age 32, married, returned soldier, British Columbia Land Surveyor, fourteen years experience in Hydrographic and Municipal Engineering, Railroad Surveying, etc. Box 9-P.

Civil Engineer, University Graduate, unmarried, desires position in South America. Experienced in construction. Employed at present time by one of the largest Canadian Mining Companies. Reason for advertisement purely personal wish to go to South America. Full particulars of experience upon enquiry and also references from past and present employers. Write Box 10-P.

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HONOUR ROLL

C. N. MONSARRAT
Col. A. E. DUBUC, C.M.G., D.S.O.
FRASER S. KEITH
And a member from each branch.

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A. E. DOUCET
District No. 2—ALEX. FRASER
District No. 3—Capt. J. L. ALLAN
District No. 4—A. A. DION
District No. 5—GEO. HOGARTH
H. U| HART
District No. 6—GUY C. DUNN
District No. 7—O. W. SMITH
District No. 8—A. W. HADDOW
SAM. G. PORTER
District No. 9—NEWTON J. KER
E. G. MARRIOTT

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L. A. HERDT, Chairman
L. W. GILL
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ENGINEERING STANDARDS

L. A. HERDT
G. H. DUGGAN
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INTERNATIONAL AFFILIATION

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JOHN MURPHY
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W. CHASE THOMSON
W. A. BOWDEN
J. G. LEGRAND
GEO. W. CRAIG
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H. E. ESTRUP

STEAM BOILER SPECIFICATIONS

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LEGISLATION COMMITTEE

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T. H. WHITE	"

Preliminary Notice

of Application for Admission and for Transfer

20th July, 1919.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in August, 1919.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BEAUCHEMIN—JULES ARMAND, of Ottawa, Ont. Born at Montreal, Feb. 5th, 1890. Educ., B.A.Sc., Laval Univ., 1911. Summers 1908-10, student asst. engr. on dredging inspection, Richelieu River improvements, P.W.D.: 1911-12, asst. to res. engr. on same, in chg. of survey and sounding party etc.; 1912-17, engr. in chg. of metering party on St. Lawrence River in connection with Chicago drainage scheme; 1917-19, engr. in chg. of metering and survey party, Ottawa and Quinze Rivers; at present, asst. engr., Upper Ottawa Storage, Ottawa.

References: C. R. Coutlee, L. A. DesRosiers, E. D. Lafleur, A. St. Laurent, S. B. Johnson, A. J. Matheson, P. E. Mercier.

BOYD—WALTER HALCRO, of Ottawa, Ont. Born at Toronto, Ont., Jan. 31st, 1878. Educ., B.A.Sc., Toronto Univ., 1898. 1900 to date with Geological survey of Canada as follows:—1900-08, asst. on field parties and responsible for topographical mapping, also asst. in office; 1908, organized and administered the topographical division and directed the work; 1912 to date, ch. topog'r.

References: K. M. Cameron, W. J. Stewart, N. J. Ogilvie, G. B. Dodge, J. J. McArthur.

CHESTNUT—VICTOR STANLEY, of East St. John, N.B. Born at Toronto, April 17th, 1888. Educ., B.A.Sc., 1909, post grad. 1912, Toronto Univ. 1907, on location, Ontario Power Co., N. St. C. & T. Ry.; 1909-10, rodman on constrn., C.N.O. Ry.; 1910-11, inst'man on constrn., C.N.P.; 1911 (6 mos.) res. engr. on constrn.; 1912-13, res. engr.; 1913-17, asst. res. engr., Welland Ship Canal; 1917 (6 mos.) asst. engr., Quinlan & Robertson, on Bloor Street viaduct, Toronto; 1917 (3 mos.) engr., Munro Constrn. Co., bridges and culverts; 1918 (9 mos.) asst. engr., McFarlane, Pratt, Hanley Ltd., on concrete grain elevator; at present, asst. engr., St. John Dry Dock & Shipbuilding Co., on constrn. of dry dock, breakwater, channel and ship repair yards.

References: E. G. Cameron, A. R. Dufresne, C. L. Hays. W. H. Sullivan, J. L. Weller.

COOMBS—JAMES ANDREW, of Toronto, Ont. Born at Blyth, Ont., Nov. 5th, 1891. Educ., B.A.Sc., Toronto Univ., 1913. 1909-10, with C.N.R.; 1911-12, rodman, draftsman, G.T.R.; 1913-14, draftsman and inst'man C.N.R.; 1915-16, inst'man, Alaskan Eng. Comm.; Feb. 1917 to date, with Hydro-Elec. Power Comm. as inst'man; at present in chg. of surveys, Nipigon project.

References: A. Drowley, G. F. Hanning, T. H. Hogg, J. N. Stanley.

DRUMMOND—RICHARD, of Lindsay, Ont. Born at Campbelltown, Scotland, Oct. 3rd, 1889. Educ., Campbelltown Academy and Glasgow & West of Scot. Tech. Coll. (evenings). 1906-08, apprentice with Andrew Giffen & Sons, gen. engr., Campbelltown; 1908-11, apprentice on marine work; 1911-13, dftsman on mining machinery, Chester Renfrew Eng. Co., Renfrew, Scotland; 9 mos. dftsman, Glasgow Nut Lock & Eng. Co., on oil and gas engines; 1913 to date, with Boving Hydraulic & Eng. Co. Ltd., as dftsman, since 1915 in chg. of drafting room.

References: R. W. Leonard, E. A. Jacobson, R. F. Wilford, H. E. Maple, N. C. Sherman.

EARNSHAW—PHILIP (Major, M.C., D.S.O.), of Toronto, Ont. Born at Huddersfield, Eng., Apr. 2nd, 1892. Educ., B.Sc., Queen's Univ., 1914. Summer 1912, geodetic precise levelling; 1913, inst'man, Pasquia reclamation survey; 1914, first asst. and inst'man, plane table work, geological survey, New Glasgow coal fields, and first asst. on hydrographic survey, Upper Ottawa conservation, also resident on repair of Temiskaming dam; 1914-19, on active service, since Jan. 1917, in command, Unit Signal, Can. Engrs., France.

References: F. X. Ahern, J. L. H. Bogart, L. Malcolm, A. Macphail, F. S. Rutherford, W. P. Wilgar.

FRASER—ROBERT HUNTER, of Ottawa, Ont. Born at Shelburne, N.S., Sept. 9th, 1866. Educ., private tuition. 1885-90, field work and constrn., N.S. Central Ry.; 1890-94, supt. of constrn., N.S.C. Ry.; supt. of operations; in chg. in Canada, elec. ry. location and constrn. Edison Gen. Elec. Co.; 1894-96, Toronto Sub. Elec. Ry.; 1896-1904, engr. of local committee, Gen. Elec. Co.; various elec. rys., lighting and power installation and operations; 1904-13, N.T.C. Ry. commission; at present, right of way and lease agent, Dept. Railways & Canals.

References: W. P. Anderson, J. A. Aylmer, A. J. Grant, G. Grant, R. W. Leonard.

FRITH—HUGH WALTER, of Vancouver, B.C. Born at London, Eng., Jan. 22nd, 1884. Educ., Tech. Inst., Cape Town, Africa. 1906, asst. on roads and highways, Cawdery Constrn. Co., Cape Town; 1907-08, asst. ch. draftsman, Franco-British Exhibition, London, Eng.; 1909-10, supt. of constrn., Imperial International Exhibition, London; 1911, asst. on underground constrn., Reeds Elec. Co. Ltd., London, Eng.; 1912-14 asst. in city engr's dept., Vancouver, B.C.; 1915, asst. on hydrographic survey, Fraser River and Squamish, P.W.D.; 1916 to date, asst. engr., Vancouver Harbor Commission, on reclamation and gen. harbor work.

References: C. Brakenridge, J. C. Craig, C. R. Crysdale, F. L. Fellowes, E. G. Matheson, T. H. Tracy.

HELYER—MAURICE (M.C.), of Vancouver, B.C. Born at Bournemouth, Eng., Nov. 14th, 1887. Educ., Woolston Coll., Southampton. 1904-06, pupil with Myers & O'Brien, architects and engrs., San Francisco, latterly as asst. supt. on bldg.; 1906-08, inst'man on location, Southern Pacific Ry.; 1908-15, private practice as structural engr., Jno. S. Helyer & Son; 1915, estimating engr., with Henry, McFee & McDonald, gen'l contractors, entire responsibility for materials and costs on govt. docks at Salisbury Drive; 1915-19, on active service with 1st Can. Bridging Co., C.R.T.; at present, structural engr.

References: H. M. Burwell, H. J. Cambie, J. R. Cosgrove, N. J. Ker, A. P. Linton.

HODSDON—DONALD WILBUR (Lieut.), of Nelson, B.C. Born at Portland, Me., Oct. 31st, 1890. Educ., 1 term Vancouver Coll., 1 yr. McGill Univ., B.C., Season 1907, with B.C. Elec. Ry.; 1908, in city engr's office, Vancouver; 1909-13, asst. with Cleveland & Cameron, engrs. and surveyors, work including topographical and land surveying, chg. of parties, etc.: 1913-14, mgr., A. I. Robertson, B.C.L.S., Victoria, B.C.; 1914-15, asst. engr., Union Terminal Ry., St. Joseph, Mo.; 1916-19, lieut., C.E.F., eng. and forestry officer, on camp, pier, dsgn. and constrn., light ry. location; since Apr. 1919, asst. dist. engr., Water Rights Branch, Nelson, B.C.

References: W. J. E. Biker, E. A. Cleveland, A. G. Dalzell, S. S. McDiarmid, A. M. Phillips, R. G. Swan, C. T. Hamilton.

JOHNSTON—WILLIAM MORRISON, of Hamilton, Ont. Born at Stamford, Ont., Oct. 11th, 1889. Educ., B.Sc., Queen's Univ., 1913. Summer 1911, rodman on land subdiv. and gen. survey work, with F. W. Paufin, Niagara Falls, Ont.; 1913-14, sewer inspector, Toronto, on tile pipe, concrete and brick sewers, etc.; 1914-16, res. engr. on sewers, Toronto; 1916-18, constrn. cost engr., International Nickel Co., Copper Cliff, Ont.; 1918 (5 mos.) overseas training company; Mar. 1919 to date, engr. in chg. of sidewalk constrn., Hamilton.

References: E. R. Gray, J. A. McFarlane, R. K. Palmer, F. W. Paulin, W. Worthington.

KEITH—GROVER, of St. John, N.B. Born at Sussex, N.B., June 12th, 1884. Educ., grammar school and ry. eng. course, corresp. school. 1903, asst. to tidal survey, Marine & Fisheries Dept.; 1904, rodman on constrn., N.B. Coal & Ry. Co.; 1904-11, with T.C. Ry., as dftsman, leveller, transit and inst'man; 1912-15, with St. J. & Que. Ry., as office engr., ch. survey party and res. engr.; 1915 to date with T. McAvity & Sons, as follows:—1915-16, asst. supt. of shell plant; 1916-17, supt., of shell plant; 1918, supt. in chg. of constrn. of munition plant.

References: R. H. Cushing, C. O. Foss, D. Maxwell, R. Thompson, S. B. Wass, L. H. Wheaton.

LANDERS—THOMAS LEON SPOOR, of Levis, P.Q. Born at Farnham, P.Q., Dec. 15th, 1888. Educ., 1 yr. science, McGill Univ., course in ry. eng., I.C.S. 1910-13, with C.P.R., Farnham, as rodman, draftsman, instman; 1913-15, asst. res. engr., C.G. Ry., New Glasgow, N.S ; 1915-17, res. engr., Truro, N.S.; 1917-19, asst. div. engr., C.N.R., Levis.

References: C. B. Brown, F. W. Cooper, A. C. Mackenzie, K. S. Pickard, H. T. Ruhl.

MacLACHLAN—JOHN GORDON (Major), of Kamloops, B.C. Born at Lochaber Bay, Que., Sept. 4th, 1886. Educ., high school. 1906, rodman on constrn., B.S. & H.B. Ry.; 1907-09, with Trent Valley Canal, as rodman, later concrete inspector; 1910, rodman and inst'man, maintenance of way, C.P.R.; 1911-14, res. engr., C.N.O. Ry.; 1914-15, acting div. engr. in chg. of track ballasting, bldgs. etc.; 2 yrs. in France as coy. commander, 3 mos. installing machinery in connection with quarrying, dept. of roads., at present, div. eng. on constrn., C.N.R.

References: W. A. Bowden, J. G. G. Kerry, D. W. McLachlan, G. P. MacLaren, A. F. Stewart, W. G. Swan.

McCARTHY—THOMAS VINCENT, of Toronto, Ont. Born at Chalk River, Ont., July 3rd, 1888. Educ., B.A.Sc., Toronto Univ., 1913. 1908-09, rodman, etc. on maintenance of way, C.P.R.; 4 mos., on constrn., with Can. Copper Co.; 1909-10, asst. res. engr., G.T. Ry., Toronto; 1911 (5½ mos.) concrete inspector, C.P.R.; 1912 (5 mos.) inst'man in chg. of field party, A.E. Ry.; 1913-16, asst. engr. in chg. waste water prevention, P.W.D., Toronto; 1916-19, overseas with Can. Field Artillery; at present, asst. laboratory engr., Hydro Elec. Power Comm.

References: C. L. Fellowes, P. Gillespie, E. R. Gray, E. G. Hewson, F. S. Rutherford, C. R. Young, R. B. Young.

O'CONNOR—J. F., of Aylmer East, Que. Born at Wexford, Ireland, Sept. 10th, 1883. 1910-11, on topographical survey, G.T.P. Ry.; 1911-13, residency on constrn., G.T.P.; 1913-16, residency, A. & G.W. Ry.; 1916-17, in chg. of constrn. of Smokey River steel bridge; 1917-18, residency, E. D. & B. C. Ry.; 1918 to date, in chg. of ry. work, including constrn. and location, United Grain Growers, Hutton, B.C.

References: J. Callaghan, J. A. Heaman, R. W. Jones, B. B. Kellifer, M. Murphy, W. R. V. Smith.

POZER—CHARLES HENRY (Major), of Vancouver, B.C. Born at St. George, Que. May 8th, 1890. Educ., B.Sc. (C.E.) McGill Univ., 1910. Summer 1908, rodman on location, Que. Central Ry.; 1909, inst'man on constrn., Q.C.R.; 1910-12, inst'man on constrn., C.P.R.; 1912-13, res. engr. on constrn., G.T.P. Ry.; 1913-14, inst'man on location, E.D. & B.C. Ry.; 1914, res. engr.; 1914-15, locating engr., A. & G.W. Ry.; 1915-16, div. engr. on constrn.; 1917-19, major, 4th Can. Ry. Troops, France; at present, industrial surveyor, vocational branch, Soldiers' Civil Re-Establishment.

References: W. R. V. Smith, F. J. George, J. T. Morkill, W. G. Swan, J. A. Walker.

REID—GEORGE CHARLES (Lieut., M.M.), of Cobalt, Ont. Born at Dartmouth, N.S., Oct. 22nd, 1880. Educ., 3½ yrs., School of Mining, Queen's Univ. 1902. Gen. work at gold and coal mines of N.S., during summers while at College. 1903-04, chemical analyst, American Steel Foundries, St. Louis, Mo., and Portsmouth Steel Co., Portsmouth, Ohio; 1904-11, leveller and transitman on location and constrn., T.C. Ry. in N.B.; 1912-15, res. engr. on constrn. in Sask., C.N.R.; 1916-19, on active service, awarded M.M. at Passchaendale, 1918, lieut., 7th, Batt., Can. Engrs., France; on trench, defence and light bridge work, etc., at present, res. engr. in chg. of constrn. Lucky Lake branch, C.N.Ry.

References: W. Burns, F. G. Haven, H. Longley, A. V. Redmond, J. A. Reid, W. P. Wilgar.

ROSS—ALEXANDER M., of Winnipeg, Man. Born at Walton, Ont., Nov. 18th, 1889. 1907-11, rodman, inst'man. etc., G.T.P.; 1912-14, res. engr.; 1917, sgt., 3rd Batt.; 1917-19, lieut., 11th Batt., Can. Ry. Troops, in chg. location and other eng. work in field; at present, inst'man, G.T.P., Mountain div.

References: W. E. Davis, G. C. Dunn, J. A. Hesketh, L. E. Silcox.

SHERMAN—HARRY B., of Regina, Sask. Born at Watertown, N.Y., Apr. 4th, 1890. Educ., 3 yrs. Syracuse Univ., 1 yr. course in automatic telephone eng., Automatic Elec. Co., Chicago; 1911-13, on installation and maintenance of automatic central office equipment, with Alta. Govt. telephones, Calgary; 1914 to date with Sask. Govt. Telephones, in connection with dsgn. of local and long distance switchboards and instruments, at present, traffic supt.

References: W. R. Warren, R. C. F. Chown, J. N. deStein, L. A. Thornton, H. S. Carpenter.

THEXTON—ROBERT DONALD (Capt.), of Ottawa. Born at Lindsay, Ont., May 19th, 1890. Educ., 4 yrs. scientific course, Davenport High School. 1908-09, draftsman, Peoples Light & Power Co., Davenport, Iowa; 1911-13, rodman and inst'man, C.N. Ry.; 1913-14, asst. to Major D. Barry, at Connaught Rifle Range, Militia Dept.; Aug. 1914, July 1919, lieut. and capt., Can. Engrs.; at present, engr., eng. branch., Dept. Militia & Defence.

References: D. Barry, A. B. Deroche, H. E. Maple, H. B. Miller, H. W. Tate, H. L. Trotter.

WEIR—DAVID HENRY (Lieut.), of Burford, Ont. Born at Cathcart, Ont., Nov. 24th, 1884. Educ., B.A.Sc., Toronto Univ., 1913. 1913-14, asst. to Dundas county engr; 1915, contractor, Oxford county highways; Mar. 1916-19, lieut., infantry and 1st. Batt., Can. Engrs., France.

References: D. H. Fleming, E. R. Gray, F. S. Rutherford.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

ARCHER—AUGUSTUS ROWLEY, of Port Washington, N.Y. Born at Birmingham, Eng., Dec. 4th, 1875. Educ., B.Sc. (Mining) McGill Univ., 1901. 1896-1902, with Purdy & Henderson, structural engr., New York, on design of large steel framed bldgs.; with Theo. Cooper, bridge engr., N.Y.; Dom. Bridge Co., Montreal, on bridge and bldg. design, and with Jacobs & Davies, conslt. engrs., N.Y.; 1902-04, structural engr., with Ford, Bacon & Davis, N.Y., on reconstrn. and electrification of Metropolitan street ry. system, Kansas City; 1901-05, res. engr., with Peter Lyall & Sons, Montreal, on constrn. of C.P.R. station, Winnipeg; 1905-09, res. and div. engr. with Jacobs & Davies on tunnels under Hudson River, etc.; 1909-14, with Carnegie Steel Co., as specialist on use of steel sheet piling; temporary mgr., Philadelphia Steel & Wire Co.; Camden, N.J., and reporting on location for and supervising design and constrn. of Boston warehouse; 1914-15, with Concrete Steel Co., N.Y., as engr. on special work; 1915-17, with Aetna Explosives Co., as supt. of constrn. and operating supt. of plant; 1917-18, with Imperial Munitions Board, Ottawa, supervising constrn. and operation of explosives plants, acids, etc.; 1918-19, with Jacobs & Davies Inc., consl. engrs., on investigation for tunnelling Mississippi River, etc.

References: H. D. Bush, W. W. Colpitts, C. J. Crowley, J. V. Davies, G. H. Duggan, C. E. Fraser, J. A. L. Waddell.

FARMER—JOHN TAYLOR, of Ste. Anne de Bellevue, Que. Born at Liverpool, Eng., Dec. 14th, 1874. Educ., B.Sc., M.Sc., Liverpool Univ., 1894. B.A.Sc., Ma. E., McGill Univ. 1891-95, apprenticeship; 1897-98, asst. examiner, Canada Patent Office; 1899, with Crosby Steam Gage & Valve C., Boston; 1899-1900, Ball & Wood Co., Elizabeth, N.J.; 1900-01, Watts-Campbell Co., Newark, N.J.; 1901-04, asst. to mech. engr. and sales engr., Green Fuel Economizer Co., New York; 1905 to date, consulting engr. in mech'l and hydraulic eng., also sales engr. and representative of various eng. concerns.

References: E. Brown, F. B. Brown, J. S. Costigan, R. J. Durley, W. J. Francis, H. M. Jaquays, R. S. Lea, F. T. Peacock.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

AGGIMAN—JACQUES NISSIM, of Port Alfred, Que. Born at Constantinople, Mar. 7th, 1892. Educ., B.Sc., McGill Univ., 1917. 1911-15, draftsman, St. Lawrence Bridge Co., on detail drawings of Quebec Bridge; 1916 (6 mos.) ch. engr. St. Lawrence Pulp & Lumber Corp., Chandler, Que., special work, design of extension to mill; May 1917 to date with Ha Ha Bay Sulphite Co. Ltd., as follows:—1917-18, ch. engr., and in chg. of constrn. of pulp mill; Feb. 1918 to date, ch. engr. and asst. supt., responsible for all eng. work and improvements to plant.

References: E. Brown, G. V. Davies, A. L. Harkness, H. M. Mackay, G. F. Porter.

KNIGHT—FREDERIC CARR, of Montreal. Born at Alberton, P.E.I., June 3rd, 1886. Educ., B. Eng. 1909, Dalhousie Univ., M.Sc., McGill, 1915. 1905 (3 mos.) leveller, Standard Coal & Ry. Co.; 1906 (2 mos.) transitman, land surveys, A. R. Bayne, Five Islands, N.S.; 3 mos. leveller, H. & E. Ry.; 1907 (4 mos.) topog'r; 1907-08, field dftsman.; 1908 (4 mos.) cost clerk, I.C. Ry., Moncton; 1910-12, in chg. of physical tests, C.P.R.; 1913 (5 mos.) inst'man, C.P.R.; 1915 (6 mos.) in chg. of field party on constrn. of sewer and design; 1916-17, in. chg. of bridge survey party, collecting pre-inventory data for valuation dept., etc. G.T.P.; 1917 (7 mos.) computer, G.T.P.; Nov. 1918-Apr. 1919, instructor in math. and eng. Khaki Coll. of Canada, France; at present preparing statistics on cost of land, G.T.P. valuation dept., in connection with U. S. Federal Valuation of railroads.

References: E. E. Brydone-Jack, A. Crumpton, R. de L. French, C. P. Howrigan, R. McKillop, A. C. Oxley, C. W. P. Ramsey.

MACRAE—LAWRENCE PASCHAL, of Victoria, B.C. Born at Hope, Arkansas, June 27th, 1887. Educ., 2 yrs. eng., Vancouver branch, McGill Univ. Summers 1907, rodman, etc. on township survey and city subdiv. work; 1909, cement testing for dam, also dftsman and rodman on constrn. work on watershed survey, Western Canada Power Co.; 1910-11, leveller on prelim. and location survey, C.N.R., also did transit work, topography, drafting.; 1911-13, inst'man, etc., on constrn.; 1913-15, res. engr. in chg. of constrn., C.N.P. Ry.; 1915 (2 mos) in chg. of surveying, munition plant, etc., Can. Explosives Ltd.; 1915-17, asst. engr. on breakwater and pier work, Victoria Harbor, P.W.D.; Jan. 1918 to date, engr., with Pacific Constrn. Co., Port Coquitlam, dsgned and constructed bldgs., complete chg. of dredging, pile driving, etc.

References: F. Silverton, J. H. Kihner, J. H. Devey, T. Rognaas, E. M. Preston, A. Galloway.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

ALLINGHAM—RAPLH, of Grenville, Que. Born at Woodstock, N.B., Oct. 19th, 1891. Educ., 1 yr. Arts, 3 yrs. Science, McGill Univ. 1911 (4 mos.) rodman, C.P.R.; 1912 (5 mos.) draftsman, ry. location, St. J. & Q. Ry.; 1913, leveller and topog'r 1913-14, inst'man with John S. Metcalf Co., constrn. of grain elevator; 1914, with E.G.M. Cape Co., as inst'man, constrn. of docks, St. John, N.B.; 1914-15, asst. supt. on repair and alterations to conveyors, with J. S. Metcalf Co.: 1915 (4 mos.) inst'man, Westinghouse, Church, Kerr Co., Drummondville, Que.; 1915-16, foreman, Scottish Can. Magnesite Co., Grenville, Que.; 1916-17, with Mecca Constrn. Co., Morristown, N.Y., as res. engr. on constrn. of reinforced concrete bridge, also extension to viaduct; May 1917 to date, with Foundation Co. Ltd., as res. engr. on constrn.; at present, on constrn. of power house at Sydney, N.S.

References: R. E. Chadwick, A. R. Crookshank, H. M. MacKay, J. Robertson, H. Rolph.

BANGS—RAYMOND GARDNER (Lieut.) of St. Catharines, Ont. Born at Carleton Place, Ont., Dec. 25th, 1892. Educ., B.Sc., McGill Univ., 1916. 1912 (5 nos.), asst. to engr. in chg. of constrn., Shipshaw Falls Power Development Co., Quebec; 1914 (4 mos.) asst. to engr. in chg. of constrn., Kamanistiquia Power Development, Kakabeka Falls, Ont.; 1916-18, Lieut., Can. Engrs.; Apr. 1919 to date, asst. engr., Welland Ship Canal.

References: K. R. Ayer, E. Brown, R. J. Durley, H. M. MacKay, J. C. Moyer.

BRUCE—CHARLES, of Ottawa, Ont. Born at Shelburne, N.S., Oct. 22nd, 1882. Educ., grad., Provincial Academy; MacDonald Manual Training School, N.S., etc. 1904-05, rodman on surveys and constrn., H. & S.W. Ry.; 1905, preparation of estimates, constrn., H. & S.W. Ry.; 1905-06, rodman and inst'man on surveys and constrn. L. & M. Ry.; 1906-07, topog'r and leveller, location surveys, H. & G. Ry.; 1907-08, transitman and in chg. of location survey, I.C.R.; 1908-09, res. engr. surveys and constrn., Northern N.B. & S. Ry.; and res. engr. on constrn., iron ore shipping terminals; 1909, engr. in chg. of constrn., N.N.B. & S. Ry.; 1910-11, res. engr. on constrn. of plant at Nictaux, N.S.; 1911-12, res. engr., Canada Iron Corp. in N.S. and N.B.; 1912 to date, engr., Fisheries branch, Dept. of Naval Service

References: E. M. Archibald, G. J. Desbarats, R. McColl, F. G. McPherson, L. H. Wheaton.

CHALMERS—GEORGE HADDON, of Turbine, Ont. Born at Smith's Falls, Ont., Oct. 21st, 1891. Educ., B.Sc. (C.E.) Queen's Univ., 1918. 1911 (7 mos.) rodman, etc., on constrn ; 1911-12, topog'r on prelim. and location surveys; 1912-13, inst'man on constrn., C.P.R.; 1914 (3 mos.) inst'man on constrn. G. & S. Ry.; Apr. 1918 to date with International Nickel Co. as follows:—1918 (5 mos.) inst'man on dam constrn. and land surveys at Bisco, Ont.; 1918-19, asst. to field engr. at Copper Cliff; since Apr. 1919, asst. to E. L. Pettingill on Big Eddy Dam, High Falls, Ont., inspecting concrete, testing cement, etc.

References: W. J. Bishop, J. B. D'Aeth, C. P. Howrigan, C. Luscombe, T. S. Scott, E. A. Stone.

DELORME—L. LUDGER, of St. Leonard Port Maurice, P.Q. Born at St. Leonard Port Maurice, July 16th, 1894. Educ., civil and chem. engr., 1917 and 1918, Poly. School. Summers 1914 to 1917, with F. C. Laberge on municipal and road work; at present, civil and chem. engr., with J. J. Joubert & Co. Ltd.

References: F. C. Laberge, P. LeCointe, C. C. Leluau, A. Surveyer.

DESCHAMPS—ADOLPHE, of Montreal, Que. Born at Montreal, Aug. 24th, 1892. With Quebec Streams Comm. and Structural Steel Co.; 1916-18, steel testing engr., Imperial Min. of Munitions, Montreal; 1918, engr. of tests, U.S. Ordnance Dept., in complete chg. of testing at Dom. Bridge Co., Lachine; at present, on contract for small building.

References: A. Frigon, C. C. Leluau.

DUNCAN—WILFRID EBEN PINKERTON (Major) of Milton, Ont. Born at Glasgow, Scotland, March 2nd, 1891. Educ., B.Sc., Glasgow Univ., 1913. 1910-15. with C.P.R., on gen. survey and constrn. work, later asst. engr., Lake Erie & Northern Ry.; 1915-19, major, Royal Engrs., on ry. constrn., etc.

References: C. W. P. Ramsey, C. Luscombe, R. Mudge, C. T. Delamere, D. Hillman.

FOURNIER—VICTOR A., of Outremont, Que. Born at Coaticook, Educ., B.A., 1911, civil and elec. eng., 1915, Laval Univ. Summers, 1912, surveying; 1913, surveying and triangulation, with Beique & Charton, Town of Lasalle; 1915-16, constrn. engr., with N.Y. Continental Jewell Filtration Co.; 1917 (3 mos.) asst. engr., Superior Board of Health, Que. Prov.; 1917-18, res. engr., R. T. Smith & Co., Aylmer, Que.: 1918 to date, asst. sanitary engr., Superior Board of Health, Prov. of Que., constrn. and testing of filtration plants and inspection of water works and sewerage systems.

References: H. G. Hunter. J. O. Meadows, F. C. Laberge, A. Surveyer.

FULLER—CHARLES HARVEY ROGERS (Capt.) of Toronto, Ont. Born at Toronto, July 3rd, 1893. Educ., B.A.Sc., Toronto Univ., 1914. 1910, on G.T. Ry., grade separation; 1911-13, res. engr., Toronto civic car lines; 1914, asst. engr., Ont. Govt. highway dept.; 1915, asst. engr. on dredging, Can. Stewart Co.; 1915-19, on active service as capt. and adjutant, 216th Batt., later asst. to ch. engr., 10th Can. Ry. Troops; at present, member of firm Fuller & Ferry.

References: J. R. W. Ambrose, H. S. Van Scoyoc, P. Gillespie, C. R. Young, D. W. Harvey.

HAY—ALAN KEITH (Lieut.) of Ottawa, Ont. Born at Ottawa, May 22nd, 1892. Educ., B.Sc. (C.E.) McGill Univ. 1914. 1910 (4 mos.) rodman, Internat. Boundary Survey, St. Croix River, N.B.; 1911, rodman on res. engr's staff, C.P.R., Ottawa; 1912, asst. engr., on city engr's staff, in chg. of constrn. of extensions on water supply systems; 1913 (4 mos.) asst. engr. on constrn. of dam, River Lievre; 1914-16, asst. engr. on roadways, sidewalks, water supply, etc.; 1917, inspector in gauge testing laboratory, Imperial Ministry of Munitions; 1918, lieut., Can. Engrs., at present, res. engr. on northern section of Ottawa-Prescott provincial highway.

References: J. B. McRae, R. J. Durley, N. J. Ker, H. M. MacKay, J. E. Openshaw, W. F. M. Bryce.

HUMPHREY—ALBERT ERNEST (Major, D.S.O.) of Abbotsford, B.C. Born at Rodney, Ont., May 5th, 1884. Educ., honor grad. R.M.C., 1907. 1907 (2 mos.) with Code & Code, O.L.S., Cobalt, Ont.; 1907-09, hydrographic survey, Great Lakes; 1909-11, articled pupil to J. H. Brownlee, B.C.L.S., Vancouver, in chg. of survey parties and responsible for work undertaken; 1912-14, private practice as B.C.L.S., latterly in partnership with Henderson & Taylor; Nov. 1914 enlisted for overseas service, Dec. 1916 to Mar. 1919 in command of Can. Corps Cyclist Batt., France, at present, private practice as B.C.L.S., also engr. on Pacific highway P.W.D.

References: F. Anderson, A. P. Augustine, J. M. Rolston, W. J. Stewart, W. Taylor.

LITTLE—EDWARD CARUTHERS (Lieut.) of St. Catharines, Ont. Born at Ottawa, June 11th, 1893. Educ., B.Sc., McGill Univ., 1915. Summers 1910, rodman, etc. A.C. Ry.; 1913-14, leveller in chg. of party on topography, St. Lawrence Ship Canal; 1915, clerk, town planning branch, Comm. of Conservation; 1916-19, Lieut., Can. Field Artillery, mentioned in despatches and awarded Belgian Croix de Guerre; at present, inst'man, Welland Ship Canal.

References: E. Brown, H. M. MacKay, J. W. LeB. Ross, C. D. Sargent, J. White.

TAYLOR-BAILEY—FRANK WHITHAM, of St. John, N.B. Born at Montreal, Mar. 7th, 1891. Educ., B.Sc. (C.E.) McGill Univ., 1916. 1908-16, with Dominion Bridge Co., as follows:—1908-09, detail drafting; 1909-11, checking structural steel drawings; 1911-16, estimating and designing; 1915, engr. for Ottawa plant since 1916, res. engr. on aerodrome constrn., Dept. of Fortifications & Works, War Office; acting staff captain, etc.; served in France with 3rd Batt., Can. Engrs., at present, res. supt. for N.B. eng. branch, S.C.R.

References: G. E. Bell, E. Brown, G. H. Duggan, H. M. MacKay, E. S. Mattice, P. L. Pratley, F. C. Shearwood, A. R. Sprenger.

VANCE—JAMES ALFRED, of Woodstock, Ont. Born in Oxford County, Ont., May 8th, 1892. Educ., 3 yrs., Faculty of app. science and eng., Univ. of Toronto, 1911-14. Vacations 1910-14, asst. in chg. of erection of steel and concrete Highway bridges, Hamilton Bridge Works Co. Ltd.; 1914 to date, gen'l contractor, designing and erecting steel and concrete highway bridges, dams, etc., with exception of 5½ mos. (in 1917) as structural draftsman, Hamilton Bridge Works.

References: J. G. Jack, C. H. Marrs, J. A. McFarlane, R. K. Palmer, F. J. Ure.

CORRECTION FROM JULY PRELIMINARY NOTICE

BARTRAM—VIVIAN TURNILL, of Toronto. Born at Ottawa, Aug. 2nd, 1878. Education, Public School and Collegiate Institute, Ottawa.

PROFESSIONAL RESPONSIBILITY:—1895-1905, Secretary, General Manager, Canada Atlantic Ry., Ottawa. Chief clerk, purchasing dept., C.P.R., Montreal, 1905-06. Purchasing agent and general storekeeper, T.'N.O. Ry., North Bay, Ont., 1906-09. Was associated with T. S. Scott, C.E., in completing the McRae, Chandler & McNeil contract on T. & N. O. Ry. In 1909 resigned to go into partnership with Mr. Denis Murphy, one of the commissioners of the ry. in construction bunisess; later on bought out Mr. Murphy and continued alone.

HARBOR WORK CONTRACTS COMPLETED :—In Ontario: Port Stanley, Port Bruce, Rondeau, Cobourg. Toronto (western gap). Nova Scotia:—Fourchu, Arichat, Grand Etang. New Brunswick:—Tormentine, Shediac. P.E.I.:—Murray Harbor, Charlottetown, Rustico.

PRESENT ENGAGEMENT:—Vice-President, National Shipbuilding Co. Ltd., Goderich, Ont.; President, Bartram & Ball Lumber Co. Ltd., Montreal; President, Spardon Electric Products Ltd., Ottawa.

References: J. J. Collins, C. H. Keefer, E. D. Lafleur, G. A. Mountain, C. O. Wood.

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AERONAUTICS

AIRCRAFT

CEMENTED SEAMS. *See Balloon Construction.*

BALLOON CONSTRUCTION. Notes on Cemented Seams and Rubber Cements with Reference to Balloon Construction, J. D. Edwards. Aerial Age, vol. 9, no. 14, June 16, 1919, pp. 688-690, 8 figs. Concluded from tests and examination of microsections of cemented seams that next to a good cement it is necessary to smooth and clean surfaces to be cemented and to apply cement in fine coat of uniform thickness, in order to secure satisfactory results.

BALLOONS AND SOLAR RADIATION. Effect nf Solar Radiation Upon Ballons, Junius David Edwards and Maurice Blaine Long. Technologic Papers of Bur. Stand., Dept. Commerce, no. 128, June 13, 1919, 29 pp., 6 figs. Measurements said to have shown obsorption power of radiation to vary from 45 to 95 per cent.

APPLICATIONS

CAPE-TO-CAIRO AIR ROUTE. Cape-Cairo Air-Way. Flight, vol. 11, no. 24, June 12, 1919, pp. 775-776, 1 fig. Scheme for organizing route.

MAPPING. *See Surveying.*

SPEED. Making the Airplane a Utility, Grover C. Loening. Jl. Soc. Automotive Engrs., vol. 4, no. 6, June 1919, pp. 489-493, 2 figs. Speed considered as element needed to give real sound utility to airplane.

SURVEYING AND MAPPING. The Aeroplane in Surveying and Mapping, E. Lester Jones. Flying, vol. 8, no. 5, June 1919, pp. 438-441, 2 figs., also Science, vol. 49, no. 1277, June 20, 1919, pp. 575-582, and Sci. Am. Supp., vol. 87, no. 2268, June 21, 1919, pp. 386-387 and 391. Value expected chiefly in reconnoissance surveys and maps. Past experiments considered as forecasting successful development of revising charts by airplanes. Address delivered before Second Pan-American Aeronautic Convention.

AUXILIARY SERVICE

HANGARS. The Heating of Hangars (Die Heizung van Flugzeughallen), F. Kaiser. Zeitschrift des Bayerischen Revisions-Vereins, vol. 23, nos. 1, 2 & 3, Jan. 15, 31 & Feb. 15, 1919, pp. 2-4, 11, 13, and 19-22, 8 figs. Compares systems of heating with a stove, by hot air, steam, and a combination of these.

Reinforced-Concrete Hangars for the Hyroplanes of the Port of Algiers (Hangar en béton armé pour les hydravions du centre maritime d'Alger), E. Carret. Génie Civil, vol. 74, no. 21, May 24, 1919, pp. 409-413, 15 figs., partly on supp. plate. Dimensions are 104 ft. free opening by 130 ft. useful depth.

LANDING STATIONS. Finding Aircraft Landing Stations by Means of Audio Frequency Receivers, Earl C. Hanson. Flying, vol. 8, no. 5, June 1919, pp. 442-443, 6 figs. Scheme suggested comprises combination of radio directive transmission system to guide aircraft at high speed in direct course between separated cities or other points, audio frequency signal means to project audio frequency energy to predetermined altitudes, but restricted to area of landing field, and indirectly illuminated zone in center of landing field.

MOTORSHIP. The Seaplant Carrier "Argus," Sci. Am., vol. 120, no. 24, June 14, 1919, pp. 630-631, 7 figs. Ship with 500 ft. starting and landing platform for seaplanes. It carries 20 seaplanes in hangar below deck, and has upper flying deck for launching and landing, which is clear of masts, smokestacks and deck structures. From Engineering, Lond.

RADIO TELEPHONES. The Radio Telephone Equipment of the NC-4, Edgar H. Felix. Aerial Age, vol. 9, no. 13, June 9, 1919, pp. 638-639 & 652, 5 figs. Design is said to permit transmission of three types; (1) voice currents, (2) continuous or undamped waves, (3) damped waves of audio frequency.

DESIGN

AIR MILEAGE. *See Cruising Radius.*

Air Mileage of Aeroplanes Intended for Long Distances and for Transport, J. Dennis Coales. Engineering, vol. 107, no. 2785, May 16, 1919, pp. 621-622, 1 fig. Effect of winds on air mileage. (Concluded).

COOLING SYSTEM. The Loomis Cooling System for Aircraft, Aeronautics, vol. 16, no. 290, May 8, 1919, pp. 479-480, 3 figs. Expansion tank surrounds core and injector is located in water connection between main and booster radiators for keeping constant volume of water in circulating system. From Bul. U. S. Experimental Dept., Aeroplane Eng. Div.

FLYING BOATS. The Construction of the Navy-Curtiss Flying Boats. Jl. Soc. Automotive Engrs., vol. 4, no. 6, June 1919, pp. 439-442, 4 figs. Radical alterations from past designs quoted as distinctive features of N-C boats are shortened hull and mounting of tail surfaces on outriggers.

Design and Construction of Flying Boats, David Nicolson. Engineering, vol. 107, no. 2786, May 23, 1919, pp. 681-686, 16 figs. Deals particularly with larger types known officially as F-2a, F-3, F-5, P-5 and N-4.

LARGE AEROPLANES. Some Considerations of the Design of Large Aeroplanes, Leslie V. Spencer. Aerial Age, vol. 9, no. 16, June 30, 1919, pp. 774-776, 7 figs. Urges that aeronautical engineers prepare their designs along new and original lines, as writer sees that large aerial liner is far from having reached a standard or final stage.

LIFT-ANGLE OF INCIDENCE. The Economies of Flight, H. B. Irving. Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1306-1308, 2 figs. Showing variation of lift-drag ratio with angle of incidence and chart for determining most economical speed of flight.

LIFT CHARTS. Chart for Performance Computations, Richard I. Elliot. Aviation, vol. 6, no. 7, June 1, 1919, p. 488, 1 fig. Prepared for solving graphical equations involving lift data.

LOADS. The Loads and Stresses on Aeroplanes, John Case. Aeronautics, vol. 16, nos. 289 and 291, May 1 & 15, 1919, pp. 445-448 and 502-506, 20 figs. Formula for computing loads that come upon machine as a whole under various conditions of flight. Estimation of movement of air forces on wings about center of gravity or other given point. (Continuation of serial).

METAL CONSTRUCTION. Metal Construction of Aircraft. A. P. Thurston. Flight, vol. 11, nos. 21 & 22, May 22 & 29, 1919, pp. 680-684, and 710-714, 29 figs., also Aeronautics, vol. 16, no. 292, May 22, 1919, pp. 534-537. Requirements of metal used for aircraft constructinn and methods of attaching fittings. Boulton and Paul spars; Humber spars; types of struts; methods of design and calculation of girder spars. Preparation and possibilities of steel and duralumin. (Continuation of serial).

STRUTS. Some Useful Fuselage Strut Curves, A. J. Sutton Pippard. Aeronautics, vol. 16, no. 288, Apr. 24, 1919, pp. 426-427, 5 figs. To determine weight of members from a knowledge of their length and the loads in them without determining actual sizes required.

The Effect of a Side-Wind on Interplane Struts, A. J. Sutton Pippard. Engineering, vol. 107, no. 2788, June 6, 1919, p. 727, 1 fig. Formulæ and curves based on Euler's formula.

ENGINES

BASSE-SELVE. The Bassé-Selve 270-300 Horsepower German Airplane Engine. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 222-227, 12 figs., also Automobile Engr., vol. 9, no. 127, June 1919, pp. 178-184, 18 figs. Similar in most of leading details of construction to 260-hp. Mercédes and 230-hp. Benz, on which design is believed to have been based.

CRANKSHAFTS. Airplane Engine Crankshaft Design Glenn D. Angle. Aviation, vol. 6, no. 10, June 15, 1919, pp. 525-528, 2 figs. In its relation to engine design in general.

CURTISS. The Curtiss Model K-12 Aero Motor. Aeronautics, vol. 16, no. 288, Apr. 24, 1919, pp. 428-430, 3 figs. Also Automobile Eng., vol. 4, no. 5, May 1919, pp. 217-220, 7 figs. Form of construction adapted said to give minimum center distance between cylinders. Pistons are of aluminum alloy flat head type. Motor said to develop 400 hp. on fuel consumption of 0.55 lb. per b.hp. hr.

HISPANO-SUIZA. Aviation Motors (Les moters d'Aviation). Aérophile, vol. 27, no. 7-8, Apr. 1 & 15, 1919, pp. 112-114, 6 figs. Carburation, cooling water circulation and lubrication of Hispano-Suiza (150 hp.) motor. (Continued.)

JUPITER. *See Radial Types.*

LIBERTY. The Liberty Aircraft Engine, J. G. Vincent, Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 383-401, 14 figs. Historical and descriptive account.

MAYBACH. Details of the Maybach 300-Horsepower Airplane Engine—II. Automotive Eng., vol. 4, no. 5, May 1919, pp. 228-233, 13 figs. Connecting rod and valve systems, lubrication, carburation and cooling. (To be continued).

MERCEDES. Mercedes 180 HP. (Le moteur Mercedes 180 hp.). Aérophile, vol. 27, no. 7-8, Apr. 1 & 15, 1919, pp. 114-117, 5 figs. Comparison of horsepower and consumption of the 160-hp. and the 180-hp. at different velocity.

MERCURY. *See Radical Types.*

NAPIER "LION". The Napier "Lion" 450 HP. Aero Engine. Aerial Age, vol. 9, no. 15, June 23, 1919, pp. 730-733, 10 figs. Engine has three groups of four cylinders each, mounted "broad-arrow."

Naval Aircraft. Characteristics of Leading Aero Engines Used in Allied Naval Aircraft. Aerial Age, vol. 9, no. 11, May 26, 1919, pp. 542-543. Supplements tables of characteristics published in issue of Mar. 3, 1919. Forty-five engines are recorded in present set.

Pistons. Elements of Piston Design and Their Particular Application to Airplane Engines, Richard Vosbrink. Pac. Mar. Rev., vol. 16, no. 6, June 1919, pp. 115-119, 10 figs. Particularly in reference to piston design. In this connection investigation and analysis undertaken as preliminary to designing standard piston used by Hall-Scott Motor Co. are referred to.

Radial Types. Some Fixed-Radical Aero-engines. Engineer, vol. 127, no. 3309, May 30, 1919, pp. 530-532, 6 figs. Jupiter and Mercury types.

Renault. Industrial Uses of Renault Motors (Groupes industriels actionnés par moteurs à explosion, système Renault). Génie Civil, vol. 74, no. 20, May 17, 1919, pp. 393-396, 7 figs. Installation of 190-hp. 8-cyl. aviation-type motor given as example.

Sturtevant. The Sturtevant Aeroplane Engines. Aerial Age, vol. 9, no. 11, May 26, 1919, pp. 536-538 & 556, 7 figs. Eight-cylinder "V"-type water-cooled. Made in two models.

Volumetric Efficiency. Increasing the Engine's Volumetric Efficiency — VI, Emil Schimanek. Automotive Eng., vol. 4, no. 5, May 1919, pp. 235-237, 7 figs. Writer expresses reasons why he believes more and less strokes than usual four increase or decrease power development. From Zeitschrift des Vereines Deutscher Ingenieure. (To be concluded).

MATERIALS OF CONSTRUCTION

Balsa Wood. The Properties of Balsa Wood, R. C. Carpenter. Aerial Age, vol. 9, no. 13, June 9, 1919, pp. 640-641, 5 figs. Tabulated results of transverse tests.

Coatings. Tests of Moisture and Water Resistant Coatings, Henry A. Gardner. Aviation, vol. 6, no. 60, June 15, 1919, pp. 539-540. Collodion dopes proved inferior to spar varnish as water excluders.

Metal Construction. *See Design.*

Plywood. The General Properties and Uses of Plywood, B. C. Boulton. Aerial Age, vol. 9, no. 15, June 23, 1919, pp. 724-727, 6 figs. Examples of distortion caused by improper construction.
Waterproof Plywood for Airplanes. Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1331-1333 and 1359, 5 figs. Strength tests for ascertaining resistance of glue.

Standards, British. British Standards for Aircraft Materials. India-Rubber Jl., vol. 57, no. 16, Apr. 19, 1919, pp. 1-2 and 5-6, 4 figs. Specifications prepared by British Eng. Standard's Assn. for rubber tubing for use with gasoline, paraffin, lubricating oil or hot water, and for rubber shock-absorber cord for aircraft.

Veneer Construction. Veneer Body Construction. Aviation, vol. 6, no. 7, June 1, 1919, pp. 485-486, 4 figs. Tests of US & B-X bodies. (Concluded).

METEOROLOGY

Barometric Variation Forecast. Forecasting Barometric Variations (Sur la prévision des variations barométriques). Gabriel Guilbert. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 18, May 5, 1919, pp. 899-902. Additional observations to note presented in Comptes rendus, vol. 168, 1919, p. 356.

Physics of Upper Air. Air Navigation, H. A. Wimperis. Aeronautics, vol. 16, no. 290, May 8, 1919, pp. 482-487, 10 figs. Advises supporting in every possible way development in scientific work in meterology in every part of the world, and especially for the study of physics of upper air.

Tides. *See Winds and Tides.*

Weather Forecast. Meteorology and Transatlantic Flight. A. Zaiman. Flight, vol. 11, no. 20, May 15, 1919, pp. 641-642, 3 figs. Necessity of co-operation between various meteorological stations in forecasting weather conditions emphasized.

Winds and Tides. Practical Study of Winds and Tides (Estudio practico de vientos y mareas), Jose Debenedetti. Ingenieria, vol. 23, no. 8, Apr. 16, 1919, pp. 496-515. Comparison of values of harmonic constants obtained by process outlined in Indian Survey with those obtained by Prof. G. H. Darwin, based on period of thirty days.
The Lunar Tide in the Atmosphere, S. Chapman. Nature, vol. 103, no. 2584, May 8, 1919, pp. 185-187. Diagram showing lunar semi-diurnal tide in atmosphere at Greenwich, as determined form Greenwich Records of barometric pressure, 1854-1917.

MILITARY AIRCRAFT

Air Ministry of Great Britain. Great Britain's War Work in the Air. Aeronautic vol. 16, no. 289, May 1, 1919, pp. 456-462. Particularly in regard to co-operation of Air Ministry with army and navy.

Naval Aircraft. Operations of Naval Aircraft, J. H. Towers, Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 368-371, 7 figs. Statistics quoted as examples of work done.

Tactics, Aerial. Aerial Tactics and Defence Against Airships (La tactique aérienne et la défense contre avions), J. A. Lefranc. Aérophile, vol. 27, nos. 7-8, Apr. 1 & 15, 1919, pp. 102-107, 5 figs. Organization of airplane pursuit: bombarding enemy airdromes; anti-aircraft guns. Experiences during the war are quoted and scientific aspect of these tactics is discussed. Second article.

MODELS

Fuselage. Model Aeroplanes—XXVI, F. J. Gamm. Aeronautics, vol. 16, no. 292, May 22, 1919, pp. 532-533, 20 figs. T-frame of fuselage as it is being used for twin screw canard models. (Continuation of serial).

Lauder Racing Model. Elementary Aeronautics, John F. McMahon. Aerial Age, vol. 9, no. 14, June 16, 1919, p. 697, 2 figs. Dimensions of Lauder racing models.

Loening Monoplane. Elementary Aeronautics and Model Notes, John F. McMahon. Aerial Age, vol. 9, no. 13, June 9, 1919, p. 647, 3 figs. Scale model of Loening monoplane.

Model Results and Full Scale Achievement. Model Experiments in Aeronautics. Engineering, vol. 107, no. 2786. May 23, 1919, pp. 657-658, 5 figs. Mathematical analysis of conditions which must be satisfied to obtain exact correspondence between model results and the full-size achievements in regard to forces brought into play by motion of a body in a fluid medium.

PLANES

Bantam. The B. A. T. Bantam. Flight, vol. 11, no. 21, May 22, 1919, pp. 662-667, 12 figs. Fuselage construction consists essentially of light frame-work, comprising six longitudinal members and a number of transverse formers built up of three-ply wood, the whole covered by a three-ply skin put on in bands some 3 ft. wide, lap-jointed where they meet.

Curtiss Biplane. The Curtiss Model 18-B Biplane. Aerial Age, vol. 9, no. 14, June 16, 1919, pp. 676-677 and 701, 4 figs. Peculiarity of machine is employment of ailerons on lower plane only, which are operated by steel tubes running through lower plane and directly connected to pilot's control stick.

Curtiss Triplane. The Curtiss Model 18-T Triplane. Flight, vol. 11, no. 22, May 29, 1919, pp. 698-700, 5 figs. Some of dimensions are: Wing span (all planes) 31 ft. 11 in.; overall length, 23 ft. 3 3-16 in.; overall height, 9 ft. 10⅛ in.

Graham-White. The Graham-White Sporting Aeroplane. Aerial Age, vol. 9, no. 15, June 23, 1919, pp. 728-729 & 733, 7 figs. Span, upper plane, 20 ft.; lower plane, 18 ft. 4 in.; overall length, 16 ft. 6 in.

Navy, U. S. The U. S. Navy Flying Boat, NC-1. Flight, vol. 11, no. 20, May 15, 1919, pp. 637-639, 8 figs. Flying boat of short-hull type with tail planes carried from hull and top main planes by means of outriggers. Hull 's 44 ft. 8¾ in. overall length with maximum beam across side fins of about 10 ft.
Development of the NC Seaplanes. Aviation, vol. 6, no. 7, June 1, 1919, pp. 468-474, 5 figs. Historial account, with particular reference to technical engineering research leading up to adoption of constructional features as ultimately developed.

Radiators. Aircraft Radiators, Archibald Black. Jl. Soc. Automotive Engrs., vol. 4, no. 6, June 1919, pp. 445-461, 24 figs. Brief description of various types.

Tarrant. The Tarrant Giant Triplane, the "Tabor." Flight, vol. 11, no. 20, May 15, 1919, pp. 626-632, 11 figs. Also Aeronautics, vol. 16, no. 291, May 15, 1919, pp. 507-514, 22 figs. Aero-dynamically striking feature of machine, apart from its great size, are overhanging middle plane, with top and bottom plane of shorter span; span is 131 ft. 3 in., height 37 ft. 3 in., and disposition of various thrust lines in relation to center of resistance. History of Development with notes on principal features of design and construction.
The Tarrant Triplane. Flight, vol. 11, no. 22, May 29, 1919, pp. 702-703, 2 figs. Accident attributed to sudden starting of two top engines after machine had traveled along ground at high speed with four lower engines running.

Vickers-Vimy. The Vickers-Vimy Passenger-Carrying Aeroplane. Engineering, vol. 107, no. 2788, June 6, 1919, pp. 736-738, 8 figs.; also in Engineer, vol. 127, no. 3310, June 6, 1919, pp. 555-560, 7 figs. Machine is built for traffic service differs from design as originally adopted for bomber purposes, principally in greater depth of fuselage, which, in the passanger class, is of elliptical section and stream-line form.

Whittemore-Hamm. The Whittemore-Hamm Model-L Biplanes. Aerial Age, vol. 9, no. 16, June 30, 1919, p. 770, 2 figs. Tractor biplanes using Curtiss, Hall-Scott and Hispano-Suiza engines.

PROPELLERS

Bothezat Theory. General Summary of the de Bothezat Blade-Screw Theory. George de Bothezat Aviation, vol. 6, no. 10, June 15, 1919, pp. 520-524, 6 figs. Expressions for slip and race velocities in slip stream solely in function of dimensions of screw blades, coefficient of fluid resistance of different blade sections and working conditions. From memoir published by Nat. Advisory Committee for Aeronautics.

TESTING

Balloons Fabrics. Use of Ultra Violet Light for Testing Balloon Fabrics, Junius David Edwards and Irwin L. Moore. Aerial Age, vol. 9, no. 15, June 23, 1919, pp. 731-735, Tests made at Bur. of Standards reported to have shown that relative deterioration of fabrics under ultra-violet light is not strictly comparable with deterioration experienced in outdoor exposure.

Metal Parts. Metal Construction of Aircraft, A. P. Thurston. Flight, vol. 11, no. 23, June 5, 1919, pp. 741-745, 12 figs. Testing specimens. Appendix on metal airplane construction. (Concluded).

Wind Tunnel. The New Curtiss Wind Tunnel. Aerial Age, vol. 9, no. 16, June 30, 1919, pp. 768-769, 3 figs. Employed by Curtiss organization as a means of verifying aeronautical design.

TRANSATLANTIC FLIGHT

AIRSHIP VS. AIRPLANE. Airship vs. Airplane for Transatlantic Service (Discorso intoron al dirigibile, all aeroplane ed alla traversata aerca dell-altlantico), Silvio Bassi. Industria, vol. 33, no. 9, May 15, 1919, pp. 263-267, 6 figs. Technical considerations of limitations of each of these types as at present developed.

The Atlantic Flight, G. Greenhill. Engineering, vol. 107, no. 2787, May 30, 1919, pp. 689-691. Airship versus airplane. Technical.

VARIA

AIR-NAVIGATION RULES. The New Air Navigation Regulations, Aeronautics, vol. 16, nos. 290, 291 and 292, May 8, 15 & 22, 1919, pp. 488-491, 516-517 and 538-541. Rules as to lights and signals. Text of order issued by Secretary of State for Air. It deals with general conditions of flying, safety provisions, licensing of personnel, log books, and aerodromes in reference to civil aviation. Rules as to air craft arriving in or departing from United Kingdom. (Continuation of serial).

ASTRONOMICAL DETERMINATION AND DIRECTION. Astronomic Determination of Direction, Edward M. Burd. Jl. U. S. Artillery, vol. 50, no. 4, June 1919, pp. 390-416. Results of comparative observations for determining the azimuth of a line. (Concluded.)

NOMENCLATURE. Nomenclature for Aeronautics. Aviation, vol. 6, no. 10, June 15, 1919, pp. 529-532. From reports issued by Nat. Advisory Committee for Aeronautics.

PHYSIOLOGY OF FLYING. The Physiology of Flying, W. Guy Ruggles. Aerial Age, vol. 9, no. 16, June 30, 1919, pp. 772-773 and 787-788, 6 figs. On the origin of orientation and equilibration with reference to various types of Ruggles orientators.

CIVIL ENGINEERING

BRIDGES

BARRIERS. Yielding Barriers Close Roads at Drawbridges. Eng. News-Rec., vol. 82, no. 24, June 12, 1919, pp. 1168-1170, 2 figs. Impact of vehicles absorbed by traveling gate to stop motor trucks, and by cables to stop automobiles.

BASCULE BRIDGES. New Bascule Bridge at La Seyne. Engineer, vol. 127, no. 3308, May 23, 1919, p. 502, 10 figs., partly on supplement plates. Lifting truss about 138 ft. long is movable around horizontally placed pin, housed in forward feet of trestle-like structure which is so situated that when truss is in vertical position entrance to harbor is entirely unobstructed.

CAISSONS. Pneumatic Caissons with Wooden Cylinders for Sinking Bridge Piers, Eng. & Contracting, vol. 51, no. 22, May 28, 1919, pp. 562-564, 3 figs. Pneumatic caisson of pivot pier was octagon 30 ft. on side, and walls consisted of one width of 10 x 10-in. timbers planked outside and inside.

CONCRETE BRIDGES. Reinforced Concrete Bridges and Their Architectural Treatment, F. G. Engholm. Cement & Eng. News, vol. 31, no. 6, June 1919, pp. 21-23, 2 figs. Writer emphasizes what he terms "error of trying to produce a living structure by using forms associated with other materials."

Safe Stress in Reinforced-Concrete Bridge Arches (Zur Frage der zulässigen Spannungen in Beton-Brückengewölben), A. O. Lusser. Schweizerische Bauzeitung, vol. 73, no. 18, May 3, 1919, pp. 201-205, 4 figs. Compares safe stresses in plain and reinforced concrete. Reference is made to experiments by Bach and Graf. Curves showing breaking load of plain concrete columns and that of columns with 0.5 per cent iron reinforcement.

DELAWARE RIVER BRIDGE. The Placement of the Delaware River Bridge, Warren P. Laird. Jl. Engrs. Club. of Philadelphia, vol. 36, no. 175, June 1919, pp. 209-219, 9 figs. Based upon investigation conducted by writer as consulting architect to Delaware River Bridge and Tunnel Commission of Pennsylvania and Interstate Bridge and Tunnel Commission of New Jersey.

ELECTRICAL EQUIPMENT. Electrical Equipments for Movable Highway and Railway, Bridges, H. H. Vernon. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 373-383, 31 figs. Equipments applicable to various types of movable span bridges are illustrated

GENESEE RIVER BRIDGE. Rebuilding the Genesee River Bridge, Lehigh Valley R.R., at Wadsworth, N. Y. Ry. Rev., vol. 64, no. 25, June 21, 1919, pp. 947-950, 5 figs. Total length of structure, about 1311 ft. Reconstruction work is said to have involved purchase of new steel to the total weight of 3,308,000 lb.

INSPECTION. Points Requiring Special Observation and Investigation in Bridge Inspection, Herbert C. Keith. Eng. & Contracting, vol. 51, no. 26, June 25, 1919, pp. 681-683. Secondary stresses due to large gusset plates, investigation of compression members, decay of timber stringers, corrosion of beams and similar points. Paper presented before Brooklyn Engrs. Club.

PONTOON BRIDGES. Improved Form of Pontoon Bridge for Public Use. Eng. & Contracting, vol. 51, no. 26, June 25, 1919, pp. 689-691, 5 figs. Bridge over Rhine river composed of 14 sections—two draw sections equipped with steam winches, eight regular fixed sections, and at ends two short ramp sections.

SWING BRIDGES. Graphic Study of Stresses in Swing Bridges (Swing Bridges. Analisis racional y grafico de sus resistencias), Rafael Agudelo C. Boletin de la Sociedad Antioquena de Ingenieros, vol. 4, nos. 4-5, pp. 52-63, 13 figs. Illustrates method of Professor F. la Rue by applying it to bridge of 12 spans, each 20 ft. long.

BUILDING AND CONSTRUCTION

BEAMS. How to Find the Proper Size Steel Beams for various Spans. George E. Thackary, and W. A. Giesen. Building Age, vol. 41, no. 6, June 1919, pp. 183-184. Table showing steel beams required for given span.

CHURCHES. A Reinforced Concrete War Memorial Church. Building News, vol. 116, no. 3360, May 28, 1919, pp. 327 and 334-337, 6 figs. Semi-elliptical vaults of uniform thickness and springing directly from floor level take place of walls and roofs. Method is patented.

CONCRETE STRUCTURES. The Fitting of Machinery, etc. to Ferro-Concrete Structures —III. Mech. World, vol. 65, no. 1690, May 23, 1919, pp. 246, 8 figs. Type used in case where it is desired to give light from a floor to a room or compartment below, as in the fore or after peak of vessels. (Concluded.)

COST. Overhead and Time Cost to Erect Elevated Railway, A. P. Roscoe. Eng. News-Rec., vol. 82, no. 24, June 12, 1919, pp. 1164-1166. Nine hours per ton said to have been required to haul, erect, rivet and paint 13,500-ton structure.

FACTORIES. The Building of Factories—IV, Arthur F. Wickenden. Eng. & Indus. Management, vol. 1, no. 17, June 5, 1919, pp. 528-529, 1 fig. Methods of construction; choosing between brick structure with timber or concrete floors and with timber or steel roofs; composite buildings of steel and brickwork, with similar varieties of roofs and floors as above; steel-framed structures; reinforced-concrete buildings.

FOUNDRY. A Model Brass Foundry Building, Charles Vickers. Brass World, vol. 15, no. 6, June 1919, pp. 187-191, 6 figs. Structure providing facilities for comfort of workers both in summer and winter.

PLUMBING. Back Venting versus Simplified Plumbing. Am. Architect, vol. 115, no. 2267, June 4, 1919, pp. 795-804, 6 figs. Various systems are illustrated, notably those in use in U. S. Government buildings and conforming to N. Y. City regulations.

STACKS. Reinforcing Steel Stacks with Gunite Concrete, M. C. Sherman. Power, vol. 49, no. 21, May 27, 1919, pp. 808-809, 4 figs. Work carried out by building reinforcing self-supporting shells around the stacks and then employing cement guns.

STEEL STRUCTURES. The Design of Steel Structures, Albert S. Spencer. Surveyor, vol. 55, no. 1424, May 2, 1919, pp. 326-327. General remarks on various points which writer advises to consider carefully in applying theory of structures. Paper read before Concrete Inst.

TANKS. Tank Construction—XXVIII, Ernest G. Beck. Mech. World, vol. 65, no. 1692, June 6, 1919, p. 270, 6 figs. Side walls of rectangular tanks.

VIBRATIONS. Methods of Preventing the Transmission of Vibrations in Buildings, A. B. Eason. Electrical Review, vol. 84, no. 2168, June 13, 1919, pp. 684-685, 7 figs. Suggests that when different materials are being used for support hard materials, such as iron, be placed next soft ones, such as felt and cork.

WALLS. Wall Construction at Norfolk Army Supply Base by Cement Gun Process. Eng. & Contracting, vol. 51, no. 22, May 28, 1919, pp. 574-575, 4 figs. Over 500,000 sq. ft. of walls, fire stops, roof, etc., are said to have been built by this process.

WIND PRESSURE. Wind Pressure on Arched Roofs (Calcul de l'effort du vent dans les toitures en arcs), F. Grua. Genie Civil, vol. 74, no. 22, May 31, 1919, pp. 441-443, 5 figs. Equations.

CEMENT AND CONCRETE

AGGREGATE TESTING. Concrete in Roads, Bridges and Culverts, H. Eltinge Breed. Can. Engr., vol. 36, no. 22, May 29, 1919, pp. 493-495, 1 fig. Recommends that fine aggregate be tested for (1) organic impurities, (2) gradation, (3) mortar strength, and (4) volume of silt or loam. See also Roads and Pavements, Concrete.

Tests Do Not Bear Out Surface-Aggregate Method, Duff A. Abrams. Eng. News-Rec., vol. 82, no. 25, June 19, 1919, pp. 1203-1207. Research conducted at Lewis Inst., Chicago.

GRADING. The Surface Area and Fineness Modulus Methods of Grading Concrete Aggregates, Duff A. Abrams. Eng. & Contracting, vol. 51, no. 26, June 25, 1919, pp. 673-676. Tests at Lewis Inst., Chicago said to have shown that with given materials and conditions of test, quantity of mixing water determining strength of concrete, so long as (1) concrete is plastic with method of placing used, (2) aggregate not too coarse for quantity of cement used, and (3) mixture not so wet that all water cannot be held by concrete.

GUNITE CONCRETE. *See Building and Construction, Stacks, Walls.*

PIPE. Concrete Pipe Made and Laid for Winnipeg Aqueduct. Concrete, vol. 14, no. 6, June 1919, pp. 209-213, 16 figs. Eighty-five miles of it built of monolithic concrete and 12½ miles of reinforced-concrete pipe.

PORTLAND CEMENTS. Portland Cements (Les ciments Portland), E. Candlot. Chimie & Industrie, vol. 2, no. 4, Apr. 1, 1919, pp. 371-384, 19 figs. Account of manufacture with reference to practices followed at Roche, Switzerland.

PROPORTION IN CONCRETE TESTS. Tests of Two Recent Theories for Proportioning Concrete. Eng. News-Rec., vol. 82, no. 24, pp. 1142-1147 and (discussion) 1147-1149, June 12, 1919, 6 figs. Fineness-modulus and surface-aggregate methods, both of which depend on water-cement ratio, are said to have been found not to insure necessary workability of mix. Tests were made at U. S. Bureau of Standards.

SLAG AGGREGATE. Slag Aggregate in Concrete and Mortar, Em. Mavant. Concrete, vol. 14, no. 6, June 1919, pp. 239-240, 4 figs. Crushing-strength tests made of basic steel slag, limestone and banc rouge as coarse aggregates.

SLAG CEMENT. Manufacture of Cement from Blast-Furnace Slag, Wm. Poole. Proc. Australasian Inst. Min. Engrs., no. 31, Sept. 30, 1918, pp. 81-97 and (discussion) pp. 97-100. Also Queensland Gov. Min. Jl., vol. 20, no. 227, Apr. 15, 1919, pp. 157-161. Processes of manufacturing, (1) puzzolan, (2) slag Portland cement, (3) iron cement, and (4) special varieties of cement.

Tunnel Lining. Concrete Tunnel Lining by Steam Jet. Ry. Rev., vol. 64, no. 23, June 7, 1919, pp. 818-820, 3 figs. Nozzle car mounted on truck carried by ordinary flat car and controlled by two hand winches.

Underground Work. Use of Concrete in Underground Works. Eng. & Min. Jl., vol. 107, no. 25, June 21, 1919, pp. 1071-1073, 4 figs. Swelling ground and consequent crushing of shaft timbers led to experiment of lining section of shaft with reinforced concrete at mine in South Australia. From Chem. Eng. & Min. Rev.

EARTHWORK, ROCK EXCAVATION, ETC.

Aquaduct. Italian Aquaduct (L'Acquedotto Pugliese), Ingegneria Italiana, vol. 3, no. 57, May 30, 1919, pp. 67-70, 7 figs. Total length 2662 kilometers.

Caissons. Pneumatic Caissons Sunk Through Moving Ground. Eng. News-Rec., vol. 82, no. 24, pp. 1160-1162, June 12, 1919, 4 figs. Constant movement of earth forced contractor to face problem of sinking pneumatic caissons in such a way that allowance could be made for possible movement of ground through which they were to be lowered.

Causeways. Construction of New Arch Section of Galveston Causeway. Eng. News-Rec., vol. 82, no. 25, June 19, pp. 1190-1192, 7 figs. Centrifugal and jet pumps mounted on derrick platforms. Old causeway walls used for cofferdam.

Dams. Weighing Concrete Materials Saved Cement on Three Big Dams, H. H. Hunt. Cement & Eng. News, vol. 31, no. 6, June 1919, pp. 36-38, 2 figs. Proportioning by weight claimed to have given better concrete with less cement and without loss of speed.

Excavators. United Fuel & Supply Co.'s Plant. Cement, Mill & Quarry, vol. 14, no. 11, June 5, 1919, pp. 13-15, 6 figs. Arrangement used permits separate operation of excavator and main plant.

Reservoirs. Economies of Reinforced Concrete Walls for Uncovered Reservoirs, H. E. Babbitt. Eng. & Contracting, vol. 51, no. 24, June 11, 1919, pp. 618-620, 16 figs. Designs said to be based on factors of safety of two against overturning. Formulæ used for details of walls are given.

Retarding Basin. Delivering Mixed Concrete by Industrial Railway, Paul Teas. Concrete, vol. 14, no. 6, June 1919, pp. 218-221, 6 figs. Constructing retarding basins to prevent recurrence of Dayton's flood of March 1913.

Tunnels. Proposed Vehicular Tunnel under the Hudson at New York. Ry. Rev., vol. 64, no. 25, June 21, 1919, pp. 929-938, 11 figs. From discussion of "The Proposed New York and New Jersey Vehicular Tunnel" at meeting at Am. Soc. Civil Engrs., proc., May.

Tosas Tunnel, Jose M. Fuster. Revista de Obras Publicas, vol. 67, no. 2275 and 2277, May 1 and 15, 1919, pp. 205-210 and 233-237, 13 figs. Shows methods of timbering.

Utilization of Waste Heat of Tunnels, F. J. Postel. Heat & Vent. Mag., vol. 16, no. 5, May 1919, pp. 26-39, 6 figs. Test made at Chicago State Hospital using hot air from pipe-tunnel system.

The Catskill Tunnels—III Railway Engineer, vol. 40, no. 473, June 1919, pp. 115-118, 6 figs. Bonticou and Eastview tunnels. (Continuation of serial.)

Chicago's Tunnels for Electric Light and Power Cables, G. B. Springer. Elec. Rev., vol. 74, no. 25, June 21, 1919, pp. 1019-1023, 10 figs. Of standard size 6 ft. 6 in. high and 6 ft. wide, top half being semi-circular. Construction methods employed.

Underwater Construction. Underwater Construction of Outshore Launching Ways, E. D. Buel. Eng. News-Rec., vol. 82, no. 23, June 5, 1919, pp. 1121-1123, 3 figs. Speed and economy of work are said to have justified choice of diver method in place of cofferdam construction at Government fabricated shipyard at Bristol, Pa.

MATERIALS OF CONSTRUCTION

Brick, Paving. *See Road Materials.*

Building Materials. Second Report on the Work of the Underwriters' Laboratories. Am. Architect, vol. 115, no. 2268, June 11, 1919, pp. 829-834, 9 figs., also Safety Eng., vol. 37, no. 4, Apr. 1919, pp. 163-170, 8 figs. Committee was appointed at convention of Am. Inst. of Architects "for the purpose of observing tests made on building materials at the Underwriters' Laboratories at Chicago, and reporting to the architects such data and results as might be of value."

Road Materials. Road Material in New Hampshire, J. W. Goldthwait. Good Roads, vol. 17, no. 22, May 31, 1919, pp. 233-234. Report of State Highway Dept. on materials available with discussion of their value.

What Paving Brick Should Be and Do, C. C. Wiley. Brick & Clay Rec., vol. 54, no. 12, June 17, 1919, pp. 1067-1070, 4 figs. Comparative tests made with monolithic brick road having bottom course of 1 : 3 :5 concrete and with concrete slabs proportioned 1 :2 :3, are quoted as having demonstrated that equal strength is possessed by such brick and concrete roads.

RECLAMATION AND IRRIGATION

Drainage System, Moore Park. Drainage System for Moore Park, Toronto, W. G. Cameron and R. W. Dickie. Contract Rec., vol. 33, no. 24, June 11, 1919, pp. 541-544, 6 figs., also Can. Engr., vol. 36, no. 23, June 5, 1919, pp. 510-511, 4 figs. About 2,000 ft. of 4 ft. 3 in. and 3 ft. 9 in. two-ring brick sewer laid. Total length, 2,500 ft. Costs of operations quoted, capacity believed to be required was 173 c. f. s.

Irrigation, Egypt and Sudan. Irrigation Schemes in Egypt and the Sudan—II, II and III. Engineer, vol. 127, nos. 3306, 3309 and 3310, May 23 and 30 and June 6, 1919, pp. 497-499, p. 536, and pp. 556-558, 11 figs. Proposed Sennar dam on the Blue Nile. Scheme to effect combination irrigation and protection works. Irrigation schemes in lower Egypt.

ROADS AND PAVEMENTS

Asphalt. A Treatise on Hot Mix Asphalt Pavements, Francis P. Smith. Contract Rec., vol. 33, no. 23, June 4, 1919, pp. 529-534. Remarks on foundation, sub-grade and mineral aggregate requirements. Construction and properties of various types.

Bituminous Pavements. Hot Mix Bituminous Pavements, F. P. Smith. Eng. & Contracting, vol. 51, no. 23, June 4, 1919, pp. 599-601. General considerations regarding foundations. Paper presented before Can. Good Roads Congress.

Suggestions for Concrete Pavement Construction, Clyde E. Learned. Mun. Jl. & Public Roads, vol. 46, no. 24, June 14, 1919, pp. 434-436, 2 figs. Based on writer's experience on concrete road construction in South West. (To be continued.)

Concrete. Concrete Roads, Bridges and Culverts, H. E. Breed. Contract Rec., vol. 33, no. 24, June 11, 1919, pp. 552-554, also Good Roads, vol. 17, no. 25, June 21, 1919, pp. 261-263, 1 fig. Recommends testing characteristics for (1) organic impurities, (2) gradation, (3) mortar strength, and (4) volume of silt or loam. Paper read before Can. Good Roads Congress.

Drainage. Drainage of Roads and Streets—I & II (Wasserbeseitigung von Strassen und Wegen), Eduard Schneider. Zeitschrift fur Transportwesen & Strassenbau, vol. 35, nos. 19 and 20, July 1 and 10, 1918, pp. 219-220 and 231-232, 3 figs. Writer recommends drainage by means of open ditches where possible, or conduits discharging into a pond built for the purpose.

Financing. Methods of Financing Highway Improvements. Eng. & Contracting, vol. 51, no. 23, June 4, 1919, pp. 608-609. Summary of various methods that have been used in this country. From committee report at convention of Am. Road Builders' Assn.

France. War-time Highways of France, John B. Woods. Power Wagon, vol. 22, no. 175, June 1919, pp. 31-32, 3 figs. How they were maintained.

Grading. Grading with Tractors and Heavy Blade Graders. Am. City, Town & Country Ed., vol. 20, no. 6, June 1919, pp. 524-526, 4 figs. Combination said to have proven satisfactory in Wisconsin county road work.

Gravel Roads. The Place and Possibilities of Gravel Roads, Chas. Talbot. Contract Rec., vol. 33, no. 22, May 28, 1919, pp. 509-511. Writer does not consider advisable to screen or in any way attempt to treat ordinary pit gravel.

Surface Treatment of Gravel Roads with Refined Tar, Philip P. Sharples. Good Roads, vol. 17, no. 22, June 7, 1919, pp. 241-242, 2 figs., also Contract Rec., vol. 33, no. 24, June 11, 1919, pp. 550-551, 1 fig. It is reported that with this treatment State Highway laid between Kittery and Portland has carried as high as 200 to 2,000 vehicles per day during summer months without requiring too high up keep costs. Paper presented before Sixth Can Good Roads Congress

Gravel Roads, Chas. Talbot. Can. Engr., vol. 36, no. 22, May 29, 1919, pp. 499-502, 1 fig. Specifications of gravel road construction employed in building Middlesex roads in 1854. The surfaces of these roads are said to be still maintained in serviceable condition.

Integraph. Predhumeau-Secretan Integraph (Intégraphe Predhumeau-Secretan), M. Predhumeau. Annales des Ponts et Chaussées, partie technique, vol. 48, no. 1, Jan.-Feb. 1919, pp. 54-76, 9 figs. Apparatus which is said to determine directly profile changes to be effected in road project and extent of work required by construction of embankments and cuts.

Level Raising. Road Building—I, II & III (Strassenbau), Curt Merckel. Zeitschrift fur Transportwesen & Strassenbau, vol. 35, nos. 10, 11, 12, Apr. 1, 10, 20, 1919, pp. 111-114, 123-126 and 135-137. 6 figs. Niveau raising. Refers especially to experience of city of Hamburg.

Macadam. Bituminous Macadam Road Construction, A. W. Dean. Am. City Town & Country Ed., vol. 20, no. 6, June 1919, pp. 517-520, 2 figs., also Good Roads, vol. 17, no. 22, May 31, 1919, pp. 231-232, and Contract Rec., vol. 33, no. 25, June 18, 1919, pp. 566-568. Regulations in regard to drainage, subgrade, foundation, using dumping platform and patching holes. It is advised that bottom course should not be less than 4 in. in thickness after rolling, and if heavy loads are to be sustained, a thickness of 6 in. is desirable. Paper read before Can. Good Roads Congress.

Maintenance. Highway Maintenance, J. A. Duchastel. Can. Eng., vol. 36, no. 22, May 29, 1919, pp. 497-499. Advises establishing and continuing system of maintenance beginning from day road has been completed.

Road Machinery. Road Machinery, Arthur H. Blanchard. Good Roads, vol. 17, no. 22, June 7, 1919, pp. 243-245, also Can. Engr., vol. 36, no. 22, May 29, 1919, pp. 502-504, and Eng. & Contracting, vol. 51, no. 23, June 4, 1919, pp. 605-606. Factors on which writer advises selection of equipment. Paper presented at Sixth Can. Good Roads Congress.

Stone Pavement. Building a Stone Road (-ie Herstellung des Steinpflasters), George Klose. Zeitschrift fur Transportwesen & Strassenbau, vol. 35, no. 17, June 10, 1918, pp. 195-197, 2 figs. Writer claims that replacement of stone pavements by compressed asphalt is for purpose of reducing noise and not because stone pavements are not able to carry increased traffic.

Street Cleaning. Street Cleaning (Strassenreinigung), Zeitschrift fur Transportwesen & Strassenbau, vol. 35, no. 10, Apr. 1, 1919, pp. 114-115, 3 figs. The automobile sprinkler and cleaner.

Surfacing. Road Surfacing with Sand Clay from Salt Flats. Eng. & Contracting, vol. 51, no. 23, June 4, 1919, pp. 595-596. Data covering use of sand clay in Aransas County, Tex.

Tarred Roads, Poisoning Streams By. The Poisoning of Fish by Road Washings, W. J. A. Butterfield. Surveyor, vol. 55, no. 1423, Apr. 25, 1919, pp. 307-308. Tarred roads are said to be dangerous to fish life where river runs through valley and is crossed by road which drains from inclines from either side of river.

SANITARY ENGINEERING

Sewer Flushing. The Flushing of Sewers—I, II & III (Die Spulung der Kanäle), W. Schwaab. Zeitschrift fur Transportwesen & Strassenbau, vol. 35, nos. 29, 30 and 31, Oct. 10, 20 and Nov. 1, 1918, pp. 339-342, 351-353, 365-367, 28 figs. Flushing, in order to clean the pipes of slime and mud deposits, requires higher water velocity than that which caused these deposits. Best results are obtained if flushing is done at frequent intervals. In order to keep sewers free of solid waste particles, a constant water velocity of 0.6 to 0.7 m. per sec. is necessary (Concluded).

Sewer Pipe. Ground Water Disintegrates Sewer Pipe, Arthur George Dalzell. Contract Rec., vol. 33, no. 23, June 4, 1919, pp. 522-524. Invertigations into causes of internal incrustation and scale on machine-made pipes. Paper presented at Can. Nat. Clay Products Conv.

Sewers. Chicago's Standard of Sewer Construction, C. D. Hill. Eng. World, vol. 14, no. 11 and 12, June 1 and 15, 1919, pp. 17-23 and 21-23. With 2467 miles of sewer costing $50,000,000, total cost of maintenance is said to have been $79,000,000, which includes expenditures for new manholes, catch basins and similar items. Considerations made in determining location of relief sewers.

SURVEYING

Geometric Leveling. Geometric Leveling by Dr. Wilhelm Seibt's Method (Nivelacion geométrica por el método del Dr. Wilhelm Seibt), Tomas Gonzalez Roura. Ingenieria, vol. 23, no. 8, Apr. 16, 1919, pp. 516-523. Concerning approximate error of single observation. (Continuation of serial).

WATER SUPPLY

Brantford. The Brantford Waterworks, System. Power House, vol. 12, no. 9, June 20, 1919, pp. 240-244, 9 figs. Mechanical features.

Chlorination. Progress of Water Disinfection in Maryland, Robert B. Morse. Mun. Jl. & Public Works, vol. 46, no. 23, June 7, 1919, pp. 405-407, General description of plants and of results of chlorination. Paper presented before New England Water Works Assn.

Cool Drinking-Water Systems. Cool Drinking Water Systems, Charles L. Hubbard. Power Plant Eng., vol. 23, no. 11, June 1, 1919, pp. 489-494, 8 figs. Systems in use and data for computing dimensions of equipment, piping etc.

Factories. What It Pays to Know About Factory Water Supply—IV, Charles L. Hubbard. Factory, vol. 22, no. 6, June 1919, pp. 1165-1168, 7 figs. Concerning amount of water to be heated.

Buffalo Water Supply, with special Reference to the Filtration Problem, H. F. Wagner. Can. Engr., vol. 36, no. 25, June 19, 1919, pp. 551-552 and 559. Contamination by excursion boats passing near intake crib in Emerald Channel necessitates addition of maximum amount of chlorine at all times. Question is whether under such conditions and after reducing waste to minimum, building of filtering plant should be advisable. Paper read before Am. Water Works Assn.

Filters. Desrumaux Drinking Water Filter of Large Capacity and Automatic Cleaning (Filtres à grand débit et à nettoyage automatique pour l'épuration des eaux potables. Système Henry Desrumaux), A. Bidault des Chaumes. Genie Civil, vol. 74, no. 23, June 7, 1919, pp. 460-464, 6 figs. Turbine rotates sand rakes.

Garages. A Typical Complete Water Supply System for Installation in Garage Basements J. Albert Doyo. Am. Architect, vol. 115, no. 2269, June 18, 1919, pp. 861-865, 5 figs. Installation of one 6-ft. by 36-ft. pneumatic tank having working capacity of 5,140 gal.

Hamilton. Hamilton Waterworks; Some Features of Design, F. C. Perkins. Power House, vol. 12, no. 8, June 5, 1919, pp. 203-205, 4 figs. Highhead electric pumping station with four motor-driven units.

Meters. Reduction of Water Consumption by Means of Pitometer Survey and Constant Inspection, George C. Andrews. Can. Engr., vol. 36, no. 25, June 19, 1919, pp. 555-557. Experiences which led Buffalo Bureau of Water to adopt pitometer work as special department. Paper read at convention of Am. Water Works Assn.

Water Meter Data. Mun. Jl. & Public Works, vol. 46, no. 23, June 7, 1919, pp. 407-421. Tables showing data gathered by means of questionnaire sent out to 450 water-works superintendents. Data deals with location, reading, testing and maintenance of meters.

Study of Revenue from Sale of Water to Metered Domestic Consumer, Philip Burgess. Eng. News Rec., vol. 82, no. 23, June 5, 1919, pp. 1116-1119, 3 figs. New England Water Works Assn. form based on service and output charge.

Sooke Lake, B. C. Sooke Lake Water Supply, Victoria, B. C., C. H. Rust. Jl. Eng. Inst. Can., vol. 2, no. 6, June 1919, pp. 446-450, 9 figs. Construction of six siphons and necessary concrete trestles, and temporary wooden trestles to carry track is specially taken up in outline of project for utilizing lake, which is 4 miles long and about half a mile wide.

Tastes and Odors. Coal Tar Derivative Waste Products Cause of Obnoxious Taste of Milwaukee Water Supply. Eng. & Contracting, vol. 51, no. 24, June 11, 1919, pp. 629-630. Investigaton conducted by Water Works disclosed that taste and odor werenot due to use of chlorinealone,but to action of chlorine on some of the organic matter present in polluted lake water, which formed compound that produced taste and odor.

WATERWAYS

Coast Erasion. Lake Michigan's Encroachment on its Coast, Hu Maxwell. Sci. Am., vol. 120, no. 26, June 28, 1919, pp. 687 and 699-700, 4 figs. How currents are stealing land from western shore and giving it back at Southern end.

Flood Waters. Impounding Flood-Waters, E. Parry. New Zealand Jl. of Sci. & Technology, vol. 2, no. 2, Mar. 1919, pp. 121-127, 4 figs., partly on supp. plate. Deals only with rise and fall of water level in lake reservoir as flow in river increases and decreases. Charts of h/h for various cases are presented.

Maas Canalization. The Maas Canalization (Eenige mededeelingen over de Maaskanalisatie), F. L. Schlingmann. De Ingenieur, vol. 34, no. 17, Apr. 26, 1919, pp. 305-313, 5 figs. Canalization started 1915 from Linne to Grave: including the Wessen-Nederweert and Maas-Waal canal,the costs were estimated at about $30,000,000 but in writer's opinion this sum will be materially surpassed on account of general rise in prices.

VARIA

Oversea War Work. Civil Engineering in the War, George K. Scott-Moncrieff. Times Eng. Supp., vol. 15, no. 535, May 1919, p. 156. Work overseas.

Salonika, Rebuilding of. The Rebuilding of Salonika. Times Eng. Supp., vol. 15, no. 535, May 1919, pp. 158-159. 1 fig. Project involves expenditure of $100,000.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

Electrolytic Dissociation and Duplex Affinity. The Theory of Duplex Affinity, Samuel Henry Clifford Briggs. Jl. Chem. Soc., vols. 115 & 116, no. 678, Apr. 1919, pp. 278-291. Its application to electrolytic dissociation. It is said that the cause of electrolytic dissociation is combination of solute and solvent by means of unsaturated secondary affinity.

ELECTRODEPOSITION

Metal Plating. Metal Plating, W. G. Knox. Metal Indus., vol. 17, no. 6, June 1919, pp. 269-271. Tables indicating time required to deposit a given thickness of metal.

ELECTROPHYSICS

Electromagnetic Wave Absorption. The Absorption of Electromagnetic Waves on Two Parallel Wires (über die Absorption elektromagnetischer Wellen an zwei parellelen Drähten), W. Arkadiew. Annalen der Physik, vol. 58, no. 2, 1919, pp. 105-138, 12 figs. On two parallel wires writer obtained pure, damped electric waves of 72.7 to 1.27 cm. in length. Energy of waves decreases on account of absorption according to exponential law. Method was worked out for measuring the absorption coefficient. Tables.

Electrostatic and Magnetic Fields. On a Reciprocal Relation Between the Electrostatic Fields of Certain Distributions of Electricity and the Magnetic Fields of Corresponding Uniform Currents, A. Gray. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 221, May 1919, pp. 472-480, 4 figs. Establishes various reciprocal theorems of coaxial circles.

Oscillations, Electrical. Electrical Oscillations Under the Action of Any Given Forces (Oscillations Electriques sous l'action de forces données de forme quelconque), John R. Carson and J. B. Romey. Revue Générale de l'Electricité. vol. 5, no. 20, May 17, 1919, pp. 715-717. With reference to theory of propagation of current in telephone and telegraph lines, writers show that it is possible to take as fundamental solution either that relating to the case when acting forces are of exponential form or that in which a constant force is suddenly introduced in a circuit.

Overvoltage, Hydrogen. Hydrogen Overvoltage, Duncan A. MacInnes and Leon Adler. Proc. Nat. Acad. Sciences, vol. 5, no. 5, May 15, 1919, pp. 160-163, 2 figs. Concerning fluctuation observed by writer while determining overvoltage of small electrodes of "platinized" platinum.

Parallel Cylindrical Conductors. Electrical Theorems in Connection with Parallel Cylindrical Conductors, Alexander Russell. Proc. Phys. Soc. Lond., vol. 31, part III, Apr. 15, 1919, pp. 111-130, 5 figs. Relations connecting three capacity coefficients when cylinders are external to one another.

Vector Diagrams. Vector Diagrams of Some Oscillatory Circuits Used with Thermionic Tubes, W. H. Eccles. Proc. Phys. Soc. Lon., vol. 31, part III, Apr. 15, 1919, pp. 137-150, 8 figs. Vector diagrams used in study of a.c. circuit applied to assemblage made up of oscillator, the thermionic relay maintaining it in oscillation and the devices linking these two parts.

FURNACES

Booth-Hall Furnace. The Booth-Hall Electric Furnace, W. K. Booth. Can. Foundryman, vol. 10, no. 6, June 1919, pp. 142-145, 7 figs. Conducting-hearth electric furnace having auxiliary electrode for starting and automatic control.

California. Electric-Steel Furnaces in California. Metal Trades, vol. 10, no. 6, June 1919, pp. 245-247, 3 figs. Heroult furnace practice. First article.

Heat-Treating Furnaces. Electric Furnaces for Heat-Treating and Shrinkage A. M. Clark. Metal Trades, vol. 10, no. 6, June 1919, pp. 259-260, 4 figs. Built in sections. Developed by General Electric Company.

Medium Temperature Furnace. How Electric Furnaces are Built. Iron Trade Rev., vol. 64, no. 24, June 12, 1919, pp. 1545-1548, 7 figs. Type developed by Electric Furnace Co., Alliance, Ohio, designed for melting non-ferrous metal, and other work not requiring excessive temperature; claimed to be especially suitable for steel treating.

Sahlin Furnace. A New Type of Electric Furnace, Axel Sahlin. Elec. News, vol. 28, no. 11, June, 1, 1919, pp. 32-34, 1 fig. Designed with view to embodying advantages of both arc and free-burning arc furnaces. Paper read before Instn. Elec. Engrs.

A New Type of Electric Furnace, Axel Sahlin. Electrical Review, vol. 84, no. 2165, May 23, 1919, pp. 591-593, 6 figs. General principle of furnace described is solid hearth which becomes conductive of electricity when hot. Furnace is built as circular ladle with contracted top and dished botton. Abstract of paper read before Instn. Elec. Engrs.

GENERATING STATIONS

Ance, France. Ance Hydroelectric Station of the Compagnie Electrique de la Loire et du Centre (L'usine hydro-électrique de l'Ance de la Compagnie électrique de la Loire et du Centre), Jacques de Soucy. Revue Générale de l'Electricité, vol. 5, no. 19, May 10, 1919, pp. 689-700, 14 figs. Attention is directed to controlling devices which permit connecting 14,800 kw. to network of company, or else dividing it into various units which are separately connected to other steam or hydroelectric power houses. (Concluded).

Brule River. Brulé River Hydro-Electric Development, C. V. Seastone. Power, vol. 49, no. 22, June 3, 1919, pp. 842-845, 4 figs. Three-unit plant generating three-phase 60-cycle current at 6600 volts. Vertical shaft turbines operate under approximate head of 60 ft.

Buenos Aires. Generating and Distributing Stations of Buenos Aires. Les nouvelles installations de production et de distribution d'électricité de Buenos Aires. Bulletin Technique de la Suisse Romande, vol. 45, no. 10, May 17, 1919, pp. 85-89, 4 figs. Three turbo-alternators of 5000 kw. are used. (To be continued).

Denver. New Electric Generating Station at Denver, T. O. Kennedy and H. H. Kerr. Elec. Eng., vol. 53, no. 6, June 1919, pp. 253-255, 3 figs. Enlarged by installing a 12,500 kw. 4000 volt General Electric turbo-generator.

Genoa. Electric Traction in Italy (Lagrande trazione elettrica in Italia). Industria, vol. 33, no. 8, Apr. 30, 1919, pp. 232-236, 4 figs. Central thermo-electric station of the state railways at Genoa.

Individual Stations. Ontario Power Co.'s Plant Extension. H. A. Gardner. Eng. World, vol. 14, no. 11, June 1, 1919, pp. 27-31, 9 figs. Enlargement consisted of installation of third conduit, parallel to the two existing conduits and additional occupational space constructed in old power house.

G. E. C. Plant at the Winchester Corporation Power House. Electricity, vol. 31, no. 1492, June 13, 1919, pp. 367-368, 4 figs. Installation of 450-kw. geared d. c. turbine generator.

Dominion Power and Transmission Co.'s Plant. Contract Rec., vol. 33, no. 21, May 21, 1919, pp. 469-471, 6 figs. Also Elec. News, vol. 28, no. 12, June 15, 1919, pp. 25-27, 5 figs. Designed for ultimate capacity of 75,000 kva. and to deliver its output at 44,000 volts. Special attention is given to coal-handling and boiler-house equipment. Generators are of revolving field type direct-connected to steam turbine and of 12,500 kva. each.

Power Factor. Increasing the Power Factor (Relevement du facteur de puissance), B. Guerschinovitch. L'Industrie Electrique, vol. 28, no. 646, May 25, 1919, pp. 184-187. Transformer. (Concluded.)

Turbo-Electric Stations. Economic Operation of Turbo-Electric Stations.—I. & I. C. T. Hirshfeld and C. L. Karr. Universal Engr., vol. 29, nos. 4 and 5, Apr. and May 1919, pp. 33-37, and 27-33, 5 figs. Graph given shows water-rate curves for various relations of load and steam consumption and different station loads. Asserts that smallest thermal cost of auxiliary power is secured when generated by steam with complete absorption in feedwater.

AUXILIARY EQUIPMENT

Switches. New Features in Switch Construction (Neuerungen im Weichenbau), E. Borst. Annalen für Gewerbe & Bauwesen, vol. 84, no. 4, Feb. 15, 1919, pp. 38-40, 6 figs. Compares advantages and disadvantages of spring tongue and pivot switches.

GENERATORS AND MOTORS

Air Gap and Ball Bearings. The Use of Ball Bearings for Electrical Machinery, H. M. Trumbull. Power House, vol. 12, no. 8, June 5, 1919, pp. 222-224, 10 figs. Points out that ball bearings enable builder to use smaller air gap.

Boosters. On Harada's Booster (In Japanese), K. Harada. Denki Gakkwai Zasski, no. 370, May 10, 1919.

Commutation. How Spacing and Thickness of Brushes Affect Commutation, Warren C. Kalb. Power, vol. no. 25, June 24, 1919, pp. 970-972, 9 figs. How spacing, alignment and thickness of brushes may cause circulating currents to flow in armature windings and thereby develop poor commutation.

Commutation Troubles—II, F. Ashton, Mech. World, vol. 65, no. 1690, May 23, 1919, p. 244. Using copper dampers in rotary converters.

Emocol Motor. The "Emocol" Motor Elecn., vol. 82, no. 22, May 30, 1919, pp. 619-621, 7 figs. Said to provide a greatly increased cooling surface, amounting in some cases to ten times the effective area as compared with the ordinary totally enclosed motor.

Fan Motors. The Development of Fan Motor Windings. E. W. Denman. Elec. Jl., vol. 16, no. 6, June 1919, pp. 257-260, 10 figs. With reference to advantages of split-phase winding.

Fires in Generators. Generator Fires. Power Plant Eng., vol. 23, no. 12, June 15, 1919, pp. 547-550, 4 figs. Means of minimizing occurrence and limiting extent of damage. From report of Committtee on Elec. Apparatus, read before Nat. Elec. Light Assn.

Generators, Large. Reinsulation of Large Generators. Elec. World, vol. 73, no. 25, June 21, 1919, pp. 1316-1318, 1 fig. To provide against interrupted service during period of heavy winter period. Practice of Milwaukee Elec. Ry. & Light Co.

Features of Mammoth Waterwheel Generator. Elec. World, vol. 73, no. 22, May 31, 1919, pp. 1156-1158, 4 figs. Method of construction employed in one of the 32,500-kva. generators which are being built for Niagara Falls Power Co.

Induction-Motor Magnetizing Current. Calculating Induction-Motor Magnetizing Current, C. M. Laffoon. Elec. World, vol. 73, no. 24, June 14, 1919, pp. 1258-1262, 25 figs. Equation connecting magnetomotive force and effective magnetizing current, and magnetizing currents for polyphase induction motors are calculated from relation between counter electromotive force, flux and magnetomotive force.

The Design of Large Induction Motors for Steel Mill Work, H. L. Barnholdt, Elec. Jl., vol. 16, no. 6, June 1919, pp. 251-255, 9 figs. Success in this industry attributed to continuity of service which alone electricity is capable of giving over long periods of time.

Mill-Type Motors. Direct Current Mill Type Motors for Steel Mill Auxiliary Drives, J. D. Wright. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 323-331, 19 figs. Compares details of construction of enclosed-frame and open-frame type motors, and furnishes information concerning ratings, brushes, bearings, and poles of various sizes of motors

Mine-Type Motors. Mine-Type Motors, L. C. Mosley. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 348-351, 8 figs. Distinctive features claimed are: Heavy construction and mounting of back-gear bracket on stator frame.

Rating. The Continuous-Rated Motor and Its Application, L. F. Adams. Sci. Am. Supp., vol. 87, no. 2268, June 21, 1919, pp. 398-400. Interpretation of the A. I. E. E. standardization rules as applied to motors.

Regulation. Regulation Without Loss of Energy of Three-Phase Motors in Rolling Mills (Ueber den derzeitigen Stand der Frage der verlustlosen Regelung von Drenstrom-Walzenzugmotoren), H. Hermans, Elektrotechnisene Rundschau, vol. 36, nos. 3-4, Jan. 22, 1919, pp. 9-10, 2 figs. Refers to various methods of regulation with special reference to the three-phase-commutator motor which can be regulated by changing the turning force of the rotating field, by displacing the brushes on the commutator, or by changing the rotor tension.

Ship-Propulsion Motors. The New Mexico's Motors, A. D. Badgley. Gen. Elec. Rev., vol. 22, no. 4, Apr. 1919, pp. 255-260, 8 figs. Single winding used to give variable poles with 2 :3 speed ratio. Motors are cooled by forced draft. Ratio of rotor diameter to length, largely reduced from usual practice.

Synchronous Motors. The Synchronous Motor as a Means of Reducing Costs, Rob. Treat. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 407-412, 7 figs. It is claimed that under usual conditions where induction motors on a circuit have lowered its power factor, the addition of a properly selected synchronous motor will improve service and increase power capacity.

Thermionic Tubes in D. C. Motor. A Small Direct-Current Motor Using Thermionic Tubes Instead of Sliding Contacts, W. H. Eccles and F. W. Jordan. Proc. Phys. Soc., Lond., vol. 31, part III, Apr. 15, 1919, pp. 151-153, 1 fig. Rotating part is ebonite disk with iron teeth on its periphery and stationary part comprises two electromagnets with their poles close to two teeth.

IGNITION APPARATUS

Bureau of Standards. Ignition Work at the Bureau of Standards, Francis B. Silsbee, Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1294-1299. Investigation has included brief study of effects of various types of spark discharge upon power developed by gasoline engine. Conclusions have been drawn in regard to condition of temperature and voltage at which a spark plug is required to operate.

Break. Notes on the "Break" of a Magneto or Induction-Coil, Norman Campbell. Lond. Edinburgh, and Dublin Phil. Mag., vol. 37, no. 221, May 1919, pp. 481-494, 2 figs. Experiments extending over various ranges of speed mentioned as demonstrating that greatest current which can be broken without sparking is independent of speed of separation of contacts.

LIGHTING AND LAMP MANUFACTURE

Argon Lamps. Argon Lamps (Du régime de fonctionnement électrique des lampes au tungstène (en atmosphère d'argon), H. Pecheux. Revue Générale de l'Electricité, vol. 5, no. 19, May 10, 1919, pp. 683-686. Influence of voltage excess on luminous intensity, with study of variations of characteristic coefficient of filaments in terms of nature of filaments and, for a given material, in terms of time during which it is subjected to action of current.

Buildings. The Lighting of Buildings. Eng. & Contracting, vol. 51, no. 22, May, 28, 1919, pp. 568-573. From an architectural point of view.

Colored Lights in Fog. Transmission of Colored Light through Fog, C. L. Utterback. Trans. Illuminating Eng. Soc., vol. 14, no. 3, Apr. 30, 1919. pp. 133-140 and (discussion), pp. 140-145, 2 figs. Measurements made are interpreted as indicating that an automobile light, or any searchlight, will have maximum transmission through fogs if light is composed of wave lengths from 5,300 to 5,900 only.

Engine-Terminal Lighting. Illumination of Toledo & Ohio Central Engine Terminal at West Columbus, O., R. E. Rice. Ry. Rev., vol. 64, no. 23, June 7, 1919, pp. 815-816, 3 figs' Flood lighting system adopted for illumination of adjacent yards.

Industrial Lighting. Selecting Equipment for Industrial Lighting—I, Ward Harrison and H. H. Magdsick. Elec. World, vol. 73, no. 25, June 21, 1919, pp. 1319-1321, 5 figs. Problems of color and elimination of glare. Technical data concerning lamps.

Lamp Operation and Maintenance. Data on Lamp Operation and Maintenance, C. H. Shepherd. Elec. World, vol. 73, no. 23, June 7, 1919, pp. 1215-1216, 2 figs. Data secured of system at Lincoln Park, Chicago, indicate that life of lamps depends greatly on switching in circuit.

LIGHTING CODES. Present Status of Industrial Lighting Codes, G. H. Stickney. Trans. Illuminating Eng. Soc., vol. 14, no. 4, June 10, 1919, pp. 153-171 and (discussion), pp. 172-208, 5 figs. Also Am. Architect, vol. 115, no. 2268, June 11, 1919, pp. 835-836. Writer looks with apprehension on laws or regulations emanating from the professions whose business they affect most directly. He claims that investigation and experience indicate need of Government regulation for factory lighting. Codes adopted in various states and in Federal establishments are discussed. Location of controlling switches. Bibliography.

MERCURY-ARC TUBE Mercury Arc Tube Operation, R. W. Kidd. Jl. Electricity, vol. 42, no. 11, June 1, 1919, pp. 527-528, 3 figs. Diagram of connections and remarks on care required by apparatus.

STREET LIGHTING. A Modern Ornamental Street Lighting System, Wm. O. Kleine. Am. City, City Edition, vol. 20, no. 6, June 1919, pp. 535-537, 5 figs. Cast iron standards about 13 ft. 4 in. high carrying 600 c-p. Mazda C lamps used in Cincinnati.

MEASUREMENTS AND TESTS

ALTERNATOR TESTING. Alternator Testing Under Reduced Power (Essai à puissance réduite des alternateurs), M. Togna. Revue Générale de l'Electricité, vol. 5, no. 22, May 31, 1919, pp. 779-787, 22 figs. Method for determining, magnetization and short circuit diagram by generalization of diagrams of Potier and Blondel.

AXLE GENERATORS. How One Road Tests Its Axle Generators, J. Doernhein, Ry. Elec. Engr., vol. 10, no. 6, June 1919, pp. 169-171, 5 figs. Testing equipment of Grand Trunk Ry., which is said to have been designed to operate under all varying conditions of speed, stop and reversals, the same as in actual operation.

METERS. A Method of Calibrating Meters, H. Gewecke and W. von Krukowski. Elecn., vol. 82, no. 23, June 6, 1919, pp. 644-645, 1 fig. Method by which revolutions of disk are automatically recorded. From Elektrotechnische Zeitschrift, no. 36, 1918.

Installation and Testing of Primary Meters, Halbert R. Thomas. Elec. World, vol. 73, no. 23, June 7, 1919, pp. 1212-1214, 3 figs. More attention is believed to be demanded at present time than formerly because tendency is to supply large consumers with energy at 2,200 volts, metering on the primary side.

PHASE ROTATION. Power Factor and Phase Rotation, Leslie F. Curtis. Jl. Electricity, vol. 42, no. 11, June 1, 1919, pp. 530-533, 8 figs. Suggests laboratory methods for determining phase rotation of voltages, phase position of currents and effective power factor.

RADIOMETER. An Application of the Radiometer to the Measurement of Electric Current, Thomas D. Cope. Jl. Franklin Inst., vol. 187, no. 6, June 1919, pp. 734-744, 3 figs. Experiments are said to have established usefulness of instrument in measuring currents.

VOLTAMETERS. The Richards Form Silver Voltameters, Jûichi Obata. Researches of Electrotechnical Laboratory, Tôkyô, Japan, no. 76, May 1919, 21 pp., 4 figs. Richards voltameters using least permeable porous-cup septum compared with Smith form; latter reported to have given heavier deposit, about 2 parts in 100,000 than Richards. Cause of difference attributed to effect of anode liquid and not to electrostenolysis.

MATERIALS OF CONSTRUCTION

MICA. Raw Materials Needed in Electrical Industries—Mica (De quelques matières premières nécessaires à l'industrie électrique le mica), Désiré Pector. Revue Générale de l'Electricité, vol. 5, nos. 19, 20 and 21. May 10, 17 and 24, 1919, pp. 701-706, 735-740 and 769-771. Deposits in Africa, America and Oceania. Notes compiled from various official publications. (Continuation of serial.) Dielectric properties; extraction and preparation. Combination with various substances for making insulator. Prices quoted at various markets of the world. (Concluded.)

PAPER AND CLOTHES. On Deterioration of Insulating Papers and Clothes (In Japanese), R. Mitsuda. Denki Gakkwai Zasshi, no. 370, May 10, 1919.

POWER APPLICATIONS

AGRICULTURE. Electrical Plowing and Mechanical Agriculture in France. Elec. Rev., vol. 74, no. 24, June 14, 1919, pp. 985-987, 4 figs. Description of equipment and comparison of costs of plowing by gasoline engine and electric motor. From Revue Générale de l'Electricité.

CENTRIFUGAL-MACHINES DRIVE. Centrifugal Machines and their Adaptability to Electric Motor Drive, H. W. Rogers. Gen. Elec. Rev , vol. 22, no. 5, May 1919, pp. 413-420, 9 figs. Formulæ and curves offered as help in selecting proper motor for a given installation.

HEATING. Experience with Electric Heating in the Northwest, J. D. Ross. Jl. Electricity, vol. 42, no. 12, June 15, 1919, pp. 566-568. Data presented as part of testimony before Idaho Public Utilities Commission in connection with study of economical generation of electric energy.

Heating of Buildings by Electricity, V. H. Greisser. Jl. Electricity, vol. 42, no. 12, June 15, 1919, pp. 564-566, 2 figs. Data of possibilities in electric heating for homes and office buildings; prepared by Washington Water Power Co.

Electricity in Household Service, H. C. Hoyt. Gen. Elec. Rev., vol. 22, no. 3, Mar. 1919, pp. 156-195, 55 figs. Illustrating various uses in lighting, supplying power for driving domestic utilities and heating and cooking.

MELTING. Application of Electrical Energy to the Melting of Metals, W. A. Greaves. Eng. & Indus. Management, vol. 1, no. 15, May 22, 1919, pp. 462-464, 8 figs. Induction furnace is not considered as commercially satisfactory, owing to loss in efficiency caused by metal being in form of ring, which is said to bring about extremely high heat losses.

OIL WELLS. The Operation of Oil Wells by Electric Power and the Resulting Gain to the Oil Producer, W. G. Taylor. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 384-394, 20 figs. Safety, reliability and convenience mentioned as advantages. Tables of comparative costs are presented.

PAPER MILLS. Electrification of Paper Mill Finishing-room Machinery, W. T. Edgell, Jr. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 399-406, 13 figs. Results obtained by Strathmore Paper Co., Woronoco, Mass.

ROD AND WIRE MILLS. Electricity in the Making of Copper Wire. Jl. Electricity, vol. 42, no. 12, June 15, 1919, pp. 569-570, 3 figs. Rod and wire mill of Anaconda Copper Mining Co., with capacity of 100,000 lbs. of rods and 50,000 lbs. wire every 8-hour shift.

SOAKING PITS. Electric Soaking Pits and Furnaces, T. F. Bailey. Blast Furnace & Steel Plant, vol. 7, no. 6, June 1919, pp. 264-267, 1 fig. Labor saving, precision of treatment produced and elimination of rejection of parts due to defective heat treatment. Paper read before Am. Iron and Steel Inst.

STEEL MILLS. Electric Drive for Steel Mill Main Rolls, K. A. Pauly. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 308-322, 23 figs. Examples of various installations with tables indicating characteristics of units employed.

TRANSPORTATION. Use of Electrical Equipment on San Francisco Water Front, Charles W. Geiger. Elec. Rev., vol. 74, no. 24, June 14, 1919, pp. 977-981, 4 figs. Methods of operating electric trucks, tractors, conveyors and piling machines to relieve traffic.

STORAGE BATTERIES

LEAD STORAGE BATTERIES. On Lead Storage Batteries (In Japanese), J. Iwashiro. Denki Gakkwai Zasshi, no. 370, May 10, 1919.

TELEGRAPHY AND TELEPHONY RADIO

ANTENNAE. Radiation and Direction of Field of Certain Types of Unenclosed Antennæ (Die Strahlung und Richtwirkung einiger Luftdrahtformen im freien Raum), W. Burstyn. Jahrbuch der drahtlosen Telegraphie und Telephonie, vol. 13, no. 5, Jan. 1919, pp. 362-378. Radiation characteristics of various forms for different directions in space.

Quantitative Experiments with Coil Antennas in Radio-telegraphy, L. W. Austin. Jl. Wash. Acad. Sciences, vol. 9, no. 12, June 19, 1919, pp. 335-339. Equations show that, other things being equal. if an antenna be used, both for sending and receiving, the received current falls off as the wave length, while if one coil be used, it falls off as the square of the wave length and with two coils as the cube of the wave length.

AUDIONS.—*See Vacuum Tubes.*

MEASUREMENTS. A New Method of Using Contact Detectors in Radio Measurements, Louis W. Austin. Proc. Inst. Radio Engrs., vol. 7, no. 3, June 1919, pp. 257-259, 1 fig. Based on use of low-resistance shunt across detector and galvanometer and calibration of arrangement using radio frequency currents which can be measured with hot-wire instruments

MUSICAL SOUNDS. Emission of Musical Sound in Radio Telegraphy (Note sur un problème d'émission musicale en radiotélégraphie), T. Minohara. Revue Générale de l'Electricité, vol. 5, no. 21, May 24, 1919, pp. 747-752, 4 figs. Technical determination of conditions for producing it.

OSCILLATIONS. Electrical Oscillations in Antennas and Inductance Coils, John M. Miller. Proc. Inst. Radio Engrs., vol. 7, no. 3, June 1919, pp. 295-326, 12 figs. After considering theory of circuits having uniformly distributed constants, writer shows graphically frequency-variation of reactance of such circuits and, after further analysis, those of inductance-loaded and capacity-loaded antennas.

POLDHU WIRELESS STATION. Great Wireless Stations, Poldhu. Wireless World, vol. 7, no. 73, Apr. 1919, pp. 1-5, 5 figs. Plant is rated at 75 kw.; normal transmitting wave length is 2,800 meters and the daylight range is given as 1,800 miles.

POULSEN. On the Poulsen Arc and Its Theory, P. O. Pedersen. Proc. Inst. Radio, Engrs., vol. 7, no. 3, June 1919, pp. 293-297, 2 figs. Continuing discussion of sustained oscillation of the first or second type produced by Poulsen arcs (see Proc. Inst. Radio Engrs., vol. 5, no. 4, p. 25) writer derives approximate value of peak voltage required for maintenance of such oscillations.

RECEIVERS. Radiotelegraphic Receivers of the Italian Navy (Ricevitori radiotelegrafici della R. Marina), G. Vallauri and G. de Luigi. Elettrotecnica, vol. 6, no. 13, May 5, 1919, pp. 254-258, 5 figs. Description of three types used by Italian Navy.

The Possiblities of Concealed Receiving Systems, A. Hoyt Taylor. Proc. Inst. Radio Engrs., vol. 7, no. 3, June 1919, pp. 261-266, 2 figs. Closed 3-meter square loop or 16 turns of wire hung about 1.5 meters from ground, said to have given good service for reception from stations as distant as 3,000 miles.

STATIC. Reception through Static and Interference, Roy A. Weagant. Proc. Inst. Radio Engrs., vol. 7, no. 3, June 1919, pp. 207-244 and (discussion), pp. 245-256, 31 figs. Effect produced by static (stray) considered and Eccles classification of static as "grinders," "clicks" and "hissing" adopted.

Weagant's Anti-Static Invention—II, Elmer E. Bucher. Wireless Age, vol. 6, no. 10, July 1919, pp. 11-21, 25 figs. Experiments made with two loops, each consisting of a single turn of wire extending out from station and back again, as measure to overcome troubles incident to use of loops with long low leads, forms of Weagant's antennae.

TELEPHONE TRANSMITTERS. Wireless Telephone Transmitter for Seaplanes. Wireless Age, vol. 6, no. 9, June 1919, pp. 14-19, 7 figs. Flying Boat type S. E. 1,100, developed by American Marconi Co. for navy use during war.

TELEPHONY. Recent Progress of Wireless Telephony (Sur les récents progrès de la téléphonie sans fil), C. Gutton. Bulletin de la Société Française des électriciens, vol. 9, no. 80, May 1919, pp. 323-332, 6 figs. In Europe and in the U. S. A.

TREES. Tree Telephony and Telegraphy, George O. Squier. Jl. Franklin Inst., vol. 187, no. 6, June 1919, pp. 657-687, 13 figs. From experiments it is concluded that a growing tree is a highly organized piece of living each which can be used in the same manner as the earth is used now as a universal conductor for telephone, telegraph and other electrical purposes.

Vacuum Tube. Cascade Amplification by a Single Vacuum Tube. Wireless Age, vol. 6, no. 10, July 1919, p. 23, 2 figs. Principle of operation is: Input e.m.f. is impressed between first section of cathode and its associated input element, and serves to vary discharge from cathode section to another electrode which is maintained positive with respect to cathode section.

The Three-Electrode Audion Lamp as Amplifier in Ordinary Telephony. (La lampada a tre elettrodi (Audion) come ripetitore-amplificatore nella telefonia ordinaria), G. Marchesi. Elettricista, vol. 8, no. 10, May 15, 1919, pp. 73-77, 6 figs. Account of research undertaken by various experimenters.

External-Anode Vacuum Tube, H. P. Donle. Elec. World, vol. 73, no. 23, June 7, 1919, pp. 1204-1206, 9 figs. Filament, control electrode and anode are disposed as follows: Filament is surrounded by control electrode which consists of helical coil of drawn tungsten wire; these two elements are the only ones inside tube, anode being a silver coating applied directly to outside of vacuum tube on that portion surrounding filament and control electrode.

WIRE

Cables. Accelerating Operation of Submarine Cables (Exploitation accélerée sur les longs câbles sous-marins). Revue Générale de l'Electricité, vol. 5, no. 22, May 31, 1919, pp. 802-804, 3 figs. Heurtley amplifier. German account of British apparatus. Translated from Archiv für Post und Telegraph.

Ocean Cable Receiving Instruments. Telegraph & Telephone Age, no. 11, June 1, 1919, pp. 255-258, 4 figs. Wiring diagrams of Gulsted relay, Brown "drum" relay and Heurtley magnifier.

Induction, Self. Regarding the Propagation of High-Speed Telegraph Signals on Lines with Increased Self-Induction (Uber die Fortplanzung schnell-telegraphischer Zeichen auf Leitungen mit vergrösserter Selbstinduktion), Ragnar Holm. Archiv fur Elektrotechnik, vol. 7, nos. 9 and 10, Feb. 17, 1919, pp. 263-292, 6 figs. Discussion of formulæ on hand of curves. The law of reflection of a coil. Main equations for pupinized lines.

Measurements. On Measurement of Signal Strength, W. H. Eccles. Proc. Inst. Radio Engrs., vol. 7, no. 3, June 1919, pp. 257-280, 11 figs. "Shunted telephone" method for measuring audibility of received signals.

Relays. Relays Used in Transoceanic Telegraphy (Relais employés en télégraphie sous-marine), J. B. Pomey. Revue Générale de l'Electricité, vol. 5, no. 22, May 31, 1919, pp. 797-801, 7 figs. With remarks on resonance relays.

Telephones, Service. The Telephone Service of Large Cities, with Special Reference to London, E. A. Laidlaw and W. H. Grinstead. Electrical Review, vol. 84, no. 2165, May 23, 1919, pp. 641-643. While holding as true that subscriber's estimate of telephone service is only criterion of satisfactory service, writer points out, however, certain factors inherent to human deficiencies of operators and concludes that there is a limit in exactness which can be expected from equipments of manual type.

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

Converter, Cabot. The Cabot Converter, Claude F. Cairns. Proc. Inst. Radio Engrs., vol. 7, no. 3, June 1919, pp. 281-291, 4 figs. Describes combination of a few-phase primary and many-phase secondary transformer and a secondary circuit commutator driven by a synchronous motor.

Transformer Connections. Parallel-Running of Transformers Fed from the Same System or from Different systems (La Pratique de la mise on parallele des transformateurs alimentés par le même reseau ou par deux reseaux), B. Guerschinovich. L'Industrie Electrique, vol. 28, no. 645, May 10, 1919, pp. 164-167, 4 figs. Tests required when connecting two systems in parallel. (Concluded.)

The Essentials of Transformer Practice—XXIII, E. G. Reed. Elec. Jl., vol. 16, no. 6, June 1919, pp. 267-268, 3 figs. Curve showing how vector sum of currents in two transformers connected in parallel compares to numerical sum with variable phase angle between currents.

Transformer Costs. Cost Comparison of Transformer Types, B. C. Dennison. Elec. World, vol. 73, no. 22, May 31, 1919, pp. 1152-1155, 5 figs. Comparison between five types of single-phase transformer designed from same specifications. It is concluded that for any type of transformer the design for dimensions that will reveal a given rating at minimum cost should be based upon (1) ratio of core section to coil section, (2) ratio of height of opening to width of opening, and (3) ratio of core depth to core width.

Transformer Dimensions. The Numerical Solution of the Equations of Transformer Dimensions, A. R. Low. Elecn., vol. 82, no. 24, June 13, 1919, pp. 671-673, 3 figs. Reduction of conditions for minimum loss with given output and cost found by application of Lagrange's method and outlined in Elecn., Nov. 15, 1918.

TRANSMISSION, DISTRIBUTION CONTROL

Arresters, Electrolytic. Experiences with Electrolytic Arresters. Elec. World, vol. 73, no. 24, June 14, 1919, pp. 1269-1272, 5 figs. Tests at 110 stations of Southern California Edison Company are interpreted as indicating need of giving particular attention to condition of horn gaps, film and electrolyte, oil, and line and ground connections.

Cable Characteristics. High-Tension Single-Conductor Cable for Polyphase Systems, W. S. Clark and G. B. Shanklin. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 6, June 1919, pp. 663-715, 24 figs. Dielectric, inductive and general line characteristics of three-conductor and single-conductor cable are compared It is asserted that line voltages of 44,000 and 55,000 are perfectly practical and mean a saving in copper over three-conductor cable of as much as 70 per cent.

Cables, Underground and Overhead. Underground and Overhead Alternating Current Maximum Power Cables (Unterirdische und oberirdische Wechselstrom-Hochstleistungskabel), W. Kummer. Schweizerische Bauzeitung, vol. 73, no. 19, May 10, 1919, pp. 213-216, 3 figs. Discusses advantages and disadvantages of ovehead and underground cables, with special reference to advantages of underground cables as per technical data of Dr. Paul Humann.

Condensers, Synchronous. Notes on the Application of Synchronous Condensers to Large Power Systems, G. V. Adendorff. Trans. South African Inst. Elec. Engrs., vol. 10, part 3, Mar. 1919, pp. 33-43, and (discussion) pp. 43-48, 5 figs. and supp. plate. Rotary condenser treatment is held to be necessary only in such cases where original design of generating plant has not been specified to type of demand it has to meet.

Distribution, Factory. The Electrical Equipment of H. M. Factory, Gretna, A. S. Cross. Electrical Review, vol. 84, no. 2167, June 6, 1919, pp. 652-654, 6 figs. Lighting, performance and distribution. High tension supply fed to eight substations extending about 4½ miles from power house over two overhead systems situated 150 ft. apart. (Concluded).

Electrolysis. Electrolysis and Modern Cable Construction, W. W. Walsh. Assn. Iron & Steel Engrs., Apr. 1919, pp. 7-24 and (discussion) pp. 24-32, 1 fig. General conclusions drawn from study of case in which pipe is considered as running parallel to track, in which case potential between rails and pipe is considered as positive at end farthest from power house, polarity being reversed in region adjacent to power house.

Feeders. Losses in Feeders (Pertes dans les feeders), W. Vuilleumier. Bul. Technique de la Suisse Romande, vol. 45, no. 9, May 3, 1919, pp. 7-8 and 80. Graphs for determining ohmic and induction losses. Percentage of losses is considered as varying inversely with square potential and directly with power.

Grounding. Grounding the Neutral of Generating and Transmission Systems, H. R. Woodrow. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 6, June 1919, pp. 745-749, 4 figs. Admitting his experience has shown that stresses on cables are relieved materially by grounding, writer, however, further believes that it is desirable to limit this grounding current as much as possible, thereby, he says, reducing stresses on system and particularly burning of lead sheath on grounding connections.

Interconnection. Interconnection of California Power Systems, P. M. Downing. Power Plant Eng., vol. 23, no. 13, July 1, 1919, pp. 580-582, 2 figs. Divided into a northern and a southern group of connected lines. Map indicating scheme of connections is presented.

Phase. Three-Phase Four-Wire Distribution, G. E. Wagner. Power Plant Eng., vol. 23, no. 11, June 1, 1919, pp. 507-510, 7 figs. Discussion of possible advantages and disadvantages and suggestions in regard to preventing troubles.

The Electrical Properties of Three-Phase Transmission lines, E. Parry. New Zealand Jl. of Sci. & Technology, vol. 2. no. 2, Mar. 1919, pp. 127-150, 3 figs. Tables applicable to sizes of conductors generally employed for transmission-line work.

Power Transmission Practice. Power Transmission, H. B. Vincent. Jl. Engrs. Club of Philadelphia, vol. 36, no. 175, June 1919, pp. 220-227, 9 figs. General study of problems and obstacles confronting operating man whose function is to provide continuity of service on high-tension power transmission lines. Paper read before Assn. Iron & Steel Elec. Engrs.

Relay Protection. Transmission Line Relay Protection, H. R. Woodrow, D. W. Roper, O. C. Traver and P. MacGahan. Proc. Am. Inst. Elec. Engrs. vol. 38, no. 6, June 1919, pp. 631-662, 19 figs. Summary of replies received from 32 operating companies by Protective Device Committee of Am. Inst. Elec. Engrs., in answer to questionnaire asking for their experience and present practice in regard to relay protection.

Substations. 900 Kw. Substation, Installed in 3-phase, 5,250 Volt, 50 Cycle Network of the Compagnie d'Electricité de Marseille (Poste de 900 kw. installé sur les canalisations triphasées, 5,250 v, 50 p: sec. de la Compagnie d'Electricité de Marseille), A. Racapé. Revue Générale de l'Electricité, vol. 5, no. 21, May 24, 1919, pp. 757-768, 7 figs. General plan and details of installation.

A Novel City Substation, Roy R. Kime, Elec. Eng., vol. 53, no. 6, June 1919, pp. 260-263, 4 figs. By reason of station being located in thickly populated New York district, dimensions of floor plan are only 24 ft. x 100 ft., although building is to contain 12,500 kva. of electrical apparatus.

Switchgear. European High-Voltage Switchgear, W. A. Coates, Elec. Jl., vol. 16, no. 6, June 1919, pp. 243-248, 13 figs. Pointing out particularly difference between British designs and those of Continental Europe. While in Great Britain transmission voltages over 15,000 to 20,000 are rarely needed, on the Continent there are in operation systems working at pressures up to 110,000 volts.

Transient Phenomena. The Effect of Transient Voltages on Dielectrics II. The Effect of Lightning Voltages on Arrester Gaps, Insulators and Bushings on Transmission Lines, F. W. Peek, Jr. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 6, June 1919, pp. 717-744, 17 figs. It is concluded that there is a great difference in the relative lightning spark-over voltages of different gaps as well as in the settings imposed by operating conditions, and it is advised that both of these factors be considered in comparing relative protective values.

Transmission-Line Surveys. The Location of Long-Distance Electric Transmission Lines, G. P. Anderson. New Zealand Jl. of Sci. & Technology, vol. 2, no. 2, Mar. 1919, pp. 95-108, 7 figs. Methods which are said to have been found necessary in field and in office in order to expedite work of surveying and of plotting results.

WIRING

Hotel. Electric Servicee in World's Largest Hotel—II, Elec. World, vol. 73, no. 22, May 31, 1919, pp. 1159-1163, 7 figs. Electric laundry installation; details of wiring on portion of a guest-room floor.

Mines. Wiring at Mines, Jack L. Ball. Coal Age, vol. 15, no. 23, June 5, 1919, pp. 1040-1041, 1 fig. It is suggested that wiring of mine be installed with as much care as in a residence, factory or similar building. This, it is said, will contribute to securing better results and large measure of safety.

Pulling Conductors Into Conduits. Pulling Conductors into Conduits, Terrell Croft. Power, vol. 49, no. 22, June 3, 1919, pp. 846-848, 10 figs. Discusses various matters and offers suggestions in regard to precautions to observe during work.

Standardization. Industrial Maintenance and Rehabilitation Methods, E. E. George. Elec. World, vol. 73, no. 22, May 31, 1919, pp. 1167-1170, 2 figs. Arguments for use of 115 volts direct-current supply instead of 230 volts; savings affected by standardization of methods and materials.

Wire, Insulated. Insulated Conductors in Relation to Cheap Wiring. C. Beaver. Elecn, vol. 82, no. 24, June 13, 1919, pp. 679-680, 2 figs. Describes method of manufacturing twin wire for circular section in which a central strip of vulcanized rubber insulates wires.

VARIA

Electromagnets and Solenoids. The Construction of 120 and 240 Volt Electromagnets and Solenoids, Henry W. Townsend. Power vol. 49, no. 23, June 10, 1919, pp. 888-890, 6 figs. Data are given of construction of a number of 120- and 240-volt electromagnets and solenoids.

Lightning Protection. Protecting Oil Storage Tanks from Lightning. Oliver Lodge. Petroleum World, vol. 16, no. 224, May 1919, pp. 198-199: also in Petroleum Times, vol. 1, no. 19, May 17, 1919, pp. 409-410. Attachment of lightning conductors to tanks not considered advisable. It is held that metal tanks, not over-elevated and not specially earthed, with good joints and free from leaks, are safe from lightning. Report of chief of petroleum executive containing views of various owners of petroleum tank installations.

INDUSTRIAL TECHNOLOGY

Ammonia, Oxidation.—*See Nitric Acid.*

Celluloid. Celluloid in the Industrial Field, John H. Stevens. Raw Material, vol. 1, no. 4, June 1919, pp. 227-232, 7 figs. Showing widely differing characteristics, celluloid is capable of possessing.

Chemical Engineering. Chemical Engineering, J. A. Wilkinson. Jl. Chem., Metallurgical and Min. Soc. of South Africa, vol. 19, no. 9, Mar. 1919, pp. 159-165, and (discussion) pp. 165-168. Points out that days of haphazard production, unaided by scientific investigation are past.

Physical Chemistry and Its Bearing on the Chemical and Allied Industries, James C. Philip Chem. News, vol. 118, nos. 3079 & 3082, Apr. 17 & May 9, 1919, pp. 181-183 & 215-222, 2 figs. Apr. 17: Influence of temperature and pressure on ammonia equilibrum. May 9: Review of prominent cases of industrial catalysis. (Concluded).

Fertilizers. The Setting of Mixtures of Superphosphate and Ammonium Sulphate, F. Scott Fowweather. Chem. Industry, vol. 38, no. 9, May 15, 1919, pp. 110T-112T. Experimental. Concluded that rate of setting of such mixtures is increased by reduction of free acid in them.

Gas. Manufacture of Gas from Wood, Adolphe Molin. Gas Jl., vol. 146, no. 2921 May 6, 1919, pp. 301-302, 3 figs. Experiences at Stockholm Gas Works in distillation of wood. From Journal des Usines à Gaz.

Gears. The Attack of Pots for Glass Melting. Engineering, vol. 107, no. 2788, June 6, 1919, pp. 725-727, 10 figs. Results of experiments conducted at Nat. Physical Laboratory.

Divitrification of Glass, N. L. Bowen. Jl. Am. Ceramic Soc., vol. 2, no. 4, Apr. 1919, pp. 261-278 and (discussion) pp. 278-281, 3 figs. Experiment interpreted as indicating that divitrification of glass is result of its tendency to reach stable crystalline conditions and that it takes place whenever glass is held for sufficient length of time within temperature where its cyrstallizing power is great.

Development of Improved Gold Ruby Glass, H. J. Bellamy. Jl. Am. Ceramic Soc., vol. 2, no.4, Apr. 1919, pp. 313-319 and (discussion) pp. 319-322. No conclusive deductions are made from research undertaken, but it is considered that a stable, reliable gold ruby glass can be econmically produced and that the presence of other colors is not a natural phenomenon of gold ruby glass.

Graphite. Refining Alabama Flake Graphite for Crucible Use. Fred G. Moses Dept. of Interior, Bur. Mines, War Minerals Investigation Ser., no. 8, Dec. 1918, 35 pp., 5 figs. Results obtained in finishing crude graphite concentrate are said to be dependent largely on character of crude flake contained in ores.

Kingsport, Tenn. Kingsport, Tennessee, and Its Chemical Industries—II. Chem. & Metallurgical Eng., vol. 20, no. 12, June 15, 1919, pp. 639-644, 4 figs. Coal-tar dyestuffs and intermediates; tannery and tanning extract plant.

Kingsport, Tennessee, and Its Chemical Industries—I. Chem. & Metallurgical Eng., vol. 20, no. 11, June 1, 1919, pp. 565-570, 6 figs. Technical description of ceramic and cement plants; also historical survey of growth of city.

Nitric Acid. Commercial Oxidation of Ammonia to Nitric Acid. Charles L. Parsons. Jl. of Indus. & Eng. Chemistry, vol. 11, no. 6, June 1919, pp. 541-552, 13 figs. Methods and apparatus which have been used or are being used for oxidation of ammonia to nitric oxide which, absorbed in water, yields nitric acid.

The Evolution of the Oxidation of Ammonia, W. S. Landis. Chem. Engr., vol. 27, no. 5, May 1919, pp. 113-117, 5 figs. Contributions made to process by American chemical engiueers in last year of war. (Concluded).

Nitrogen Fixation. How the Nitrogen Problem Has Been Solved, Henry Jermain Maude Creighton. Jl. Franklin Inst., vol. 187, no. 6, June 1919, pp. 705-735, 4 figs. Outline of principles underlying oxidation of ammonia by air in the presence of catalyst. A bibliography of literature on and relating to nitrogen fixation and oxidation of ammonia. Sixth article.

Nitroglycerin. The Behavior of Nitroglycerin When Heated, Walter O. Snelling and C. G. Storm. Dept. of Interior, Bur. of Mines, technical paper 12, 1912, 14 pp., 3 figs. Experiments interpreted as establishing that nitroglycerin begins to decompose at temperatures of 50 or 60 deg. cent., decomposition being accompanied by evolution of heat.

Nitrous Acid. The Decomposition of Nitrous Acid, Joseph Knox and Douglas M. Reid. Chem. Industry, vol. 38, no. 9, May 15, 1919, pp. 105T-108T, 4 figs. Investigation undertaken to determine influence of surface, shaking, excess of air, temperature and other factors on decomposition.

Peat. Distillation of Peat (La distillation de la tourbe). Journal des Usines à Gaz, vol. 43, no. 11, June 5, 1919, pp. 172-173. Description of installation.

Platinum Substitutes. Comparative Tests of Palau and Rhotanium Ware as Substitutes for Platinum Laboratory Utensils, L. J. Gurevich and E. Wichers. Jl. of Indus. & Eng. Chemistry, vol. 11, no. 6, June 1919, pp. 570-573. It is concluded that rhotanium A ware is superior to platinum ware, both of high (2.4 per cedt) and low (0.6 per cent) iridium content in respect to its resistance to loss on heating.

Potash. The Potash Situation, A. W. Stockett. Dept. of Interior, Bur. Mines, War Minerals Investigation Ser., no. 2, Oct. 1918, 13 pp. Summarizes conditions as fellows: Normal requirements of country 250,000 tons of K^2O per year; total production of 1917—32573 tons. Promising sources of permanent supply sufficient for future requirements, brines of Searles Lake and dust from blast furnaces and cement kilns.

Rubber. Effect of Certain Accelerators Upon the Properties of Vulcanized Rubber, G. D. Kratz and A. H. Flower. India-Rubber Jl., vol. 57, nos. 19 & 20, May 10 & 17, 1919, pp. 1-2 and 1-5, 5 figs. Experimental data on activity of certain organic and inorganic accelarators. It is found that magnesia in small amount is less active than certain organic accelarators and does not impart to mixtures the physical improvement characteristic of the latter. (Concluded).

The Manufacture of Synthetic Rubber, H. Duisberg. Chem. Eng., vol. 27, no. 5, May 1919, pp. 111-112. Compound used at Leverkusen works is said to have been dimethlylbutadiene. Paper read before German Busen Soc.

Sugar. The Loss of Moisture from Sugar Samples Under Different Methods of Preservation, C. A. Browne and G. H. Hardin. Sugar, vol. 21, no. 6, June 1919, pp. 294-295. Manner of testing and results obtained at N. Y. Sugar Trade Laboratory. Paper read before Division of Agriculture and Food Chemistry, Am. Chem. Soc.

Sulphuric Acid. The Effects of Cooling Burner Gases on the Catalytic Action of Platinum in Sulphuric Acid Contact Plants, S. T. T. Geary. Jl. Soc. Chem. Indus., vol. 38, no. 10, May 31, 1919, pp. 133T-136T, 1 fig. Claims that an average conversion of 98 per cent is obtained when reaction in platinum chamber is allowed to run its course with no attempt at cooling.

Tar Distillation. The Sulzer Process of Tar Distillation. Gas Jl., vol. 146, no. 2923, May 20, 1919, pp. 433-434, 6 figs. Tar passes constantly through apparatus in successive portions, various constituents of which are removed until final residue of pitch is obtained. From Journal des Usines à Gaz.

Tellurium. A Contribution to the Chemistry of Tellurium Sulphide, Aaron M. Hagaman. Chem. News, vol. 118, no. 3082, May 9, 1919, pp. 217-219, 1 fig. Concludes from investigation that introduction of hydrogen sulphide into an aqueous tetravelent tellurium solution at room temperatures or below causes immediate production of a red-brown precipitate represented by formula $Te\ S_2$. (Concluded).

Zinc Oxide. The Manufacture of Zinc Oxide. Chem. Eng. & Min. Rev., vol. 11, no. 127, Apr. 5, 1919, pp. 190-191, 1 fig. Plant installed by Broken Hill Associated Smelters Pty. Ltd., Port Pirie.

MARINE ENGINEERING

AUXILIARY MACHINERY

Electrical Auxiliaries. The Electrical Division Aboard Ship, Alex M. Charlton, U. S. Naval Inst. Proc., vol. 45, no. 196, June 1919, pp. 987-1008, 2 figs. Organization, routine and tests developed on U. S. S. "Texas."

Electrically Driven Ships' Auxiliaries. Engineer, vol. 127, no. 3307, May 16, 1919, pp. 478-480, 16 figs. Scott-Bentley load-discriminating device for application to deck winch.

Rudders. The Kitchen Reversing Rudder. Engineering, vol. 107, no. 2785, May 16, 1919, pp. 631-634, 22 figs. Consists of two curved deflectors forming parts of a circular cylinder and partly enclosing the propeller.

SHIPS

American Shipping. The Future of American Shipping, Edwin N. Hurley. Universal Engr., vol. 29, no. 4, Apr. 1919, pp. 21-32, 10 figs. Advises not to concentrate too much upon strength of competition with other nations.

Cargo Vessels. *See Freighters.*

Concrete Ships. Design and Construction of Navy Concrete Oil Barges, R. M. Burkhalter. Eng. News-Rec., vol. 82, no. 22, May 29, 1919, pp. 1056-1058, 5 figs. Boats have oil holds protected by air compartments and also may carry deck loads. Concrete poured from trestle at rear of boats.

First British-Built Ferro-Concrete Steamship S.S. "Armistice." Steamship, vol. 30, no. 360, June 1919, pp. 275-277, 4 figs. Dead weight capacity 1150 tons. Built on Mouchel-Hennebique system under survey of Lloyd's Registry.

German Views on the Economics of Ferro-Concrete Ships, Carl Commentz. Shipbuilding and Shipping Rec., vol. 13, no. 20, May 15, 1919, pp. 635-636. Table comparing several sizes of steel and reinforced-concrete vessels for both short and long voyages taking pre-war prices throughout as basis of comparison. From Hansa.

Form Work and Timbering Details in Concrete Barge Construction. Concrete, vol. 14, no. 6, June 1919, pp. 222-225, 10 figs. Boats have overall length of 112 ft., 36 ft. beam and draft of 9 ft.

Electric Propulsion. *See New Mexico.*

FREIGHTERS. Speed, Dimensions and Form of Cargo Vessels. Shipbuilding & Shipping Rec., vol. 13, no. 21, May 22, 1919, pp. 665-668, 2 figs. Theoretical discussion of best speed, which is defined as the one that will give the largest profit per pound of capital invested, per day invested.

Economical Form and Speed. Shipbuilding & Shipping Rec., vol. 13, no. 23, June 5, 1919, pp. 725-727. Comparison of cost of operating five typical merchant ships.

Cargo Steamers with Rateau Geared Turbines. Shipbuilder, vol. 20, no. 106, June 1919, pp. 327-350, 31 figs. Turbines develop 2500 shaft hp. under ordinary service conditions at 3000 r.p.m. Propeller speed, 70 r.p.m.; total ratio of reduction in speed, 43 to 1.

LEPARMENTIER UNSINKABLE SHIPS. Leparmentier System of Building Ships Which Cannot Sink or Capsize (Les Navires inchavriables et insubmersibles Leparmentier), Raymond Lestonnat. Génie Civil, vol. 74, no. 23, June 7, 1919, pp. 453-456, 5 figs. Outlines procedure followed at New Orleans.

MODELS. Some Experiments on Full Cargo Ship Models, James Semple. Engineering, vol. 107, no. 2788, June 6, 1919, pp. 751-754, 9 figs. To determine effect on performances (1) of fullness and (2) of longitudinal distribution of displacement. Wake and thrust deduction investigations were also carried out on a number of models and in addition some comparisons are drawn between results obtained at various establishments.

MOTOR SHIPS. The Motor Ship "Santa Margherita." Engineering, vol. 107, no. 2787, May 30, 1919, pp. 691-693 and 706, 8 figs. partly on supp. plates. Equipped with Diesel engines. Dimensions selected by builders to meet stipulated requirements of British Admiralty in regard to stability, draft and trim, are: length, 440 ft.; breadth, molded, 54 ft.; depth molded (upper deck), 36 ft. 6 in.

Present Position of the Diesel Engine as Applied to Marine Service, Thomas Orchard Lisle. Jl. Soc. Automotive Engrs., vol. 4, no. 6, June 1919, pp. 477-481, 10 figs. Holding that less than 150 hp. per 1000 ton is not of much use as a propelling means, American type of wooden vessel developed during the war is said to have proven unsuccessful because, in addition to other circumstances which are also considered as drawbacks, auxiliary power was insufficient to drive them at a profitable speed without the sails and a favorable breeze and sometimes even with all these.

Motor-Driven Oil-Tank Vessel "Santa Margherita." Shipbuilding & Shipping Rec., vol. 13, no. 23 & 24, June 5 & 12, 1919, pp. 719-721 & 748-750-753, 19 figs. partly on supplement plate. Principal dimensions are: length, 440 ft.; breadth, 54 ft.; depth, 36 fit. 6 in.; draft, normal, 25 ft. 9 in., and maximum, 28 ft. ½ in.; deadweight capacity, 9916 tons. Power supplied by two heavy-oil engines, each of 1250 b.h.p. at 130 r.p.m.

NEW MEXICO. General Characteristics of Electric Ship Propulsion Equipments, E. F. W. Alexanderson. Gen. Elec. Rev., vol. 22, no. 4, Apr. 1919, pp. 221-232, 8 figs. It is said that simplicity and reliability were aimed at for U. S.S. "New Mexico" by elimination of liquid rheostats, and development of new type of squirrel-cage induction motor.

Electric Propulsion for the U. S. S. New Mexico—I, C. S. Raymond, Sci. Am. Suppl., vol. 87, no. 2266, June 7, 1919, pp. 356-358, 5 figs. One feature that differs from land practice is omission of turbine and generator base castings. Turbine casing, generator stator frame and bearing standards are bolted directly to stiff structural-steel foundation which is securely tied in with ship's structure. (To be concluded.)

The Turbines of the U. S. S. New Mexico, E. O. Hunt. Gen. Elec. vol. 22, no. 4, Apr. 1919, pp. 233-243, 10 figs. While resembling in many particulars General Electric Co. types built for lamp operation, they possess, it is said, ability to operate over wide range of speed under control of special design governing arrangement.

The New Mexico's Generators, C. S. Raymond. Gen. Elec. Rev., vol. 22, no. 4, Apr. 1919, pp. 244-254, 23 figs. Special feature is said to be arrangement of stator winding in two coils per phase, connected in parallel for low voltage and in "square" for high voltage operation.

U. S. S. New Mexico, Description and Official Trials, S. M. Robinson and Henderson B. Gregory. Jl. Am. Soc. Naval Engrs., vol. 31, no. 2, May 1919 pp. 345-404, 28 figs. partly on supp. plates. Trials referred to were conducted after ship had been out of dry dock about seven weeks, which is said to have increased by 4000 the shaft hp. necessary to make guaranteed speed of 21 knots.

The Main Control Equipment of the New Mexico, C. T. Hentchel. Gen. Elec. Rev., vol. 22, no. 4, Apr. 1919, pp. 261-271, 16 figs. Construction and interrelationship of units of control apparatus.

Controlling the Propulsion of the New Mexico, H. Franklin Harvey. Gen. Elec. Rev., vol. 22, no. 4, Apr. 1919, pp. 272-292, 10 figs. Refers specially to features permitting inter-connection for obtaining direct-current supply at switchboard for turbine-generator excitation, this interconnection providing for contingencies in case of damage to equipment.

A Review of the Propelling Equipment and Operation of the New Mexico, Eskil Berg. Gen. Elec. Rev., vol. 22, no. 4, Apr. 1919, pp. 293-298, 2 figs. Circulating air, hot-well, and lubricating pumps, ventilating fans and other auxiliaries.

ORE CARRIERS. Geared-Turbine-Engined Ore and Coal Carrier "Conde de Zubiria." Shipbuilding & Shipping Rec., vol. 13, no. 21, May 22, 1919, pp. 659-660, 5 figs. on supp. plate. Principal dimensions are : Length, 314 ft.; breadth, 47.9 ft.; depth, 24.3 ft.; gross tonnage, 3278 tons and net tonnage, 2683 tons.

PATROL BOATS. The "P" Boats. Engineer, vol. 127, no. 3308, May 23, 1919, pp. 512-513, 2 figs. Patrol boats fitted with 4000-hp. Parsons geared turbines.

REMOVABLE PROPELLING MACHINERY. Removable Propelling Machinery for Ships (Mécanismes amovibles pour la propulsion des navires), M. Tayon. Génie Civil, vol. 74, no. 16, Apr. 19, 1919, pp. 308-312, 9 figs. Points out that the propelling machinery of a ship is effective only during actual navigation. More economical navigation is, therefore, obtained. It is concluded, by a system which will permit adaptation of machinery set to various hulls.

TONNAGE. The Tonnage of Modern Steamships, A. T. Wall. Steamship, vol. 30, no. 360, June 1919, pp. 278-280. Effect of recent legislation and modern machinery on tonnage measurement. Paper read before Instn. Naval Architects.

TERMINALS

PORT MANAGEMENT. Some Problems of Port Management, Hamilton Higday. Freight Handling & Terminal Eng., vol. 5, no. 5, May 1919, pp. 186-191. Deals particularly with labor problem, development of industrial areas, and levying of port charges.

PERU. The Ports of Peru, Grosvenor M. Jones. Freight Handling & Terminal Eng., vol. 5, no. 5, May 1919, pp. 170-174. Lobitos, Talara, Callao, Paita, Eten, Salaverry and Chimbote. Description is confined to extent of foreign trade at each.

YARDS

AMERICAN SHIPBUILDING. Shipbuilding Development in the United States and Canada, W. R. Gray and Edward F. Clarke. Trans. Northeast Coast Instn. of Engrs. & Shipbuilders, vol. 35, no. 4, June 1919, pp. 151-162 and (discussion) pp. 162-178. Notes gathered on writer's visit to U. S. A.

American Shipbuilding Costs. Shipbuilding & Shipping Rec., vol. 13, no. 20, May 15, 1919, pp. 630-631 & 633-634, 6 figs. Swedish ship of 440 ft. in length with d.w. tonnage of 9500. Engines are 6-cyl., 4-stroke single-action Diesel motors.

CONCRETE SHIPS. Concrete Shipbuilding at Barrow-in-Furness, W. Noble Twelvertees. Engineering, vol. 107, no. 7285, May 16, 1919, pp. 624-627, 14 figs., partly on four separate plates. Site is adapted for building vessels up to 250 ft. in length.

FORD METHODS. Ford Methods in Ship Manufacture—VI, Fred E. Rogers. Indus. Management, vol. 57, no. 6, June 1919, pp. 456-464, 14 figs. Details of launching scheme and of achievement claimed to have been made in erecting Eagle No. 59 in ten days.

REDESIGNING. Commerce Absorbs Transports Ships. Mar. Rev., vol. 49, no. 7, July 1919, pp. 326-329, 9 figs. Redesigning of thirteen vessels planned for war emergency to carry freight and passengers.

STANDARDIZATION OF SHIP MATERIAL. Standardizes Steel Ship Materials, Fred T. Llewellyn. Iron Trade Rev., vol. 64, no. 24, June 12, 1919, pp. 1549-1551. Remarks on standards adopted by Emergency Fleet Corporation which were modeled after British standards. Paper read before Am. Iron & Steel Inst.

WISCONSIN YARDS. Wisconsin Shipbuilding, Richard S. McCaffery. Wisconsin Engr., vol. 23, no. 8, May 1919, pp. 275-280, 3 figs. Importance of ocean tonnage delivered from Wisconsin shipyards emphasized by remarks that if vessels built at these shipyards during last year were placed in line, the line would be two miles long.

SALVAGE

How the "Lake Weston" was Salved. Shipbuilding & Shipping Rec., vol. 13, no. 24, June 12, 1919, pp. 747-749. Vessel ran ashore in Bristol Channel.

MECHANICAL ENGINEERING

AIR MACHINERY

AIR CONDITIONING. Refrigeration in Relation to Air Conditioning in War Industries, J. I. Lyle. Am. Soc. Refrig. Engrs., vol. 5, no. 5, March 1919, pp. 376-382, 4 figs. Illustrating uses of dehumidifier.

AIR VALVES, COMPRESSOR. Magnetic Air Valve. Iron & Coal Trades Rev., vol. 98, no. 2673, May 23, 1919, p. 702, 2 figs. For unloading automatically a motor-driven air compressor before starting and stopping driving motor. Valve is a combination of electromagnet of contractor type, a two-way valve and a small switch controlled by a dashpot.

Automatic Valves for Motor-Driven Air Compressors. Elecn., vol. 82, no. 24, June 13, 1919, pp. 676-677, 2 figs. Valve patented by British Thomson-Houston Co. is said to insure that air compressor is unloaded before current is switched on to motor as well as throughout starting period.

AIR WASHERS. Air Washer Experiences, Samuel R. Lewis and E. V. Hill. Heating & Ventilating Mag., vol. 16, no. 6, June 1919, pp. 25-31, 4 figs. Suggests scheme with two sets of sprays arranged so that they wet throughly entire surface of front haffles.

AIR WEIGHT AND VOLUME MEASUREMENTS. Air Weight and Volume Measurement—II, Don T. Hastings. Automotive Industries, vol. 40, no. 25, June 19, 1919, pp. 1399-1402, 1 fig. Theory of venturi meter as applied to liquids and also to gases.

COMPRESSORS. Some Recent Improvements in Air Compressor Design. Engineer, vol. 127, no. 3309, May 30, 1919, pp. 538-540, 7 figs. Rotary compressor of crescent type in which blades instead of being forced against bore of stationary casing press against interior of liner which revolves on ball bearings concentric with casing.

FLOW IN PIPES, COMPRESSED AIR. Flow of Compressed Air in Pipes, Johan Sarvaas. Proc. Australasian Inst., Min. Engrs., no. 31, Sept. 30, 1918, pp. 121-130, 1 fig. Tables and equation offered as serviceable in simplifying computations involved in application of Rankine's and D'Arcy's formulæ.

PUMP, MARINE. The Marine Air Pump as a Power Factor, Harold C. Walker. Mar Engr. & Naval Architect, vol. 4, no. 505, June 1919, pp. 270-276, 11 figs. Also Mar. Eng., vol. 9, no. 6, June 1919, pp. 205-208, 12 figs. Discusses wet, Edwards and rotary types and their comparative. Paper read before Inst. of Marine Engrs.

RECEIVERS. The Air Receiver, Frank Richards. Power Plant Engr., vol. 23, no. 12, June 15, 1919, pp. 554-558, 2 figs. Suggestions in regard to determining capacity and avoiding explosions.

USES. Air Uses at Newburgh Shipyards Plant, Francis Judson Tietsort. Compressed Air Mag., vol. 24, no. 6, June 1919, pp. 9155-9160, 10 figs. Plant builds 9000-ton ships.

CORROSION

COPPER AND CORROSION OF STEEL. The Influence of Very Low Percentages of Copper in Retarding the Corrosion of Steel, D. M. Buck. Am. Soc. Testing Materials University of Penna., 22nd annual meeting, June 24, 1919, advance copy, 14 pp., 10 figs. Concluded from tests that very low amounts of copper in steel materially lower corrosion rate.

IRON ALLOYS. The Relative Corrosion of Cast Iron, Wrought Iron and Steel Pipe in House Drainage Systems, F. N. Speller. Plumbers' Trade Jl., vol. 66, no. 12, June 15, 1919, pp. 752 and 754-755, 2 figs. Discussion of paper by Wm. Paul Gerhard presented at Am. Soc. Mech. Engrs. meeting, Dec. 1918.

RUSTPROOFING. Rustproofing Cast-iron Parts. Machy. (N. T.), vol. 25, no. 10, June 1919, pp. 919-921, 5 figs. Process is based on fact that film of magnetic iron oxide is formed on surface of iron castings when heated to temperature of 700 deg. cent. or over in oxidizing atmosphere.

Metallic Coatings for Rust-Proofing Iron and Steel—III. Bibliograph. Henry S. Rawdon, M. A. Grossman and A. N. Finn. Chem. . & Metallurgical Eng., vol. 20, no. 11, June 1, 1919, pp. 591-592. Divided into following sections: Nature of corrosion, miscrostructure, methods of coating, black finishes and similar coatings, "pickling" and its effects, and methods of testing coatings.

Calorizing Process for Protection of Metal from Oxidation at High Temperatures, W. E. Ruder. Jl. Am. Steel Treaters Soc., vol. 1, no. 5, Feb. 1919, pp. 160-170, 14 figs. Notes on various processes and account of tests of report and carbonizing and annealing boxes.

TESTS. Corrosion Tests (Essai de corrosion), H. LeChatelier and B. Bogitch. Revue de Métallurgie, vol. 16, no. 2, Mar-Apr. 1919, pp. 129-139, 16 figs. Chemical heterogeneity of reheated or slowly cooled steels is considered as being due entirely to oxygen.

FORGING

MARINE FORGINGS. Keeps Pace With War Requirements. Iron Trade Rev., vol. 64, no. 25, June 19, 1919, pp. 1616-1617, 3 figs. Describes Camden Forge Co's plant which formerly manufactured railroad forgings and is now turning out marine forgings.

SHELLS. Forgings and Inspecting Ordnance Shells, Stanley A. Richardson. Sibley Jl. Eng., vol. 33, no. 4, May 1919, pp. 40-43 & 45. Particular reference is made to successive steps in inspecting, gaging, checking and testing.

STAMPS. Drop-Stamping. Drop-Forgings, Etc.—III, Joseph Horner. Mech. World, vol. 65, no. 1691, May 30, 1919, p. 259, 6 figs. Illustrating stamps where top tools or dies are not necessary (Continuation of serial.)

FOUNDRIES

ALUMINUM CASTINGS. Casting Aluminum (Das Giessen von Aluminum), H. Stoesser. Metall, no. 5, Mar. 10, 1919, pp. 61-62. Instructions as to kind of sand to be used, construction of molds, and type of crucible.

BRASS CASTINGS, POROSITY OF. Some Principles Involved in Melting Metals—VI, Charles Vickers. Brass World, vol. 15, no. 6, June 1919, pp. 175-176. Cases of porosity in brass castings due to shrinkage of individual crystals made possible by their having grown abnormally large. (To be continued.)

BRASS FOUNDRY. Modern Works of The Mueller Co., Sarnia, Ontario. Can. Foundryman, vol. 10, no. 6, June 1919, pp. 139-141, 6 figs. Production of brass castings.

CUPOLAS. A Cupola With Novel and Interesting Features, J. F. Mullan. Can. Foundryman, vol. 10, no. 6, June 1919, p. 152, 1 fig. Wind jacket is placed inside of shell instead of outside.

ELECTRIC STEEL. Electric Steel Castings made in Chicago Shop. Foundry, vol. 47, no. 324, June 1, 1919, pp. 352-355, 8 figs. Battery of three electric furnaces in use at foundry of Electric Steel Co. at Chicago. Two furnaces are of Schneider type and one of Pittsburgh type.

ENGINE CYLINDERS. Patterns and Moulds for Engine Cylinder Castings—II. Joseph Horner. Foundry Trade Jl., vol. 21, no. 208, Apr. 1919, pp. 215-223, 22 figs. Discusses various practices in process of molding. (Continued.)

ENGLAND. Progress in Metal Casting in England, W. R. Barclay. Metal Indus., vol. 17, no. 6, June 1919, pp. 266-268, 6 figs. Comparison of technique of casting process as carried out by steel and metal casters.

FEEDER-HEAD METHOD. A "Feeder-head" Method in Non-ferrous Ingot Casting, W. R. Barclay. Metal Industry, vol. 14, no. 18, May 2, 1919, pp. 361-364, 6 figs. Draws comparison between general methods adopted in crucible steel ingot casting and those followed in crucible non-ferrous ingot casting.

JARRING MACHINE. The Manufacture of Semi-steel Shells, E. A. Suverkrop. Am. Mach., vol. 50, no. 22, May 29, 1919, pp. 1041-1043, 9 figs. Shockless jarring machine adapted for molding shells.

MOLDING. Steel Castings for Our First Line of Defense, Walter S. Doxsey. Foundry, vol. 47, no. 9, June 15, 1919, pp. 367-372, 14 figs. Additions to foundry of naval gun factory with reference to molding methods and layout of shop.

SAND. Production of Albany Molding Sand. Iron Age, vol. 103, no. 23, June 5, 1919, pp. 1499-1501, 4 figs. Analysis of origin and composition. States that standard specifications based on grain size are difficult to draw up.

SHIP PARTS. Making Castings Used in Ship Construction—III, IV, Ben Shaw and James Edgar. Foundry, vol. 47, no. 8 & 9, June 1 & 15, 1919. pp. 336-339 & 388-392, 27 figs. Building rudder yoke pattern. Suggestions in regard to exercising care to obviate subsequent foundry difficulties. Methods of molding and casting rudder yokes as pursued in English steel foundries.

WASTE. Modern Methods Applied to the Foundry—Ii, W. R. Dean. Metal Industry, vol. 14, no. 17, Apr. 25, 1919, pp. 349-350, 5 figs. Recommends classification of wastes and their causes and suggests methods for establishing a system of classification.

FUELS AND FIRING

ASH, FUSIBILITY. Fusibility of Ash from Pennsylvania Coals, W. A. Selvig and A. C. Fieldner. Coal Age, vol. 15, no. 24, June 12, 1919, pp. 1086-1089. Table giving results obtained. Samples tested are said to have been gathered in accordance with method adopted by Bureau of Mines.

COAL. Utilization of Fuel (Zur Frage der zukünftigen Brennstoff-Ausnutzung), De Grahl. Annalen für Gewerbe und Bauwesen, vol. 84, no. 1, Jan. 1, 1919, pp. 1-8, 7 figs. Characteristics of gasification of bituminous coal at high and low temperatures.

The Gasification of Coal and the Rational Utilization of Fuels (Kohlenvergasung und rationelle Ausnutzung der Brennstoffe), M. Dolch. Montanistische Rundschau, vol. 11, nos. 3, 4, 5 & 6. Feb. 1 & 16, Mar. 1 & 16, 1919, pp. 61-64, 93-97, 125-129, and 162-166. From the economic point of view. Importance and future of by-products. (To be continued.)

COAL, PULVERIZED. Use of Pulverized California Coal, Chas. H. Delaney. Nat. Engr., vol. 23, no. 6, June 1919, pp. 278-279. Discussion of its economical employment as substitute for fuel oil from standpoint of initial cost and comparative operating expense. Paper read before Nat. Elec. Light Assn.

Pulverized Coal Systems in America, Leonard C. Harvey. Elecn., vol. 82, no. 22, May 30, 1919, pp. 616-619, 3 figs. Also in Iron & Coal Trades Rev., vol. 98, no. 2673, May 23, 1919, pp. 704-705. Analysis of costs and efficiency secured leads writer to conclude that advantages of burning coal in pulverized form have been definitely proved and that heat values of coal can be utilized to a far higher degree by this means than by any other process.

The Use of Pulverized Coal, L. C. Harvey. Eng. & Indus. Management, vol. 1, no. 14, May 15, 1919, pp. 423-426, 3 figs. Quigley semi-automatic bin-filling system. It is claimed that by this system coal dust can be readily conveyed to ships in harbor or at sea.

COAL SELECTION. The Economical Use of Coal, T. J. Nelson. Domestic Eng. & Estate Engr., vol. 39, no. 5. May 1919, pp. 62-65. Price delivered at works, suitability to furnaces installed, calorific value and amount of ash suggested as factors governing choice of coal to be used when it has to be brought some distance by rail to works.

COAL WASTE. Utilization of Coal Waste (L'Utilisation des déchets de Houille). L'Echo des Mines et de la Métallurgie, vol. 47, no. 2626, May 18, 1919, pp. 298-300. A committee of the Société de l'Industrie minérale report that their experiments have demonstrated that coal having 40 per cent ash and 23 per cent volatile matter yields tar in greater quantity and of better quality than the kind generally obtained in gas works.

Waste Due to Excessive Ash or Non. Combustible in Coal, W. A. Shoudy. Stevens Indicator, vol. 36, no. 1, Jan. 1919, pp. 11-17, 4 figs. Reduction in heating value due to presence of ash schematically illustrated. Report prepared for Eng. Committee of National Research Council.

Utilizing Mine Waste and Inferior Fuels, F. Blache. Colliery Guardian, vol. 117, no. 3047, May 23, 1919, pp. 1225-1226, 2 figs. Plant of Société de Montrambert comprises set of two gas producers of cylindrical section and about 10 ft. in diameter, with automatic charging and distributing mechanism to spread fuel evenly over entire surface.

COLLOIDAL FUEL. Possibilities of Colloidal Fuel. Power Plant Eng., vol. 23, no. 13, July 1, 1919, pp. 583-585, 2 figs. Methods of preparation and results of boiler tests.

Colloidal Fuel—A Chemist's Dream Come True, Robert G. Skerrett. Rudder, vol. 35, no. 6, June 1919, pp. 271-275, 12 figs. Examples of application of mixtures composed of powdered coal, liquid fuel and "fixateur," and account of uses of this fuel for naval operations.

FUEL CONSERVATION. Electricity vs. Gas in Regard to Coal Conservation, Hugh M. Goody. Elecn., vol. 82, no. 21, May 23, 1919, pp. 595-596. Examines figures on which Sir Dugald Clerk based his conclusion that "There is no case for electricity for the production and distribution of heat energy; there is a case in strong competition with gas for illumination; and as against the average reciprocating steam engine of the country, the advent of the steam turbine of high efficiency shows a distinct advantage."

GASOLINE. Motor Gasoline Properties. Laboratory Methods of Testing, and Practical Specifications, E. W. Dean. Dept. Interior Bur. Mines, Technical paper 214. Petroleum Technology, 52, Feb. 1919, 33 pp., 2 figs. Based on properties which are considered desirable by Bureau. These are absence of too large a percentage of highly volatile products or of heavy or non-volatile constituents, freedom from substances that attack metal either before or after combustion or which leave residue that collects in motor.

HAND FIRING. Standard Practice of Hand Firing, Robert June. Elec. Rev., vol. 74, no. 23, June 7, 1919, pp. 937-939, 3 figs. Of the two methods of hand firing—spreading method and coking method—writer believes that modern practice leans more and more to spreading method, because he says, of its higher efficiency higher CO_2, lower flue gas and more uniform steam generation.

OIL. Oil Gains Importance as Ship Fuel, V. G. Iden. Mar. Rev., vol. 49, no. 7, July 1919, pp. 321-324, 5 figs. What the Government did to standardize oil burning on merchant ships.

PEAT. Peat, Oil and Gas Fuel, B. J. Forrest. Jl. Eng. Inst. Can., vol. 2, no. 6, June, 1919, pp. 439-445, 5 figs. Writer's opinion is that industrialization of peat could be most efficiently brought about by gasifying in gas producers, because, he says, this procedure would render feasible the recovery of several valuable by-products.

The production of Peat Fuel, Ernest V. Moore. Jl. Eng. Inst. Can., vol. 2, no. 6, June 1919, pp. 435-438. General properties, mode of occurrence and present utilization of peat found in vicinity of Montreal.

The Future of Peat as a Fuel—II, J. B. C. Kershaw. Coal Age, vol. 15, no. 21, May 22, 1919, pp. 946-950, 7 figs. Gasification and powdering are believed to be routes of improvement along which future progress in peat utilization may be expected.

STOKERS. Fuel-Burning Equipment of Modern Power Stations, Joseph G. Worker. Power House, vol. 12, no. 7, May 20, 1919, pp. 187-191, 15 figs. Data relative to installations where inclined multiple retort has been completed. With performance curves of a six-retort stoker and a 558-hp. boiler.

Economical Fuel Burning Equipment, J. G. Worker. Blast Furnace & Steel Plant, vol. 7, no. 6, June 1919, pp. 227-280, 8 figs. Steam-cylinder mechanism for operation of forward and rear dumping grates of multiple-retort inclined underfeed stokers.

Surface Combustion. Surface Combustion (La Combustion de surface), M. Desmarets. Revue Générale des Sciences, vol. 30, no. 9, May 13, 1919, pp. 274-278, 5 figs. Historical account of researches and industrial applications. Geological characteristics of deposits and notes on manner of instituting their research.

Tar Oil. Tar Oil as Fuel (Teeröl als Brennstoff). Zeitschrift des Bayerischen Revisions-Vereins, vol. 23, nos. 1 & 3, Jan. 15 and Feb. 15, 1919, pp. 1-2 and 17-19. Evaporation tests.

FURNACES

Grates. Minimum Distance between Grates and Lower Part of Arch Tubes, L. M. Stewart. Ry. Jl., vol. 25, no. 6, June 1919, pp. 19-22. As depending upon grade of coal being used and whether or not firemen have been taught to shake grates and keep fire worked down. Paper before Master Boiler Makers' Assn.

Heat Treating. Heating Furnaces and Annealing Furnaces—VI, W. Trinks. Blast Furnace & Steel Plant, vol. 7, no. 6, June 1919, pp. 294-297, 7 figs. Discusses means by which fuel consumption per unit weight of steel (heated or annealed) can be reduced.

GAGES

Gage Making. Examples of Gauge Making. A. G. Robson. Engineer, vol. 127, no. 3308, May 23, 1919, pp. 499-501, 33 figs. Examples chosen are of straightforward kind. Modus operandi of gauge-maker. rather than extent of calculations required, is indicated.

Hoke Gages. Government Steel Plant, S. W. Stratton. Blast Furnace & Steel Plant, vol. 7, no. 6, June 1919, pp. 268-270, 4 figs. Research work done by Bur of Standards in connection with manufacture of Hoke precision gages.

Plate Gauges. Master and Working Plate Gauges, R. Worthy. Machy. (Lond.), vol. 14, no. 345, May 15, 1919, pp. 185-193, 40 figs. Laying out, testing, hardening and lapping.

GAS ENGINEERING

Distribution Pressures. Distribution Pressures, S. C. Singer. Gas Rec., vol. 15. no. 10, May 28, 1919, pp. 343-344, 1 fig. Experience of rapid growing city. Schematic diagram or distribution system is presented.

Joints, Pipe. Wherein a Joint in the Outlet Pipe from a 2,000,000 Cu. Ft. Holder 18 Ft. from Tank Bottom and a Diver Cleans Out Bottom with Holder Full of Gas, A. H. Harris. Am. Gas Eng. Jl., vol. 110, no. 25, June 21, 1919, pp. 525-536, 7 figs. Leaky joint let in enough ground water to interfere with working of seal and cleaning was necessitated by naphthalene accumulation that tilted lifts to the extent of distorting side-guide rubber shafts.

Natural Gas. Displacing Natural Gas with Manufactured Gas, Kay C. Krick. Gas Age, vol. 43, no. 11, June 2, 1919, pp. 583-585. Anticipates failure of natural gas supply. Paper read before Natural Gas Assn.
Manufactured Gas to Supplement Natural Gas, Kay C. Krick. Gas Age, vol. 43, no. 11, June 2, 1919, pp. 567-568. Advises greater conservation through increased price. Address delivered before Natural Gas Assn.

Retorts. Steaming Retorts, H. J. Toogood, Gas Rec., vol. 15, no. 11, June 11, 1919, pp. 377-378, 2 figs. Proposes connecting retorts in different stages of carbonization to work in series.
Results from Vertical Retorts at Meriden. Gas Age, vol. 43, no. 12, June 16, 1919, pp. 633-634, 4 figs. In regard to labor required.

Standards. Gas Standards. Gas Jl., vol. 146, no. 2920. Apr. 29, 1919, pp. 238-240. Also Gas Age, vol. 43, no. 11, June 2, 1919, pp. 569-572, and Gas World, vol. 70, no. 1814, Apr. 26, 1919, pp. 312-314. Recommendations of Fuel Research Board as to "most suitable composition and quality of gas and the minimum pressure at which it should be generally supplied, having regard to the desirability of economy in the use of coal, the adequate recovery of by-products, and the purposes for which gas is now used."

Water Gas. Water-Gas Plant at Colchester, W. W. Townsend. Gas Jl., vol. 146, no. 2921, May 6, 1919, pp. 296-299 and (discussion), pp. 299-300, a figs. Reconstruction of plant effected by converting two sets, each of capacity of 300,000 cu. ft. per day, to capacity of 500,000 cu. ft. each. Paper read before Eastern Counties Gas Managers' Assn.

HANDLING OF MATERIALS

Ash. *See Coal and Ash.*

Coal and Ash. New Coal Handling Plants for Philadelphia Water Works, Harrison R. Cady. Eng. News-Rec., vol. 82, no. 23, June 5, 1919, pp. 1095-1097, 3 figs. General and detailed design for three systems supplying total of 16 boilers with total boiler capacity of 7400 hp.
Handling Coal and Ashes at the Pusey & Jones Power Plant, Henry J. Edsall. Power Plant Eng., vol. 23, no. 11, June 1, 1919, pp. 483-487, 5 figs. Details of system employing bucket conveyor.

Coal and Ore. The Coal Shortage and Handling by Gravity, George Fred. Zimmer. Eng. & Indus. Management, vol. 1, no. 13, May 8, 1919, pp. 413-416, 3 figs. Gravity-driven band conveyor for loading ore erected by Fraser & Chalmers, Ltd., of Erith and London, and similar installations for handling of concrete, etc.
Handling Plant of the Galveston (Tex.) Coal Co., Chas. Fowler, Jr., Coal Trade Jl., vol. 50, no. 25, June 18, 1919, pp. 737-739, 4 figs. Equipped with Lidgerwood installation, coal being handled by one Hayward 3-cu. yd. clamshell bucket on one transfer and a 2-cu. yd. bucket on the other.
Electricity as Applied to Loading and Unloading Coal and Ore Boats, R. H. McLain. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 352-365, 26 figs. Notably at coal-loading pier of Baltimore & Ohio R. R. Co. at Curtis Bay and at ore docks of Duluth and Iron Range R. R., Two Harbors, Minn. Paper read before Soc. Terminal Engrs.

Conveyors. Economical Handling of Materials. Can. Manufacturer, vol. 39 no. 6, June 1919, pp. 27-28, 6 figs. Uses of portable scoop conveyor.
Belt Conveyors for Ore Handling. Chem. Eng. & Min. Rev., vol. 11, no. 124, January 5, 1919, pp. 95-98, 4 figs. Plan showing general layout of bins and conveyor in connection with handling of charge for blast furnace.

Grain. Mechanical Grain-Loading Devices on the Roumanian Danube, George Frederick Zimmer. Eng. & Indus. Management, vol. 1, no. 15, May 22, 1919, pp. 477-480, 5 figs. Include means for unloading of railway trucks by mechanical shovels. (To be continued.)

Live Stock. Proper Loading and Handling of Live Stock, W. J. Embree. Off. Proc. St. Louis Ry. Club, vol. 23, no. 12, Apr. 11, 1919. pp. 289-296. Disease and injury received by smaller cattle from larger cattle in same car are considered as chief losses from shipment of cattle.

Ore. *See Coal and Ore.*

Truck Loading. Truck Loading Devices Reduce Lost Time, J. Edward Schipper. Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1346-1350. 12 figs. Examples of installations of apparatus for handling loose or bulky material.

HEAT-TREATING

Duralumin. Heat Treatment of Duralumin P. D. Merica, R. G. Waltenberg, and H. Scott. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 150, June 1919, pp. 913-949, 26 figs. Experiments carried out in laboratory of Bureau of Standards and partly in co-operation with Aluminum Col of America. Temperature of quenching, it is concluded, should not be above that of the aluminum eutectic which is usually about 520 deg. cent., but should be as near to this as possible without danger of eutectic melting.

Forging, Large. Temperature Observations on Heating, Quenching and Drawing of a Large Steel Forging, O. A. Knight and F. F. Hansen. Chem. & Metallurgical Eng., vol. 20, no. 11, June 1, 1919, pp. 590-591, 3 figs. Experiments conducted at heat-treating plant of Watertown Arsenal.

Furnace. New Features in Heat Treating Plant. Iron Age, vol. 103, no. 23, June 5, 1919, pp. 1493-1495, 4 figs. Car type furnace with chamber 30 ft. by 6 ft. for annealing large parts of automobile frames in plant of Parish & Bingham Co., Cleveland.
See also Furnaces, Heat-Treating.

Quenching. Influence of Quenching Temperature on Structural and Mechanical Characteristics of Steel (Influenza della temperatura di ricottura sulle caratteristiche strutturalo e meccaniche degli acciai), Pietro Forcella. Rivista Tecnica della Ferrovie Italiane, vol. 15, no. 4, Apr. 15, 1919, pp. 144-150, 23 figs. on three supplement plates. Researches undertaken under auspices of Instituto Sperimentalo della Ferrovie.
Quenching Cracks in Carbon Steels, Kôtarô Honda and Tokujirô Matsushita. Science Reports of the Tôhoku Imperial University, vol. 8, no. 1, Apr. 1919, pp. 31-42, 8 figs. Experimental. It is concluded that cause of retarded cracks in quenched carbon steel is neither thermal stress caused by unequal cooling of specimens nor implusive stress due to differential expansion of adjacent parts caused by rapid cooling through a range of the A_1 point. but it is the persistent stress due to differential expansion of adjacent parts caused by different degree of martonsitization.

Steel. Heat Treatment of Steel, C. O. Bannister. Jl. & Trans. Soc. of Engrs., vol. 10, no. 4, 1919, pp. 163-179, and (discussion) pp. 179-184, 9 figs. Suggestions in regard to various accepted practices based on examination of specimens and results obtained in tests.
Heat Treatment of Alloy Steel, K. A. Juthe. Am. Mach., vol. 50, no. 233. June 5, 1919, pp. 1077-1079. Suggestions based on writer's experimental research.

Theory. Some Notes on Heat Treatment Theory, W. F. Edwards. Jl. Am. Steel Treaters Soc., vol. 1, no. 5, Feb. 1919, pp. 141-159, 12 figs. Considerations intended to show that phase law is of little value in explaining phenomena of heat treatment of steel. It is believed that rates of heating, cooling or changes of pressure, etc., are of much more significance than usual interpretations of equation diagram.

HEATING AND VENTILATION

Engine Houses. The Heating and Ventilation of Engine Houses, T. W. Reynolds. Ry. Age, vol. 66, no. 21, May 23, 1919, pp. 1245-1248, 3 figs. Discusses use of underground concrete air ducts as applied to a 30-stall engine house, having concrete floors, brick walls and timber frame and roof.

Mechanics' Liens. Heating and Ventilating Plants and Mechanics' Liens, Arthur L. H. Street. Heat. & Vent. Mag., vol. 16, no. 5, May 1919, pp. 19-23. Review of Appellate Court decision defining circumstances under which security is available. (To be continued).

Radiation, Computation. Standard Rules for Computing Required Radiation. Metal Worker, vol. 91, no. 25, June 20, 1919, pp. 790-792. Also Heat & Vent Mag., vol. 16, nos. 5 & 6, May & June 1919, pp. 23-26 & 36-39. Proposed regulations for figuring steam and hot-water radiation in heating systems. Reprint from Bul. Nat. District Heating Assn.

Radiators, Flow of Water to. Care of Heating and Ventilating Equipment, Harold L. Alt. Power, vol. 49, no. 24, June 17, 1919, pp. 932-933. Discusses various methods of controlling flow of water to radiators.

Steam Heat. Practical Economies in the Use of Steam Heat, Lloyd Howell. Heating & Ventilating Mag., vol. 16. no. 6, June 1919, pp. 22-24. Damages caused by incorrect installation are pointed out.

Workshops. The Heating and Ventilation of Workshops—I. Engineer, vol. 127, no. 3308, May 23, 1919, pp. 504-506, 8 figs. System in plant having reinforced-concrete roof.

HOISTING AND CONVEYING

CRANES. Heavy Shop Framing for 250-ton Traveling Crane. Eng. News-Rec., vol. 82, no. 24, June 12, 1919, pp. 1172-1173, 3 figs. Columns carry double-deck runways with T-section girders for overhead crane handling locomotives.
Electrically Operated Travelling Cranes. Elec. Rec., vol. 25, no. 5, May 1919, pp. 316-321, 17 figs. The different types of modern traveling cranes are defined with idea of bringing out inherent features of each. Included also is a short history of evolution of electric traveling cranes from hand-operated jib cranes.

FREIGHT ELEVATORS. Freight Elevators, Charles H. Weeks. Safety Eng., vol. 37, no. 6, June 1919, pp. 307-313, 4 figs. Statistics of accidents and their causes as collected by Dept. of Labor of New Jersey; also instructions for elevator operators.

HOISTS. Progress in the Electrification of Mine Hoists, R. S. Sage. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 332-341, 17 figs. Brief historical survey and description of modern hoist equipments used at various mines.
Electrically Operated Hoists. Elec. Rec., vol. 25, no. 6, June 1919, pp 386-394, 21 figs. Constructional and operating features of hoists as used in different industries.
A New Electrically-Driven Winding Equipment. Elecn., vol. 82, no. 20, May 16, 1919, pp. 570-571, 2 figs. Designed for 720-ft. shaft. It has cylindro-conical drum 11 ft. to 15 ft. in diameter. (To be concluded).
Steam and Electric Mine Hoists, Frank C. Perkins. Nat Engr., vol. 23, no. 6, June 1919, pp. 264-266, 2 figs. Types used at various plants, especially direct-acting steam type used at Michigan Copper Co. and electric hoist of 1,850 hp. employed by North Butte Mining Co.

OVERSPEED PREVENTION. A New Electrically-Driven Winding Equipment. Elecn., vol. 82, no. 21, May 23, 1919, pp. 593-594, 3 figs. Description of overspeed preventer device. (Concluded).

OVERWINDING. Safety in Winding Operations, J. A. Vaughan. South African Jl. Sci., vol. 15, no. 4, Nov.-Dec., 1918, pp. 205-216. Remarks are confined to question of safe handling of winding engine and particularly statistical records of accidents due to overwinding.

WINCHES. Applications of the Williams-Janney Variable Speed Gear. Engineering, vol. 107, no. 2787, May 30, 1919, pp. 693-695, 10 figs. Advantages claimed for application of this gear to winches. (Continuation of serial).

HYDRAULIC MACHINERY

PIPE LINES. The 25-Mile Gravity Pipe Line of Everett, Washington, W. A. Scott. Eng. World, vol. 14, no. 12, June 15, 1919, pp. 41-46, 14 figs. Pipe line has length of 133,000 ft., and between intake and reservoir there is net head of 252 ft.
Economical Size of Pipe for Given Loss of Head, E. W. Rettger. Cornell Civil Engr., vol. 27, no. 4, Apr. 1919, pp. 83-92, 2 figs. Formulæ derived on Adams principle which writer states as follows. That type is most economically designed for which interest and depreciation on first cost of pipe, plus annual value of power loss due to friction in pipe, is a minimum.

SLUICES. Automatic Sluices (Les barrages automatiques), E. Froté. Génie Civil, vol. 74, no. 22, May 31, 1919, pp. 429-433, 21 figs. Diagramatic representation of various types.

SURGES. Graphical Records of Surge Pressures in Pipe Lines, Ralph Benntee. Eng. News-Rec., vol. 82, no. 22, May 29, 1919, pp. 1048-1050, 9 figs. Tests made for determining effect of varying air-chamber conditions and changing choke-gate area.
The Surge-Chamber Problem, E. Parry. New Zealand Jl. of Sci. & Technology, vol. 2, no. 2, Mar. 1919, pp. 78-86, 2 figs. Derivation of formula when limited in its application to chamber with parallel sides.

WILLIAMS-JANNEY SPEED GEAR. The Williams-Janney Variable Speed Gear. Engineering, vol. 107, no. 2786, May 23, 1919, pp. 662-666, 14 figs. Device consists of two similar hydraulic units, each of which comprises a group of cylinders, mounted upon a shaft revolving in a fixed casing, one unit fulfilling function of pump and supplying fluid to other which acts as motor. (To be continued).

INTERNAL-COMBUSTION ENGINES

CARBURATION. The Carburation of Low-Grade Distillates, H. O. Ensign. Pac. Mar. Rev., vol. 16, no. 6, June 1919, pp. 121-124, 7 figs. Carburetor development in California and having as distinguishing factors, according to writer, that maximum air velocity equals in all cases that of engine manifold, and that fuel is delivered to center of metering chamber at point where velocity is practically zero.

DIESEL ENGINES. Internal Combustion Engines for Submarines. Constructed by Messrs. Franco Togi, Engineers, Legnano, Milan. Engineering, vol. 107, no. 2788, June 6, 1919, pp. 732-734, 8 figs. Results of tests with two types: Two-cycle engine wth six working cylinders and a four-cycle type with eight working cylinders.
An All-American Diesel. Pac. Mar. Rev., vol. 16, no. 6, June 1919, pp. 111-114, 7 figs. Winton 8-cylinder engine.
The Diesel Engine, Charles Day. Automobile Engr., vol. 9, no. 127, June 1919, pp. 169-171, 6 figs. Features and limitatons. Paper presented to Instn. Automobile Engrs.
Vickers High-Powered Submarine "Diesel" Engines. Motorship, vol. 4, no. 6, June 1919, pp. 35-36, 3 figs. Eight and twelve-cylinder, 1,800-b. hp. motors of "solid-injection – type. Cast-steel cylinder heads said to be used successfully.
Slow-Combustion Engines and Their Uses, J. Drosne. Motorship, vol. 4, no. 6, June 1919, pp. 43-45, 1 fig. Together with details of Schneider crosshead type merchant-marine and naval Diesel engines.
An American Diesel Engine. Motorship, vol. 4, no. 6, June 1919, pp. 30-32, 7 figs. Six-cylinder Winton marine engine. Outstanding features are enclosed crankcase, trunk-pistons, and crankshaft bolted up to its bearings.

DORMAN ENGINES. The Dorman Engines. Automobile Engr., vol. 9, no. 127. June 1919, pp. 191-193, 9 figs. Post-war program includes six engines, ranging in power from 10 hp' to 40 hp. Power curves for these types are given.

FLAME PROPAGATION. A New Method of Determining Rate of Flame Propagation, P. M. Heldt. Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1256-1258, 3 figs. Based on principle that when flame surrounds pair of spark terminals electrical pressure required to break down resistance of gap is reduced.

FUEL AND PERFORMANCE. Engine Performance, H. L. Horning. Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 344-345 and (discussion) pp. 345-348, 1 fig. Diagram of power available in a 60-hp. engine with different fuels.
The future of Internal-Combustion Engines (De toekomst fer verbrandingsmotoren), P. Meyer. De Ingenieur, vol. 34, no. 17, Apr. 26, 1919, pp. 313-318. Discusses future from technical as well as from economic point of view. Special attention given to the fuel question.
The Fuel Question of Internal-Combustion Engines (Zur Betriebsstoffrage der Verbrennungsmotoren), Hugo Brach. Oelmoter, vol. 8, no. 3, Mar. 1919, pp. 65-69. Special consideration is given to the automobile motor. Tables.

GAS ENGINES. Installation and Working of Large Horizontal Gas-Engines, H. Pilling. Gas Jl., vol. 146, no. 2919, Apr. 22, 1919, pp. 191-193. Possibility of utilizing 20,700 cu. ft. gas per min. for blowing and power purposes in a supposed blast-furnace installation producing 2,000 tons of iron per week. Paper read before Cleveland Instn. Engrs.

GILE ENGINE. A New Combustion Engine. Mar. Eng. & Can. Merchant Service Guild Rev., vol. 9, no. 5, May-1919, pp. 177-178, 4 figs. Gile engine, Fuel is mixed in cylinder by forcing charge of compression around subpiston head through series of small restricted passages to combustion chamber against cylinder head.

HIGH-SPEED ENGINES. High-Speed High-Efficiency Engines, D. McCall White. Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 327-334, 18 figs. Fundamentals of high-speed engines, survey of various types manufactured in United States, and uses which have been given to these engines, particularly during the war.

HOT-SURFACE OIL ENGINES. Hot Surface Oil Engines for Industrial Purposes, A. H. Goldingham. Jl. Soc. Automotive Engrs., vol. 4, no. 6, June 1919, pp. 482-485, 1 fig. Engines of horizontal or vertical design arranged for direct connection or by belting to electrical or pumping and other machinery are discussed from viewpoints of reliability, first cost, and economy.

KESSLER SUPER-CHARGE ENGINE. The Kessler Super-Charge Engine Developed for Automobile Purposes, Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1289-1293 and 1308, 9 figs. Uses four-stroke cycle with ramming charge of excess air; time compression crankcase employed.

MARINE ENGINES. Automotive Applications of Marine Engines in the War, George F. Crouch. Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 349-357, 20 figs. partly on supp. plate, particularly of 220-hp. Internal-combustion engine used on United States 110-ft. submarine chaser. Reference is made to British M. L. submarine chasers.

MOTORCYCLE ENGINES. Two-Stroke Engines for Motorcycle, E. Tilston. Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1304-1305, 2 figs. also Automobile Engr., vol. 9, no. 127, June 1919, pp. 185-187, 4 figs. Model with distinct type exhaust valve designed by writer. Paper presented to Instn. Automobile Engrs.

STILL ENGINE. A New Prime Mover of High Efficiency and British Origin, Frank E. D. Acland. Jl. Roy. Soc. Arts, vol. 67, no. 3472, June 6, 1919, pp. 463-475 and (discussion) pp. 475-482, 6 figs.; also Engineer, vol. 127, no. 3309, May 30, 1919, pp. 540-541, 2 figs.; Automotive Industries, vol. 40, no. 25, June 19, 1919, pp. 1404-1405, 1 fig.; Elec. Rev., vol. 84, no. 2165, May 23, 1919, pp. 643-646, 4 figs.; Shipbuilding & Shipping Rec., vol. 13, no. 22, May 29, 1919, pp. 697-698, 2 figs., and Eng. & Indus. Management, vol. 1, no. 18, June 12, 1919, pp. 567-573, 6 figs. Engine is said to be capable of using any form of liquid or gaseous fuel and to make use of recoverable heat which passes through surface of combustion cylinder as well as of exhaust gases. Combines features of steam and gas engine.

THERMAL EFFICIENCIES. Recent Developments in the Internal Combustion Field, A. L. Taylor. Utah Soc. Engrs., vol. 5, no. 3, Mar. 1919, pp. 54-61. Thermal efficiency of various types.

VALVES. New Valve Operating System. Autocar, vol. 42, no. 1231, May 24, 1919, pp. 814-815, 4 figs. Rotary reciprocating valve engine with single-sleeve valve in each cylinder which both rotates and reciprocates, dual motion being obtained through action of gears and cams respectively.

VALVES, AIR-FLOW THROUGH. Study of Air Resistance and Air Flow, H. Levy: Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1260-1264, 10 figs. Laws of air resistance determined for various air speeds; applications to aircraft and automotile problems.

LUBRICATION

BUREAU OF STANDARDS. Lubricating Oil Program of the Bureau of Standards. Automotive Industries, vol. 40, no. 23, June 5, 1919, pp. 1230-1232. Outline of problems which bureau proposes to solve by experimental research work.

EXPERIMENTS. Notes on Lubrication, S. Skinner. Proc. Phys. Soc., Lond., vol. 31, part III, Apr. 15, 1919, pp. 94-100, 2 figs. Experiments on pressure of air in neighborhood of a flywheel running in contact with a flat, long board are presented as exhibiting properties of a compressible lubricant.

MACHINE ELEMENTS AND DESIGN

BALL BEARINGS. Ball Bearings, H. D. McGuire. U. S. Naval Inst., Proc., vol. 45, no. 196, June 1919, pp. 973-986, 16 figs. Advantages claimed for them.
Ball Bearings' Application in Industry. Raw Material, vol. 1, no. 4, June 1919, pp. 222-226, 14 figs. Application to two machine-shop tools. (Continued).

Cams. Cam Design and Construction—V, Franklin de R. Furman. Am. Mach., vol. 50, no. 24, June 12, 1919, pp. 1123-1126, 5 figs Deals with swinging follower arms, with both roller and sliding contact and method of finding length of shoe of sliding arm.
Cam Profiles, A. Johnson. Automobile Engr., vol. 9, no. 127, June 1919, pp. 166-169, 12 figs. Technical. Types used to operate valves of internal-combustion engines.

Gears. Horse-Power Chart for Spur and Bevel Gears. Machy. (Lond). vol. 14, no. 347, May 22, 1919, p. 232, 1 fig. Plotted from Lewis and-Barth formulæ.
Angles for Spiral Bevels. Machy. (Lond.), vol. 14, no. 349, June 5, 1919, pp. 282-283. Tables giving increment angles for spiral bevel pinions.

Radio-Thrust Bearings. Load Characteristics of Radio-Thrust Bearing, F. W. Gurney. Am. Mach., vol. 50, no. 26, June 26, 1919, pp. 1233-1236, 4 figs. Description of chart for finding capacity of ball bearings of radio-thrust type.

Springs. Tables for Calculating Helical Springs, J. H. Sullivan. Machy. (N. Y.), vol. 25, no. 10, June 1919, pp. 961-964. Showing maximum loads in pounds and corresponding compressions in inches in helical round bar springs.

MACHINE SHOP

Chucks. Collet Chucks—IV, Fred Horner. Mech. World, vol. 65, no. 1690, May 23, 1919, p. 243, 3 figs. Advantages of hinged collet construction. (To be continued).

College Machine Shop. Machine Work at the Ohio State University, W. A. Knight. Eng. Education, vol. 9, no. 10, June 1919, pp. 446-460, 9 figs. Electrical and mechanical engineering students required to take 6 hr. per week in a school year. Of this time 5 hr. per week are spent in shop and 1 hr. in classroom for lectures and recitations. Aim is to bring student in contact with such features in shop production as organization, interchangeable parts, work limits, inspection standard time and progress reports.

Finishing Operations. Finishing Operations on Liberty Motor Cylinders, H. A. Carhart. Am. Mach., vol. 50, no. 25, June 19, 1919, pp. 1197-1201, 11 figs. Various operations involved are taken separately and reference is made to special fixtures used.

Jigs and Tools. Jigs, Tools and Special Machines, with their Relation to the Production of Standardized Parts, Herbert C. Armitage. Jl. Instn. Mech. Engrs., no. 4, May-1919, pp. 213-253 and (discussion) pp. 253-320, 18 figs., also Can. Machy., vol. 21, nos. 22 and 23, May 29 and June 5, 1919, pp. 542-544 and 576-580, 17 figs. and Model Engr. & Elecn. vol. 40, no. 943, May 22, 1919, pp. 393-399, 11 figs. Advantages and disadvantages of use of jigs and special tools in repetition work are discussed from viewpoint of relationship between output and cost of components and study of possible Scheme for securing maximum efficiency from standardization of machines and methods.
Templets, Jigs and Fixtures—XXIV, Joseph Horner. Engineering, vol. 107, no. 2785. May 16, 1919, pp. 622-624. Limitations imposed on jig and fixture work by dimensions, shapes or numbers required. (Concluded).

Metal Finishing. Progress in Metal Finishing, P. S. Brown, Metal Indus., vol. 17, no. 6, June 1919, pp. 274-276, 3 figs. Operations as practiced at Corona Typewriter Co., Groton, N. Y.

Milling. Planer Milling Practice in Automobile Plants, Edward K. Hammond. Machy. (N. Y.), vol. 25 no. 10, June 1919, pp. 965-971, 7 figs. Milling operations on crankcases. (First of two articles).
Methods of Milling and Boring Yoke and Cap. F. Scriber. Can. Machy., vol. 21, no. 25, June 19, 1919, pp. 630-632, 9 figs. Illustrating jigs employed in various operations.

Shafting. Shaft Alignment and Its Importance, J. Y. Dahlstrand. Power, vol. 49, no. 23, June 10, 1919, pp. 882-886, 6 figs. Reasons are presented as to why two or more members of a unit mounted on the same bedplate lose their alignment. Uneven strain on the anchor bolts, incorrect foundation, improper and insecure doweling and wearing are causes for misalignment.

Tinsmithing. What a Tinsmith Can Do in a Machine Shop, Peter F. O'Shea. Am. Mach., vol. 50, no. 23, June 5, 1919, pp. 1067-1076, 21 figs. Example of home-made time and labor savers at tinsmith shop of New England plant.

MACHINERY, METAL-WORKING

Chucks. The Design of Concentric Chucks, A. Clegg. Machy, (Lond.), vol. 14, no. 349, June 5, 1919, pp. 277-281, 11 figs. Concerned with power, truth and durability and strength.
Some Interesting Features of the Massey-Harris Brantford Plant, J. H. Moore. Can. Machy., vol. 21, no. 21, May 22, 1919, pp. 509-511, 8 figs. Among jigs and fixtures described, a quick-action chuck and automatic milling machine are considered as distinctive features of shops.

Counterboring and Reaming. Automatic Machines, H. E. Thomas. Page's Eng. Weekly, vol. 34, no. 769, June 7, 1919, pp. 309-310, 3 figs. Tools recommended for counterboring and reaming. (Concluded). Paper read before Manchester Assn. Engrs.

Milling Machines. The No. 4 Cincinnati Vertical High-Power Milling Machine. Am. Mach., vol. 50, no. 26, June 26, 1919, pp. 1229-1232, 7 figs. Intended for extremely heavy work and patterned after No. 5.
Designs Novel Continuous Miller. Iron Trade Rev., vol. 64, no. 21, May 22, 1919, pp. 1559-1560, 3 figs. Work is carried on a rotary platen which is set at 15-deg. angle to facilitate loading and unloading.
"Ohio" Tilted Rotary Milling Machine. Machy. (N. Y.), vol. 25, no. 10, June 1919, pp. 979-982, 5 figs. Provision is made for employing either continuous rotary method of milling or for applying an indexing principle of operation by which successive pieces of work are brought opposite cutter.
A New System of Thread Milling. Machy. (Lond.), vol. 14, no. 348, May 29, 1919, pp. 271-272, 4 figs. Headstock carries chuck in which work is held and has hollow spindle for accommodating rods that require their ends screwed.
Continuous Rotary Milling. Machy. (Lond.), vol. 14, no. 348, May 29, 1919, pp. 245-252, 14 figs. Davis & Thompson, Kearney & Trecker, and Becker Milling Machine Co. milling machines. Article deals chiefly with design of fixtures, methods of operation and statement of rates of production which are obtained in handling various classes of work.

MACHINERY, SPECIAL

Balancing Machines. Balancing Machines. F. G. Hechler. Jl. Am. Soc. Naval Engrs., vol. 31, no. 2, May 1919, pp. 405-419, 6 figs., partly on supp. plates. Carwen dynamic balancing machine, made by Carlson Wenstrom Co., and combined static and dynamic balancing machine, built by Vibration Specialty Co. examined in reference to requirements writer believes should be fulfilled by ideal balancing machine.

Capstan Lathe Tools. Capstan Lathe Tools—III, E. W. Field and A. E. Simpson. Machy. (Lond.), vol. 14, no. 347, May 22, 1919, pp. 227-231, 11 figs. Recessing tool-holders, centering and facing tools; floating reamers.

Cooling Towers. Natural Draught Cooling Towers, Harold Nielsen. Engineer, vol. 127, no. 3309, May 30, 1919, pp. 526-527, 1 fig. Making transverse free section as large as possible in order, writer contends, to give air proper time to get saturated with vapor. He offers modifications in Rankine's formula to make it apply in determining force of draft for natural-draft water-cooling towers.

Crushers and Pulverizers. Power Requirements of Rock-Crushing Plants, Mark. H. Reasoner. Min. & Sci. Press, vol. 118, no. 24, June 14, 1919, pp. 819-820. Table showing approximate power requirements of various types of crushers and pulverizers.

Evaporators. Modern Commercial Evaporators, W. L. Badger. Mich. Technic, vol. 32, no. 2, May 1919, pp. 77-88, 14 figs. Comparison between horizontal and vertical types. (To be continued.)
Industrial Vacuum Evaporators—VIII, Frank Coxon. Mech. World, vol. 65, no. 1693, June 13, 1919, p. 282, 5 figs. Test figures on use of evaporators.

Piercing and Shearing Tool. An Automatically Indexed Piercing and Shearing Tool, L. L. Dodds. Am. Mach., vol. 50, no. 24, June 12, 1919, pp. 1133-1135, 4 figs. Laminated copper contact brush made up of twelve strips of leaves, all of which are of equal length, but riveted together so as to give each end of brush a beveled appearance.

Pile Drivers. "Daza" Electric Pile-Driver (Machina eléctrica, sistema Daza, para hinca de pilotes), J. Eugenio Ribera Revista de Obras Publicas, vol. 67, no. 2271, Apr. 3, 1919, pp. 157-160, 5 figs. Comparison with "Laeour" machine. Writer prefers "Daza," which he says is designed specially for driving reinforced-concrete piles, but can be also used for driving piles of other materials.

Typewriters. The Principles of Typewriter Mechanism, Nathan Sharpe. Model Engr. & Elecn., vol. 40, nos. 940 and 941, May 1 and 8, 1919, pp. 327, 330-332 and 354-360, 16 figs. Diagram showing various action and details of mechanism. Several American types are considered.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

Binders. Viscosity and Sticking Strength of Binders, Allen Abrams. Textile World Jl., vol. 55, no. 26, June 28, 1919, pp. 41-45, 6 figs. Stated on basis of experiments that usually full sticking strength of textile binders is obtained only by heating to at least 90 deg. cent.

Brass. Notes on the Influence of Certain Variables Associated with the Anneal of Cold-Worked Alpha Brass, Arthur Phillips and George C. Gerner. Chem. & Metallurgical Eng., vol. 20, no. 12, June 15, 1919, pp. 622-628, 16 figs. Engine tests on annealed samples. Concluded that while grain size before final reduction has some influence on mechanical properties to anneal brass, magnitude of effect is small, especially in metal annealed at high temperatures.
Structural Characteristics of Rolled Sheet Brass, H A. Eatick. Metal Industry, vol. 14, no. 19-20, May 9-16, 1919, pp. 381-383 and 402-404, 8 figs. Study of cumulative hardening effect of cold work by examination of characteristic curves of various alloys. Study of equilibrium diagrams. (Concluded.)

Bronze. Use of Bronze for Valve Snap Rings and Piston Surfaces, and Bull Rings in Large Cylinders, C. E. Fuller. Ry. Age, Daily Edition, June 26, 1919, pp. 1791-1793, 2 figs. Experiments per formed and results obtained by Union Pacific.
See also Copper and Bronze, Copper Aluminum Alloys.

Copper-Aluminum Alloys. Physical Properties of Copper Aluminum Alloys, A. H. Robinson and S. C. Zylstra. Mich. Technic, vol. 32, no. 2, May 1919, pp. 134-140, 9 figs. Tests performed on copper-aluminum-iron and copper-aluminum alloys established, it is reported, that the former is the stronger of the two at ordinary temperatures, but has only a slight advantage at higher temperatures; also that the iron alloy is more free from blow-holes and slag-inclusions than the straight alloy.

Copper and Bronze. Copper and Bronze—a Technological Study Regarding the Effects of Heat Treatment with Special Reference to the Duration of the Tensile Test (Kupfer und Bronze—eine technologische Studie über die Wirkung des Reckens und Glühens unter besonderer Berücksichtigung der Zerreissversuchsdauer), Willy Müller. Forschungsarbeiten auf dem Gebiete des Ingenieurwesens, no. 211, 1918, pp. 3-47, 16 figs. General remarks regarding the behaviour of metals when breaking. Metals tested were copper, manganese bronze and tin bronze.

Elasticity. Note on the Elasticity of Metals as Affected by Temperature, A. Malleck. Proc. Roy. Soc., Series A, vol. 95, no. A671, Apr. 1, 1919, pp. 429-437, 6 figs. It is reported that the ratio of Young's modulus were measured for 15 methods between temperatures of liquid air and 100 deg. cent.

Hemp. Sisal and the Plant for Extracting the Fiber. South African Eng., vol. 30, no. 1, Jan. 31, 1919, pp. 3-4 and p. 8, 4 figs. Size of hemp obtained from leaves of agava as cordage fibre.

MACHINE CONSTRUCTION, MATERIALS FOR. Materials of Machine Construction, G. H. Kendall. Machy. (N. Y.), vol. 25, no. 10, June 1919, pp. 944-947. Properties and uses of principal materials.

STEEL. Influence of Rolling and of Initial Thickness of Ingot on Quality of Steel (Influence du Corroyage et de la grosseur du lingot initial sur la qualité d'une pièce en acier), Andre Pouilloux. Bulletin et comptes rendus de la Société de l'Industrie Minérale, vol. 15, no. 5, 1919, pp. 311-337, 9 figs. Based on experiments conducted at Firminy Steel Works. Forming an article from the smallest possible ingot is advocated principally because larger ingots are said to be necessarily of inferior quality.

Gear Steels, J. Heber Parker. Automotive Industries, vol. 40, no. 23, June 5, 1919, pp. 1220-1221. Classifications of gears according to application, materials and treatment. Methods employed in carbonizing and heat treatment. Paper read before Am. Gear Mfrs. Assn.

The Mechanical Properties of Steel, W. H. Hatfield. Engineering, vol. 107, no. 2785, May 16, 1919, pp. 634-636 & 638, 14 figs. Evidence substantiating occurrence of steels possessing true brittleness. (Continuation of serial.) Paper read before Instn. Mech. Engrs.

STEEL, HIGH-SPEED. The Properties of High Speed Steel, G. J. Horvitz. Iron Age, vol. 103, no. 26, June 26, 1919, pp. 1711-1714, 13 figs. Its metallography and heat-treatment; crucible and electric process in its production; effect of uranium; theory of hardening. Paper presented at New York Chapter of Am. Steel Treaters' Soc.

TOUGHNESS. Static, Dynamic, and Notch Toughness, Samuel L. Hoyt. Iron & Steel of Can., vol. 2, no. 5, June 1919, pp. 126-131, 10 figs. A high degree of notch toughness to insure against failure is recommended because, it is said, that even a hasty examination of such machiney as locomotives, automobiles, stationary gas engines, steam engines, etc., reveals an amazingly large number of notches.

MEASUREMENTS AND MEASURING APPARATUS

ABRASION METERS. The Abrasion Meter, Raymond Francis Yates, Sci. Am. Supp., vol. 87, no. 2267, June 14, 1919, pp. 372-373, 7 figs. Device for determining cutting efficiency of abrasive wheels.

AIR FLOW. The Determination of the Efficiency of the Turbo-Alternator, S. F. Barcay. Jl. Instn. Elec. Engrs., vol. 57, no. 281, Apr. 1919, pp. 293-304 and (discussion), pp. 305-314, 14 figs. Shows that actual losses on load can be deduced conveniently and accurately from measurements of cooling air flowing through alternator. It is further shown, however, that although such methods are sound in principle, misleading results may be obtained unless certain precautions are taken in applying them.

See also Air Machinery.

FLATNESS. Flatness Tests at Bureau of Standards, R. L. Rankin. Am. Mach., vol. 50, no. 26, June 26, 1919, pp. 1218-1220, 3 figs. Optical method based on principle of light interference.

HARDNESS. Methods of Testing for Hardness, Dean Harvey. Elec. Jl., vol. 16, no. 6, June 1919, pp. 264-266, 2 figs. Advantages and limitations of various test methods presented with suggestions for selecting test for given application.

HEAT PENETRATION. Studies on Canning. An Apparatus for Measuring the Rate of Heat Penetration, W. T. Bovie and J. Bronfenbrenner. Jl. of Indus. & Eng. Chemistry, vol. 11, no. 6, June 1919, pp. 568-570, 5 figs. Apparatus consists of constant thermo-junction which is maintained at temperature of 0 deg. cent. and is located just outside of can.

MANOMETER. An Optical Lever Manometer, J. E. Shrader and H. M. Ryder. Physical Rev., vol. 13, no. 5, May 1919, pp. 321-327, 6 figs. Type devised for measuring vapor pressures in range between that which can be measured by Knudsen gage (0.001 mm) and ordinary mercury manometer.

NOTCHED-BAR IMPACT TEST. The Single Blow Notched Bar Impact Test as Used in the American Industry, E. H. Dix, Jr. Am. Soc. for Testing Materials, Univ. of Pa., annual meeting, June 24-27, 1919, 36 pp., 12 figs. Research conducted in effort to standardize tests. It was concluded that striking distance for Olsen and Izod machines should be made 0.866 in., and span of Charpy machine, 40 mm. (1.575 in.); no broad method of converting results of one machine from terms of another was found possible.

PENDULUM METERS. Theory of the Aron Meter; A Note on the Effect of Impulsive Forces on Pendulums, H. G. Rowledge. Elecn., vol. 82, no. 22, May 30, 1919, pp. 622-624. Concludes that such errors as may arise by using a pendulum to measure an irregular attraction are compensatory, and that in a large number of periods the compensation, by the law of averages, tends to become exact, so that the time integral of the attraction is correctly registered by the oscillations of the pendulum.

PITCH, APPARATUS TO DETERMINE BREAKING POINT OF. Apparatus for Determination of Breaking Point of Pitches, H. E. Lloyd and P. P. Sharples. Am. Soc. for Testing Materials, Univ. of Pa., annual meeting, June 24-27, 1919, 8 pp., 3 figs. Metal hinge on which pitch cast in mold is placed, is bent while submerged in cold water at constant rate until pitch is fractured. Temperature of water is then raised and process repeated until no fracture occurs.

PRONY BRAKES. Construction and Dimensions of Prony Brakes (Ueber die Abmessungen und die Bauart von Bremszäumen), W. Wilke. Oelmotor, vol. 8, no. 3, Mar. 1919, pp. 57-65, 9 figs. Calculation of dimensions. Equations and curves. (To be continued.)

PYROMETER. Practical Fundamentals of a Pyrometer, W. A. Gatward. Jl. Am. Steel Treaters Soc., vol. 1, no. 5, Feb. 1919, pp. 172-178, 3 figs. Suggests protecting couple from contamination from furnace gases or fumes and advises that most satisfactory leads are those made from same alloys as couple.

REFRACTOMETER. Refractometers. Nature, vol. 103, no. 2582, Apr. 24, 1919, pp. 145-147, 4 figs. Instrument as construed by firm of Zeiss and other types. such as the Pulfrich and the Bellingham & Stanley refractometers.

SPECTROPHOTOMETER. A New Sector Spectrophotometer, Samuel Judd Lewis. Jl. Chem. Soc., vols. 115 & 116, no. 678, Apr. 1919, pp. 312-319, 2 figs. Apparatus designed with object of combining accuracy and refinement in resulting spectra and also to be able to use instrument alternately with photometer and for other purposes.

STEAM METERS. Reduced Model of Steam Meter (Présentation d'un modèle réduit du compteur de vapeur), H. Parenty. Comptes rendus des Séances de l'Académie des Sciences, vol. 168, no. 17, Apr. 28, 1919, pp. 835-837, 2 figs. Further observations on the apparatus described in Comptes Rendus, vol. 168, 1919, p. 492.

TILE, DRAIN. An Investigation of Tests of Iowa Shale Drain Tile, W. J. Schlick. Off. Pub. Iowa State College of Agriculture, vol. 16, no. 43, Mar. 27, 1919, bul. 49, 71 pp., 18 figs. Object was to determine best method for making actual accelereted freezing, thawing and absorption tests upon drain tile.

MECHANICS

BEAMS, THEORY OF BENDING. The Stresses in Braced Structures with Rigid Joints, John Case. Flight, vol. 11, no. 22, May 19, 1919, pp. 704-706, 7 figs. Extends theory of bending of beam under combined action of lateral distributed load and longitudinal thrust to treatment, as complete unit, of braced structures with stiff joints.

New Method of Calculating Stresses in Continuous Beams (Nouvelle méthode de calcul et propriétés diverses des poutres à travées solidaires), P. Sonier. Génie Civil, vol. 74, no. 16, Apr. 19, 1919, pp. 312-315, 8 figs. Suggested modifications in graphical method.

Lines of Influence of a Continuous Girder on Three Supports (Die Einflusslinien des kontinuierlichen Tragers auf drei Stutzen), Ernst Laube. Schweizerische Bauzeitung, vol. 73, no. 20, May 17, 1919, pp. 225-227, 10 figs. Simple method for determining the lines of influence of continuous girders on three supports at different spans 10 and 11.

JOINTS, PINNED. An Investigation Into the Strength of Pinned Joints, V. C. Davies. Machy. (Lond.), vol. 14, no. 346, May 15, 1919, pp. 194-195, 4 figs. Results of tests on plain shafts.

SHAFTS, WHIRLING. The Whirling of an Excentrically Loaded Overhung Shaft, S. Lees. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 221, May 1919, pp. 515-523, 3 figs. Derivation of expression of kinetic energy and potential energy of system and subsequent application of Lagrange's equations.

The Whirling of an Airscrew Shaft, J. Morris. Flight, vol. 11, no. 21, May 22, 1919, p. 679, 1 fig. Technical determination of whirling speed in cases of uniform shaft and conically tapered shaft.

MECHANICAL PROCESSES

ADDING MACHINE. A Mechanical Mathematician. Ellsworth Sheldon. Am. Mach., vol. 50, no. 25, June 19, 1919, pp. 1185-1188, 13 figs. Construction and assembling of Monroe machine. Second article.

BEARINGS, ROLLER. Making the Timken Roller Bearing, Edward K. Hammond. Machy. (N. Y.), vol. 25, no. 10, June 1919, pp. 953-956, 20 figs. Methods of heat-treating, machining and inspecting. Second article.

CLOCKS. Clock Escapements. Nature, vol. 103, no. 2582, Apr. 24, 1919, pp. 155-168, 3 figs. Description of various types and manner of overcoming sources of error.

DRILL CHUCKS. Manufacturing a Drill Chuck, Fred R. Daniels. Machy. (N. Y.), vol. 25, no. 10, June 1919, pp. 948-952, 11 figs. "Ettco" drill chuck manufactured by Eastern Tube & Tool Co. Main features are said to be that it may be operated without use of wrench and that it is self-tightening.

ENGINE CYLINDERS. Modern Methods of Making Motor Cylinders, Fred H. Colvin. Am. Mach., vol. 50. no. 23, June 5, 1919, pp. 1099-1103, 15 figs. Cylinder department of Locomobile Co. where, it is said, handling has been reduced to a minimum.

ENGINE, HISPANO-SUIZA. The Hispano Suiza Airplane Engine—I, H. O. C. Isenberg. Am. Mach., vol. 50, no. 26, June 26, 1919, pp. 1213-1217, 16 figs. Process in manufacture followed at New Brunswick plant, Wright-Martin Aircraft Corp., especially in regard to securing accuracy.

ENGINES, MARINE. Efficiency in Marine Engine Production, G. N. Somerville. Pac. Mar. Rev., vol. 16, no. 6, June 1919, pp. 83-87, 6 figs. Illustrating practice of various Pacific Coast Shops.

Building Marine Engines on a Quantity Basis, F. B. Jacobs. Mar. Rev., vol. 49, no. 7, July 1919, pp. 338-343, 7 figs. Manufacturing operations on lighter units such as valve gear, bearings, air pump, crosshead, etc. (Continuation of serial.)

FILES. Some Points in the Manufacture of Files—II, Geo. Taylor. Machy. (Lond.), vol. 14, no. 348, May 29, 1919, pp. 273-276, 14 figs., also Iron Age, vol. 103, no. 25, June 19, 1919, pp. 1631-1636, 9 figs. How to deal with four defects in grinding which are said to exercise a deletrious influence in cutting process. These are: (1) Surface of blank ground slightly concave, (2) slightly convex, (3) wavy appearance giving series of depressions, (4) surface covered with scratches due to course gritstone.

GOLD LEAF. The Manufacture of Gold Leaf and Metal Foil, W. Theobald. Metal Industry, vol. 14, nos. 16 & 17, Apr. 18 & 25, 1919, pp. 321-324 and 341-346, 15 figs. Historical account of beating industry, based on series of articles appearing in Annalen für Gewerbe and Bauwesen.

ROLLING-MILL PRACTICE. Alloy Steels for Helmets and Armor, John A. Coyle. Chem. & Metallurgical Eng., vol. 20, no. 12, June 15, 1919, pp. 618-620, 1 fig. Details of electric furnace and rolling-mill practice.

Rolling of Beams Having Profiles Made Up of Three Elements Converging in a Point (Sur le calibrage des profils à trois branches convergeant en un même point), Norbert Metz. Revue de Métallurgie, vol. 16, no. 2, Mar.-Apr. 1919, pp. 89-127, 38 figs. Analysis of methods given by various writers in France and Germany and exposition or method developed by writer, in which he endeavors to simplify the determination of elongation coefficients.

ROOFING PRODUCTS. Manufacturing Brantford Roofing Products, J. H. Moore. Can. Machy., vol. 21, no. 22, May 29, 1919, pp. 537-541, 6 figs. Plant, building and yard cover area of seven acres. Conan conducts its own forge shop, toolroom and steam-fitting department.

SPHERES. Automatic Machines, H. E. Thomas. Page's Eng. Weekly, vol. 34, no. 768, May 31, 1919, pp. 297-298, 6 figs. Method for producing a sphere. (Continuation of serial.)

SPRINGS. Spring Making on a Quantity Basis, F. B. Jacobs. Iron Trade Rev., vol. 64, no. 21, May 22, 1919, pp. 1343-1348, 13 figs. Methods of Raymond Mfg. Co., Ltd., Corry, Pa., in manufacture of various classes of springs.

WESTINGHOUSE MARINE SYSTEM. Building the Westinghouse Marine System, Edward K. Hammond. Machy. (N. Y.), vol. 25, no. 10, June 1919, pp. 929-937, 28 figs. At Westinghouse plant in South Philadelphia, Pa. Second article.

WRENCHES. Making an Automobile Wrench in Two Operations, Hugo F. Pusen. Am. Mach., vol. 50, no. 24, June 12, 1919, pp. 1147-1148, 3 figs. Valuable feature in follow dies of this nature is system of sliding stops for guidance of stock until regular latch stop comes into action.

MOTOR-CAR ENGINEERING

BRAKES. Correct Location of Brake Levers, Walter C. Baker. Jl. Soc. Automotive Engrs., vol. 4, no. 6, June 1919, pp. 508-511, 2 figs. By means of brake-rod gage which consists of several interchangeable rods of various lengths, graduated every inch and operating through a dial gage that indicates lengthening or shortening of rods when placed by attachments in position of brake rods themselves.

CARBURETORS. The Godward Carburetter. Autocar, vol. 42, no. 1231, May 24, 1919, p. 787, 3 figs. Designed, it is said, to provide easy starting, flexibility, and economical running.

CAR PERFORMANCE. Research of Car Performance, P. W. Steelsmith. Mich. Technic, vol. 32, no. 2, May 1919, pp. 125-133, 9 figs. Tests conducted in accordance with standard rules of Society of Automobile Engineers.

CAR-SPEED CHART. Engine and Car Speed Chart. Motor Age, vol. 35, no. 23, June 5, 1919, p. 45, 1 fig. Chart to determine car speed in miles per hour when engine speed in revolutions per minute, high-gear reduction ratio and wheel diameter are known.

EXHAUST. Odorless Exhaust Gases (Verusche zur Erzielung geruchloser Abgase). Praetorius, Motorwagen, vol. 22, no. 2, Jan. 20, 1919, pp. 28-30, 6 figs. Suggests passing gases through calcium chloride and then through quicklime. Describes apparatus used for this purpose.

FANS. Radiator Cooling Fans, George W. Hoyt. Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 335-339, 8 figs. Writer observes that no one unit can do all the engine cooling and suggests that manufacturers of motor vehicles co-operate with accessory manufacturers to such an extent that the latter can help to solve mechanical difficulties.

GASOLINE-ELECTRIC CARS. The Stevens Petrol-Electric Vehicle. Electrical Review (Lond.), vol. 84, no. 2164, May 16, 1919, pp. 557-559, 4 figs. Electrical generator of four-pole interpolar type is direct coupled by means of flexible coupling to the gasoline engine which is fitted with centrifugal governor, adjustable as to speed by handwheel on middle of dashboard.

GOVERNORS, SPEED. Variable Speed Governors, W. W. Walls. Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 375-379, 7 figs. Description of tests made by Clyde Cars Co.

Tractor Engine Governors, G. L. Moyers. Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 364-366, 1 fig. Centrifugal and vacuum types.

KARDELL. Kardell Utility Tractor. Automotive Industries, vol. 40, no. 22, May 29, 1919, pp. 1162-1163, 3 figs. A two-plow tractor designed to be also suitable for cultivation and other farm work.

SPEEDOMETERS. Temperature Control of A-C Speedometer. Automotive Industries, vol. 40, no. 23, June 5, 1919, pp. 1228-1229, 2 figs. Magnetic instrument fitted with thermostatic compensator.

TRACTIVE RESISTANCE. Tractive Resistances to a Motor Delivery Wagon on Different Roads and at Different Speeds, A. E. Kennelly and O. B. Schwein. Mass. Inst. Technology, bul. no. 10, June 1916, no. 1011-1039, 19 figs. Also Am. Inst. Elec. Engrs., 33rd Annual Convention, June 30, 1916, bul. Investigation with wagon equipped with solid rubber tires; (1) overall efficiency of truck mechanism and (2) tractive resistance of a number of typical urban roads.

TRACTORS. Motor Plows, Tractors, etc., in Switzerland (Erprehung landvirtschaftlicher Maschinen in der Schweiz). Allgemeine Automobil-Zeitung, vol. 20, no. 1, Jan. 5, 1919, pp. 6-12, 5 figs. Competitive tests of American and Swiss makes held at Orbe, Switzerland. Official figures of results.

Small Motors for Agricultural Purposes (Der Klemmotor), Max Apel. Motorwagen, vol. 22, no. 4, Feb. 10. 1919, pp. 62-72, 16 figs. Points or design based on study of nature of work to be performed by machine as tractor, cultivation machine, or machine for driving others.

The Principles of the Wheeled Farm Tractor, Edward R. Hewitt. Gas Engine, vol. 21, no. 6, June 1919, pp. 182-185, 3 figs. Laboratory tests checked with work on machine in the open are said to have demonstrated that the maximum drawbar pull is a definite function of the weight per inch of width, amount available on sandy ground with a smooth metal wheel being about 30 per cent of weight on wheel when soil is dry and about 43 per cent when it is damp.

Farm Tractor Design—I & II, Joseph Jandasek. Automotive Industries, vol. 40, no. 24 & 25, June 12 & 19, 1919, pp. 1265-1273 & 1406-1407, 10 figs. Examples of calculations preceding design. Tabulated data on power requirements, soil packing and other items.

Agricultural Motor Tractors, G. Hildick-Smith. Jl. of Chem., Metallurgical & Min. Soc. of South Africa, vol. 19, no. 10, Apr. 1919, pp. 195-200, 3 figs. Notes on work and organization of Technical Section of Food Production Dept., England.

TRACTOR, DRAWBAR LOCATION ON. The Influence of Hitches and Drawbar Location on Tractor Design, A. W. Scarratt. Automotive Industries, vol. 40, no. 24, June 12, 1919, pp. 1334-1335 and 1359, 2 figs. Method of calculating weight required on front wheels to prevent bearing of tractor under full load on level or steep grades.

TRUCKS. Motor Lorry Design. Times Eng. Supp., vol. 15, no. 555, May 1919, p. 157. Lessons to be drawn from experience under war conditions as to construction of chassis of motor lorries; present article deals with engine and transmission gear.

VOISIN. Voisin's Initial Chassis, W. F. Bradley. Automotive Industries, vol. 40, no. 22, May 29, 1919, pp. 1178-1179, 4 figs. Four-cylinder, 30-hp. Knight engine car, built in small volume with view to increasing quality.

WAR VEHICLES. Utilization of War Vehicles for Industries and Agricultural Purposes (Wrs können die aus dem Kriege zuruckkehrenden Feldkrattwagen für Industrie und Landwirtschaft leisten), P. Sanio. Motorwagen, vol. 22, no. 5, Feb. 20, 1919, pp. 84-85. Directs attention to the fact that rail and railless vehicles of all kinds will have received such rough usage at the front, improper treatment through overloading, and bad handling and use of unsuitable materials in their manufacture that many of them will be unsuitable for civil purposes.

The Employment of Motor Trucks After the War—I & II (Zur Frage der Verwendung von Motorlastwagen nach dem Kriege), Th. Wolff. Zeitschrift für Transportwesen & Strassenbau, vol. 35, nos. 35 & 36, Dec. 10 & 20, 1918, pp. 412-416 and 426-431. Discusses advantages of motor trucks for various industrial purposes.

POWER GENERATION

CANADA. Hydro-Electric Development on Nipigon River. Can. Engr., vol. 36, no. 24, June 12, 1919, pp. 529-531, 8 figs. Reported that Hydro-Electric Power Commission of Ontario will install five units totaling 60,000 hp., at Cameron's Pool. A concrete dam 200 ft. long, 43 ft. high, is to be erected.

FRANCE. Intended Legistation on Water Power in France (Le nouveau projet de loi sur les forces hydrauliques). Houille Blanche, vol. 18, nos. 27-28, Mar.-Apr. 1919, pp. 41-46. Concerning state control of hydraulic energy developments.

GREAT BRITAIN. Electrical Energy from the River Dee. Engineer, vol. 127, no. 3309, May 30, 1919, pp. 524-526, 3 figs. Diagrams and plans of proposed utilisation of river between Llangollen and Chester.

The Supply of Electricity, John Somerville Highfield. Jl. Roy. Soc. Arts, vol. 67, no. 3469, May 16, 1919, pp. 408-420 and (discussion), pp. 420-424. Analysis of reports of Coal Conservation Sub-Committee, Elec. Trades Committee and Elec. Power Supply Committee, with tables showing amounts of capital expenditure and gross profits in various company and municipally-owned electricity undertakings.

ISOLATED PLANT. Effect of the War Upon Isolated Plant Costs. Elec. Rev., vol. 74, no. 25, June 21, 1919, pp. 1024-1027, 2 figs. Comparison of expenses of central station and isolated plant.

NIAGARA FALLS. Structural Details of Plant Extension at Niagara Falls Elec. Rev., vol. 74, no. 25, June 21, 1919, pp. 1028-1033, 9 figs. Addition of 40,000 hp. which involved construction of conduit 13.5 ft. in diameter.

Regional Planning of the Niagara District, Thomas Adams. Contract Rec., vol. 33, no. 25, June 18, 1919, pp. 563-566. Question examined from viewpoint (1) industrial development, (2) economic use and regulation of sub-division of land and character and density of structures in rural and urban areas. (3) housing, sanitation, convenience and amenity. (4) transportation—railways, highways and waterways. (5) sources and distribution of power. (6) water supplies and sewerage. (7) general amenties—including parks and boulevards and development of tourist facilities.

NORWAY. Hydroelectric Power Station near Hardanger, Norway (Storindustrien paa Vestilendet). Teknisk Ukeblad, vol. 66, no. 17, Apr. 25, 1919, pp. 211-212, 3 figs. Project for installing machinery to utilize 25,000 hp. out of 75,000 hp. available at Osa waterfalls.

Industrial Development in Norway (Den nye Toll i Norge. Nogen Track av det industrielle Gjennembrudds Historie). Teknisk Ukeblad, vol. 66, no. 18, May 2, 1919, 223-229, 14 figs. Figures showing effect of harnessing waterfalls.

SPAIN. Water Power Utilization in Spain (Salto de agua " Ribadelago " en el rio Tera), B. Oliver y Roman. Revista de Obras Publicas, vol. 67, no. 2276 May 8, 1919, pp. 218-239, 3 figs. on supp. plate. Project to utilize 1880-ft. waterfall.

UNITED STATES. The Energy Resources of the United States; A Field for Reconstruction Chester G. Gilbert and Joseph E. Pogue. Smithsonian Instn., U. S. Nat. Museum, bul. 102, vol. 1, 1919, 165 pp., 23 figs. Extended discussion of coal and water as sources of power and their present utilization in the U. S. A. Claimed need of (1) provision of common-carrier system for transmission of electrical energy (2) application of constructive economic policy to conditions surrounding petroleum.

WATER-POWER LEGISLATION. Need for and Status of Water-Power Legislation. Elec. Rev., vol. 74, no. 22, May 31, 1919, pp. 893-894. Summary of situation prepared by Nat. Service Committee of Eng. Council.

WISCONSIN RIVER. Hydroelectric Development on Wisconsin River at Stevens Point. William F. Snyder. Elec. Rev. vol. 74, no. 22, May 31, 1919, pp. 881-884, 7 figs. Flow of Wisconsin River is used as effective head of 14 ft. A total of 5700 hp. made up of six 950-hp. hydraulic turbines of the vertical type is comprised.

ZINC INDUSTRIES. Conditions in Electrometallurgical and Electrochemical Zinc Industries (L'état actuel des industries électrométallurgique et électrochimique du zinc), M. Lemarchands. Houille Blanche, vol. 18, nos. 27-28, Mar.-Apr. 1919, pp. 46-53. In England, France and the U. S., both before the war and at present. Opinions of various writers in regard to advantages secured by utilizing hydraulic energy in zinc industries are presented.

PIPE

Concrete. Reinforced-Concrete Pressure Pipe for Hydro-electric Plants (In Japanese), A. Inokuty. Denki Gakkwai Zasshi, no. 370, May 10, 1919. *See also Civil Engineering, Cement and Concrete Pipe.*

Sewer Pipe. *See Civil Engineering, Sanitary Engineering, Sewer Pipe.*

POWER PLANTS

Boiler Operation. The Practical Operation of Industrial Boilers, W. E. Snyder. Porc. Engrs. Soc. Western Pa., vol. 35, no. 2, March 1919, pp. 59-101 and (discussion) 101-116. With regard to safety and economy. A manual of instruction for boiler foremen is suggested.
Boiler Troubles; Their Origin and Remedy, T. H. Fenner. Power House, vol. 12, no 7, May 20, 1919, pp. 183-186, 5 figs. Note on pitting, grooving and external corrosion.

Boiler Room. Improving Operation in Typical Industrial Plant Boiler Room, J. T. Beard, Jr. Power, vol. 49, no. 25, June 21, 1919, pp. 967-969, 6 figs. Replaeing the pinhole grate with grate of proper design for coal to be burned; installing up take dampers and operating them by hand independent of other regulators, and other similar ehanges.
Boiler Furnaces and Boiler Furnace Design, D. S. Jacobus. Stevens Indicator, vol. 36, no. 1, Jan. 1919, pp. 1-10. Recommend avoiding construction in which brickwork is heated on both sides when under too great stress; also torch-like action of flames on walls. Paper presented at Phila. Conv. of Am. Boiler Mfrs. Assn.
Boiler Room of the Sheet Metal Products Co., Ltd., W. F. Sutherland. Power House, vol. 12, no. 9, June 20, 1919, pp. 245-247, 5 figs. With reference to efficiency of operation.

Combustion Control. Combustion Control in Mill Boiler Plant—I, Robert June. Blast Furnace & Steel Plant, vol. 7, no. 6, June 1919, pp. 274-276, 2 figs. Analysis of causes of losses.

Condensers. Parkersburg Station, Monongahela Valley Traction Co. Power Plant Eng., vol. 23, no. 13, July 1, 1919, pp. 575-578, 8 figs. Condenser pit provided in which circulating system operates as a syphon.

Dominion Power Co. Steam Electric Plant of the Dominion Power and Tranmission Company, Hamilton—II. Elec. News, vol. 28, no. 11, June 1, 1919, pp. 28-30, 3 figs. Description of turbines and auxiliary steam equipment.

Electrical Equipment. Electrical Equipment in a Model Y. M. C. A. Building. Elee. Rec., vol. 25, no. 6, June 1919, pp. 365-367, 4 figs. Brooklyn, N. Y. central building. Generating equipment includes two 200-kw. and one 75-kw. dc. machines driven by side-crank reciprocating steam engines. B. & W. water-tube boilers supply steam for operating engine.
Improvements in Industrial Plant Operation, E. F. George. Elec. World, vol. 73, no. 23, June 7, 1919, pp. 1207-1209, 2 figs. Methods of electrical construction and operation at plant of Lodge & Shipley Machine Tool Co., Cincinnati.

Exhaust Utilization. The Contraflo System of Utilizing Exhaust. Mar. Eng., vol. 9, no. 6, June 1919, pp. 209-211, 4 figs. Illustrating various arrangements of system.

Hydraulic Operating Board. Operation at Holtwood—Features of Station Operation and Maintenance. Charles H. Bromley. Power, vol. 49, no. 23, June 10, 1919, pp. 892-896, 9 figs. Hydraulic operating board which indicates operation of pumps, governor valves, etc., is located on turbine-room floor and is visible to switchboard operator.

Ice Difficulties. Operation at Holtwood, Charles H. Bromley. Power, vol. 49, no. 22, June 3, 1919, pp. 850-854, 4 figs. Handling ice difficulties at plant.

Instruments. Boiler and Turbine Room Instruments, Power Plant Eng., vol. 53, no. 13, July 1, 1919, pp. 586-588, 2 figs Their value in maintaining high degree of operating efficiency. From report of Committee on Prime Movers, presented at convention of Nat. Elec. Lighting Assn.

Johns Hopkins University. Mechanical Equipment at Johns Hopkins University, Julian C. Smallwood. Power, vol. 49, no. 21, May 27, 1919, pp. 811-814, 7 figs. Power plant designed with view to providing economical and continued service, and also facility for undergraduate experimentation and means for research, usual and special.

Muscle Shoals Plant. United States Nitrates Plant No. 2, Muscle Shoals. Ala.—Station Heat Balance. Edward R. Wells and H. C. Lockwood. Power, vol. 49, no. 21, May 27, 1919, pp. 802-805, 8 figs. Hotwell water, which varies between 80 and 100 deg. fahr. used for cooling lubricating oil for main turbine. This turbine is of 60,000 kw. continuous capacity and is electrically in parallel with two noncondensing house turbines, which furnish power for driving auxiliaries.

Starting and Stopping Large Units. Operation at Holtwood, Charles H. Bromley. Power, vol. 49, no. 25, June 24, 1919, pp. 973-976, 6 figs. Procedure and precautions used in starting and stopping large main units.

Steam Traps. Notes on Steam Traps, F. G. Hechler. Jl. Am. Soc. Naval Engrs., vol. 31, no. 2, May 1919, pp. 430-437, 1 fig. Insisting upon regular inspection of all traps is advised.

Universal Portland Cement Co.'s Plant. Universal Portland Cement Co.'s Largest Plant, William B. Eastwood. Cement, Mill & Quarry, vol. 14, no. 11, June 5, 1919, pp. 17-19, 2 figs. Waste-heat power plant consists of 12 Babcock & Wilcox boilers, each individually fed with waste gases from rotary kilns.

POWER TRANSMISSION

Belting. Proper Use and Care of Leather Belting, Guy B. Smith, Cement, Mill & Quarry (Belting Section), vol. 14, no. 11, June 5, 1919, pp. 13-15, 1 fig. Contends that slippage is due chiefly to incorrect choice and an improper width of belt, undersized pulleys, poor alignment, insufficient precautions against oil from leaky bearings and use of poor belt dressings.

PRODUCER GAS

Gas Producers. Recent Development in Gas Producers (Ueber Gaserzeuger und ihre neuste Entwicklung), Dr. Markgraf. Technische Blätter, vol. 9, nos. 13-13, Mar. 31, 1919, pp. 60-62, 4 figs. Historical review of use of gas for technical purposes. According to writer, so far the hope to use low-grade fuels has not been realized and the best fuel at present for revolving grates is washed nut eoal. (To be eontinued).

PUMPS

Bilge Pumps. Turbine-Driven Pipeless Salage Bilge Pumps. Engineering, vol. 107, no. 2787, May 30, 1919, pp. 698-700, 8 figs. Vertical standard type with capacity of 1000 tons of water per hour.

Centrifugal Pumps. Steam Turbine-Driven Centrifugal Pumps, Fire & Water Eng., vol. 65, no. 23, June 4, 1919, pp. 1392-1393, 3 figs. Considered as advantageous for city water supply.
Design of Motor-Driven Centrifugal Pumps, A. T. Clark. Can. Engr., vol. 36, no. 25, June 19, 1919, pp. 548-549, 5 figs. Characteristic curves for different types under identical conditions.

Gear Reduction Drive. Helical Gears Solve Cornwall's Pumping Problem R. N. Austin. Can. Engr., vol. 36, no. 23, June 5, 1919, pp. 507-509, 5 figs. High-speed single-stage centrifugal pumps are driven by low-speed hydraulie turbines with pumping efficiency of 73 per cent including gear loss.

Louisville. Louisville's New Pumping Station. Mun. Jl. & Public Works, vol. 46, no. 23, June 7, 1919, pp. 398-402, 8 figs. Latest increase said to be 30,000,000 gal. vertical, triple flyheel pump.

Rotary Fire Pump. New Type Rotary Fire Pump, Fire & Water Eng., vol. 65, no. 25, June 18, 1919, pp. 1546-1547. With lateral intake and discharge and hardened steel pilot gears.

Salvage Pumps. *See Bilge Pumps.*

San Francisco. San Francisco Pumping Stations, Charles W. Geiger. Power Plant Eng., vol. 23, no. 12, June 15, 1919, pp. 527-536, 7 figs. Details of two so-called earthquake-proof salt-water pumping stations.

Toronto Waterworks. Main Pumping Station Toronto Waterworks, W. F. Sutherland. Power House, vol. 12, no. 7, May 20, 1919, pp. 177-182, 10 figs. Present capacity is 200,000,000 gal. per 24 hr.

REFRACTORIES

Dolomite. Experiments in Dead-Burning Dolomite, H. G. Schurecht. Jl. Am. Ceramic Soc., vol. 2, no. 4, Apr. 1919, pp. 291-305, 13 figs. Roll seale reported to have been found very effective in dead-burning delomite without decreasing its refractoriness too much.

Firebrick. Firebrick-Manufacture and Use, W. H. Grant. Can. Manufacturer, vol. 39, no. 6, June 1919, pp. 23-25. Particularly in steel and clay-products industries.

Porcelain. The Comparative Value of Kneading and Pugging in the Preparation of Porcelain Bodies, L. E. Barringer. Jl. Am. Ceramic Soc., vol. 2, no. 4, Apr. 1919, pp. 306-312, 2 figs. Results of tests are claimed to demonstrate that the center of pug-mill blank contains more air than the edge, this being due to greater pressure on blank where it comes in contact with die.
Some Physical Properties of American Commercial Porcelain Bodies, J. W. Wright and S. I. Sewell. Jl. Am. Ceramic Soc., vol. 2, no. 4, Apr. 1919, pp. 282-290, 3 figs. Numerical results obtained from determination made upon commercial bodies.

Zirconia. Fused Zirconia—The New Refractory, A. J. Franklin. Metal Industry, vol. 14, no. 20, May 16, 1919, pp. 401-402. Analysis of various varieties of Brazilian baddelyite and the biography of zireonia including principally articles published in German magazines.

REFRIGERATION

A. E. F. Refrigerating Plant. Refrigerating Plant No. 1, American Expeditionary Forces, John V. Fisher. Power, vol. 49, no. 24, June 17, 1919, pp. 920-922, 7 figs. Capacity of 600-ton.
Refrigeration for the Army, L. R. Phillips. Ice & Refrigeration, vol. 56, no. 6, June 1919, pp. 369-375, 14 figs. Ice-making and cold-storage plants erected in France. Also plants erected at cantonments, notably one with large freezer capacity at Chicago.

Abattoir. The Municipal Abattoir of the City of Reichenberg (Der städtische Scalachthor in der Stadt Reichenberg). Zeitschrift für Eis-und Kälte-Industrie, vol. 11, no. 8, Feb. 1919, pp. 113-116, 3 figs. Total area oecupied is 29,400 sq. m., of which 8,730 sq. m. is used for stock yards.

Code, Refrigerating. Tentative Refrigerating Code. Refrigerating World, vol. 54, no. 6, June 1919, pp. 11-14, 2 figs. For Municipal and State Regulations for refrigerating machines and refrigerants proposed by Refrigerating Regulations Committee and approved by Council of the A.S.R.E.

Marine Refrigeration. Notes on Marine Refrigeration, A. H. Baer. Am. Soc. Refrig. Engrs., vol. 5, no. 5, March 1919, pp. 383-386. Result obtained by the Government.

Williams Refrigerating Machine. The Williams Refrigerating Machine, Wm. L. DeBaufre. Jl. Am. Soc. Naval Engrs., vol. 31, no.2, May 1919, pp. 454-469, 10 figs. Test to determine capacity under various temperatures of refrigeration, also to note general operating characteristics and durability of parts.

RESEARCH

Industrial Laboratories. Lynite Laboratories of the Aluminum Castings Company Embody Most Progressive Ideas and Up-to-Date Equipment in the Field of Industrial Research. Aerial Age, vol. 9, no. 14, June 16, 1919, pp. 678-683, 11 figs. Organization and work undertaken by the three sections—research development and technique—into which laboratory is divided.

Furnace Manufacturer's Research Plant. Metal Worker, Plumber & Steam Fitter, vol. 91, no. 23, June 6, 1919, pp. 727-729, 6 figs. Investigation at University of Illinois Engineering Experiment Station for which Nat. Warm Air Heating & Ventilating Assn. appropriated $8000 at its 1918 convention.

Works Laboratory Organization, J. E. Hurst. Foundry Trade Jl., vol. 21, no. 208, Apr. 1919, pp. 224-227, 1 fig. Chart of principal technical departments of a modern engineering works, showing relationship between scientific and production department. Paper read before Lond. Branch British Foundrymen's Assn.

Municipal Testing Laboratories. The Organization of a Standard Municipal Testing Laboratory. J. C. Preston. Can. Engr., vol. 36, no. 23, June 5, 1919, pp. 520-522, also Eng. & Contracting, vol. 51, no. 23, June 4, 1919, pp. 592-594, 1 fig. It is concluded that standard testing laboratory is an economical investment for any municipality, that its field or service is of almost unlimited expansion. Concluded from May 22 issue.

Naval Research. Naval Research, C. S. McDowell. U. S. Naval Inst. Proc., vol. 45, no. 196, June 1919, pp. 895-908. List of problems in which it is considered desirable to undertake research work and enumeration of advantages.

Norway. Christiania Experimental Testing Station (Kristiania Materialproveanstalt). Teknisk Ukeblad, vol. 66, no. 16, Apr. 18, 1919, pp. 201B-201D Applications for tests on strength of metals, wood, rope and belts, and on building materials totalled 984 for 1917-1918. Instances are quoted indicating nature of tests required. (To be continued).

Switzerland. Mechanical, Physical and Chemical Testing Laboratory of the Engineering School at Lausanne (Le laboratoire d'essais mécaniques, physiques et chimiques de l'école d'ingénieurs de l'Université à Lausanne). Bul. Technique de la Suisse Romande, vol. 45, nos. 9 & 10, May 3 & 17, 1919, pp. 79-81, 489-91, 47 figs. Compression press with capacity of 150 tons built similarly to tension machine described in preceding installment Description of amisler pendulum dynamometer. (Continuation of serial).

STANDARDS AND STANDARDIZATION

German Motor Industry. Standardization and Specialzation in the German Motor Industry (Normalisierung-Spezialisierung), B. von Lengerke, Motorwagen, vol. 22, no. 3, Jan. 31, 1919, pp. 50-51. Although regarding outlook as rathed rak, for motor industry, writer thinks position could be improved by adopting American methods of quantity production.

Plate Industry, Steel. Features of the Steel Plate Industry. Raw Material, vol. 1, no. 4, June 1919, pp. 206-212, 7 figs Guides to specification of various grade of plates and advice concerning specifications necessary to obtain, solid homogeneous metal free from defects.

Quarry Products. Standardization of Quarry Products (Die Normung der Steinbruchserzeugnisse), Freystedt. Zeitschrift für Tranportwesen & Strassenhau vol. 36, no. 7, Mar. 1, 1919, pp. 75-84, From the viewpoint of the quarry operator. Tables of standard sizes.

Threads, Pipe and Screw. New Series of Pipe and Screw Threads. Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 358-360, 1 fig. Tables giving standards proposed by Nat. Screw Thread Commission.

STEAM ENGINEERING

Boiler Baffling. Suggestions for Correct Boiler Baffling, A. D. Williams. Blast Furnace & Steel Plant, vol. 7, no. 6, June 1919, pp. 283-286, 10 figs. Regulating gas velocity to permit maximum heat transfer.

Boiler Heads. Alignment Charts for Finding the Dimensions and Volumes of Bumped Heads, C. H. Berry. Power. vol. 49, no. 24, June 17, 1919, pp. 926-927, 5 figs. Deals in diameter, radius of spherical surface and height of bump.

Boiler Setting. Suspension and Concrete Setting of Boiler at the Robert Gair Plant, Brooklyn. Power, vol. 49, no. 24, June 17, 1919, pp. 934-935, 2 figs. Building columns and boiler-support columns, will be exposed to furnace temperatures.

Compound Engines. The Design of Compound Engines, F. S. Bauer. University of Colorado, Jl. of Eng., vol. 15, no. 3, Apr. 1919, pp. 25-37, 2 figs.Curves showing relations between absolute boiler pressure and cylinder-volume ratio, total ratio of expansion and receiver pressure of various back-pressures.

Turbines. Westinghouse-Rateau Marine Geared Turbines. Engineering, vol. 107, no. 2786, May 23, 1919, pp. 666-668, 6 figs., partly on two separate plates Turbine consists of independent high and low pressure cylinders, giving 2,500 shaft hp. Steam is supplied from three single-ended marine type boilers, 15 ft. in diameter, and 11 ft. 9 in. long.

Steam Turbine Reviewed Historically—II. Universal Engr., vol. 29, no. 3, Mar. 1919, pp. 29-45, 25 figs. Governor control employed by Westinghouse Co. Arrangement developed for automatic operation of bypass valves to enable turbine to carry heavy overloads

Turbine Blade Fastenings—II. Mech. World, vol. 65, no. 1692, June 6, 1919, pp. 271-272, 7 figs. Blading reaction turbines in segments. (Continuation of serial.)

Uniflow Engines. Modern Advancement in Steam Prime Movers, E. H. Beckstrand. Utah Soc. Engrs., vol. 5, no. 3, Mar. 1919, pp. 45-54. Believes that prime mover best adapted to high pressure end of steam diagram would be Uniflow engine with poppet valves.

The "Uniflow" Pumping Engine, D. A. DeCrow. Can. Engr., vol. 36, no. 25, June 19, 1919, pp. 557-558, 2 figs. Claims simplicity of construction, low cost of production as compared with compound and triple expansion reciprocating pumping engines, and economy in use of steam. Paper read at convention of Am. Water Works Assn.

THERMODYNAMICS

Heats of Fusion, Latent. A Note on Latent Heats of Fusion and their Relation to Molecular Composition, Harbord George Wayling. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 221, May 1919, pp. 495-497. Expressing Trouton's rule as ratio of product of latent heat of fusion by molecular number, to melting point on absolute scale, writer finds that for several compounds this ratio is equal to number of atoms in molecule.

WELDING

Acetylene Generating Plant. Acetylene Generating Plant for Large Welding Shops. Acetylene & Welding Jl., vol. 16, no. 188, May, 1919, pp. 93-94, 1 fig. It consists of seven generators, gas collector, moisture separator, two condensers, gasometer capable of storing 350 cu. ft. of gas and four large purifiers with bypasses for working in pairs.

Acetylene Welding. Acetylene Welding. Ry. Jl., vol. 25, no. 6, June, 1919, pp. 19-19. Committee report before Master Boiler Makers' Assn.

Great Britain's Acetylene Welding Industry—its Birth, Growth and War Record, Norman MacLeod. Jl. Acetylene Welding, vol. 2, no. 12, June, 1919, pp. 601-603, 8 figs. Founding of Northern Polytechnic Inst., and featuring courses in autogenous welding. Among samples of welding applications, the reconstruction of a bomb dropped in London by a German zeppelin is described.

Shutdown of Great Steel Plant Avoided by Oxywelding, L. M. Malcher. Jl. Acetylene Welding, vol. 2, no. 12, June 1919, pp. 611-614, 5 figs. Repairing wrecked low-pressure cylinder which was cracked at head end in seven different places.

A Difficult Cylinder Block Job, David Baxter. Jl. Acetylene Welding, vol. 2, no. 12, June 1919, pp. 607-610 & 622, 10 figs. Presented as case in which welding operator was handicapped by intense heat radiating against tip at close quarters from every direction and very limited space in which to manipulate.

Notable Repairs on Large Cylinder by Oxy-Acetylene Welding, L. M. Malcher. Pac. Mar. Rev., vol. 16, no. 6, June 1919, pp. 104-105, 4 figs. Cylinder of Allis-Chalmers twin compound reversing engine, 70 in. diameter, badly fractured. Cost of repair estimated about one-third of that of a new cylinder.

Welding by the Oxy-Acetylene Method—III, J. F. Springer, Automobile Eng., vol. 4, no. 5, May 1919, pp. 238-239, 2 figs. Examples of successful welds in cast-iron frames, with remarks on methods of making welding groove and filling it with new metal.

Aluminum Welding. The Vertical Welding of Aluminum. Acetylene & Welding Jl., vol. 16, no. 188, May, 1919, pp. 94 & 99, 2 figs. Tests made on sheet aluminum of 11 and 14 gage.

Boiler Repairs. Repairs to Boilers and Engines by Welding, E. G. Hiller. Can. Machy., vol. 21, no. 21, May 22, 1919, pp. 520-521, 2 figs. Examples such as repairing wrought steel, hot-water boiler which was fractured at fire hole and building up by electric welding flanged seams of flue-tube for Lancashire boiler. Paper read before Instn. Mech. Engrs.

Concrete, Reinforced, Construction. Autogenous Welding in Reinforced-Concrete Construction (Die Flammenverschmelzung im Eisenbetonbau). Autogene Metallbearbeitung, vol. 12, no. 1, Jan. 1919, pp. 26, 12 figs. Description of method of construction, said to be especially suited for concrete vessels and large tanks. (To be continued.)

Cylindrical Bodies. Welding Performed on Cylindrical Bodies, Ernest Schwartz. Can. Machy., vol. 21, no. 22, May 29, 1919, pp. 552-553, 4 figs. Concerning welding of seams and of head and bottom cylindrical bodies.

Dredges. Oxy-Acetylene and Electric Welding on Dredges, H. G. Blankman. Min. & Sci. Press, vol. 118, no. 21, May 24, 1919, p. 716. Also Metal Trades, vol. 10, no. 6, June 1919, p. 257. Can. Klondyke Mining Co. operates three large dredges and has installed in its machine shop an oxy-acetylene welding equipment. Article quotes results obtained.

Electric Welding. Electric Welding: Its Theory, Practice, Application and Economies, H. S. Marquand. Elecn., vol. 82, nos. 20, 21, 23 & 24, May 16, & 23, June 6 & 13, 1919, pp. 535-567, 591-593, 645-647, and 681-683, 19 figs. Best results with Bernados system are said to be obtained with current supplied at about 75 to 80 volts; it is noted, however, that when this potential is obtained from a higher voltage circuit through resistance, there is great loss of energy and quality of work is likely to be impaired. (Continuation of serial.)

Electric Welding and Welding Appliances—XIII. Engineer, vol. 127, no. 3366, May 9, 1919, pp. 444-446, 5 figs. Machines manufactured by Al Manufacturing Co., of Industry Works, Bradford. They produce machines and accessories for resistance welding only.

Electric Welding in Warships, W. H. Gard. Mar. Engr. & Naval Architect, vol. 41, no. 500, May 1919, pp. 238-244, 7 figs. Among various examples of repair work, restoring of cast-steel sternpost of battleship is quoted as significant development of process. Paper read before Inst. Naval Architects.

Electric Welding, Arc. Important Factors for Efficient Arc Welding, E. Wanamaker and H. R. Pennington. Ry. Elec. Engr., vol. 19, no. 6, June 1919, pp. 179-185, 13 figs. Concerning flexibility of installations, location of accessories and eye and body protection.

Relation of Arc Phenomena to Electric Welding, C. D. Fawcett. University of Colorado, Jl. of Eng., vol. 15, no. 3, Apr. 1919, pp. 15-24, 2 figs. Suggestions in regard to welding practice with table giving approximate relation of electrode diameter, plate thickness, etc.

Electric Arc Welder for Portable and Stationary Use. Automotive Industries, vol. 40, no. 23, June 5, 1919, p. 1233, 2 figs. Outfit designed for operation on either direct current or alternating current lines.

Electric Welding, Plastic Arc. The Plastic-Arc System of Welding, J. O. Smith. Coal Age, vol. 15, no. 26, June 26, 1919, pp. 1162-1166, 7 figs. Also Ry. Rev., vol. 64, no. 24, June 14, 1919, pp. 898-900, 9 figs. Description of outfit and examples of repairs effected by this system. Paper presented before meeting of Coal Min. Elecns. and Mechanics Inst.

Engine Cylinders, Liberty. Welding Operations on Liberty Motor Cylinders H. A. Carhart. Am. Mach., vol. 50, no. 22, May 29, 1919, pp. 1019-1025, 13 figs. Mixtures and apparatus used by Lincoln Motor Co.

GAS CUTTING TORCHES. Modern Welding and Cutting. Am. Mach., vol. 50, no. 23, June 5, 1919, pp. 1081-1087, 15 figs. Difference between gas cutting torches and those used for welding; details of various makes of gas cutting torches. 13th articles.

Modern Welding and Cutting—XIV, Ethan Viall. Am. Mach., vol. 50, no. 26, June 26, 1919, pp. 1237-1243, 15 figs. Gas-pressure regulators and working assemblies; directions for lighting of torch; charts showing various flame characteristics with different gas combinations.

PRE-HEATING WORK. Pre-Heating Work for Oxy-Acetylene Welding, J. F. Springer. Ry. & Locomotive Eng., vol. 32, no. 6, June 1919, pp. 184-185, 1 fig. On prevention of cracking.

SHIP CONSTRUCTION. Welding as a Process in Ship Construction, S. V. Goodall. Gen. Elec., Rev., vol. 22, no. 8, Mar. 1919, pp. 213-216. Observes that riveting being greatest single labor item, any improvement in method of binding together whole structure offers fruitful field for economy.

STRENGTH OF WELDS. Electric Welding and Welding Appliances—XIV. Engineer, vol. 127, no. 3307, May 16, 1919, pp. 471-473, 1 fig. Account of tests which have been devised for determining strength of electric welds. (Concluded.)

STRESSES IN SEAMS. Stresses in Seams in Autogenous (Wie wird beim Autogenschwissen die Schweisshaht beansprucht). Autogene Metalibearbeitung, vol. 12, no. 1, Jan. 1919, pp. 6-8. Phenomena observed in welding mild steel.

THERMIT WELDING. Thermit Process Used on Big Welding Job on Northern Pacific. Mar. News, vol. 6, no. 2, July 1919, pp. 96-97, 5 figs. Illustrating repair on cast-steel stern frame which was cracked through just above upper post gudgeon, the break forming roughly a triangle, each side of which was about 2 ft. long.

Restoring Steel Machinery to Service by the Thermit Process. Welding Engr., vol. 4. no. 6, June 1919, pp. 29 and 32-33, 14 figs. Examples of repairs of large pieces of work for Pittsburgh Steel Co.

WELDING JIGS. Some Examples of Welding Jigs and Methods for Overcoming Distortion, C. S. Milne. Acetylene & Welding Jl., vol. 16, no. 187, Apr. 1919, pp. 66-73 33 figs. Illustrates various kinds of defects that are usually remedied by welding and discusses practices in reducing cooling stresses. Paper read before British Acetylene & Welding Assn.

WOOD

GIRDERS, LATTICE. Wooden Lattice Girders (Boltede Gittekonstruktioner of Trae med "Bufobrikker"). Ingeniren, vol. 28, no. 30, Apr. 12, 1919, pp. 196-199, 8 figs. Corrugated steel "Bufo" washers are used between the rod and beams.

SPRUCE, SEASONING. Emergency Seasoning of Sitka Spruce, L. A. Welo. Sci. Am., Supp. vol. 87, no. 2269, June 28, 1919, pp. 404-405, 2 figs. Strength of kiln-dried and air-dried spruce compared.

VARIA

ENGINEERING PROFESSION. The Engineer and the Community, E. H. Sniffin. Elec. Jl., vol. 16, no. 6, June, 1919, pp. 249-251. Writer asks why the engineer who has "made the world more habitable than was even dreamed of by the greatest imaginations of former ages" is not "a more conspicuous member of the community."

Proper Recognition of the Engineering Profession, W. W. K. Sparrow. Ry. Rev., vol. 64, no. 18, May 3, 1919, pp. 668-670. Believes that prime requisites to obtaining greater recognition of engineering profession are organization, licensing and broader education.

METRIC SYSTEM. The Metric System in Engineering, Frederick A. Halsey. Eng. Education, vol. 9. no. 10, June 1919, pp. 491-499. Argues that value of introducing metric system should be measured by results to be expected from its introduction; as no special benefit is seen in changing already standardized mechanical constructions from their present values to metric units, acceptance of metric system in engineering is not considered practical.

NATIONAL DEPT. OF PUBLIC WORKS. The Movement to Establish a National Department of Public Works, Frederic H. Fay, Jl. Boston Soc. Civ. Engrs., vol. 6, no. 6, June 1919, pp. 235-244 and (discussion) pp. 244-264. Prospect of establishing national budget system visualized as sound argument in favor of aiding Nat. Dept. of Public Works.

STEREOAUTOGRAPH. The Stereoautograph, Model 1914, Its Correction and Application (Der Stereoautograph Modell 1914, seine Berichtigung und Anwendung). H. Lüsher. Zeitschrift für Instrumentenkunde, vol. 39, no. 1, Jan. 1919, pp. 2-19, 11 figs. Instrument for mechanical utilization of stereoautographic pictures. (To be continued.)

TANKS, CAPACITY. The Capacity of Cylindrical Tanks. Motor Age, vol. 35, no. 24, June 12, 1919, p. 51, 1 fig. Chart for computing contents of tanks of usual lengths and diameters or size required for desired capacity.

METALLURGY

ALUMINUM

ALUMINUM ALLOYS. Special and Commercial Light Aluminum Alloys, Robert J. Anderson, Dept. of the Interior, Bur. of Mines. Minerals Investigation Series, no. 14, April 1919, 22 pp. Description with chemical analyses and enumeration of physical properties of various alloys submitted to government bureaus. Writer does not feel that the majority of so-called "new" alloys possess properties claimed for them or that it is economical to manufacture them.

BLAST FURNACES

BRITISH 800-TON PLANT. 800-Ton Blast Furnace Plant at the Park Gate Works. Rotherham, and the Staveley Works, Chesterfield. Iron & Coal Trade Rev., vol. 98, no. 2675, June 6, 1919, pp. 759-760, 12 figs. partly on supp. plates. Also Engineer, vol. 127, no. 3310, June 6, 1919, pp. 564-566, 10 figs. on supp. plates. Furnace said to have been designed with a view to secure even distribution around large bell; equal distribution of large and fine, gas-tight top, means for changing bell rods and other gear with minimum loss of time. Internal dimensions are given.

CHARGING. Charging Raw Material into Blast Furnaces, J. A. Mohr. Iron Age, vol. 103, no. 22, May 29, 1919, pp. 1432-1434 and (discussion), pp. 1434-1436, 3 figs., also Iron Trade Rev., vol. 64. no. 22, May 29, 1919, pp. 1413-1415, 1 fig. and Blast Furnace and Steel Plant, vol. 7, no. 6, June 1919, pp. 298-305, 6 figs. On co-ordinating and arranging different phases of charging and mixing of raw material so as to achieve uniformity in their disposition and arrangement that will best suit conditions of individual plant.

ELECTRIC SMELTING. Commercial Feasibility of Electric Smelting of Iron Ores in British Columbia. Alfred Stansfield. Chem. & Metallurgical Eng., vol. 20, no. 12, June 15, 1919, pp. 630-636. Also Iron & Steel of Can., vol. 2, no. 5, June 1919, pp. 132-145. Excerpts from bul. no. 2, 1919, British Columbia Department of Mines. Electric pig iron.

CLEVELAND (ENGLAND) ORE SMELTING. The Smelting of Cleveland Iron-Stone. S. G. Smith. Foundry Trade Jl., vol. 21, no. 208, Apr. 1919, pp. 229-232, General outline of process of converting ore into pig iron, as followed at district embracing coast from Saltburn to Whitby, also Normandy and Eston Hills. Paper read before Lancashire Branch British Foundrymen's Assn.

STEEL TURNINGS. Utilization of Steel Turnings in the Blast Furnace (L'Emploi des tournures d'acier au haut fourneau), M. Tripier. Bulletin et comptes rendus de la Société de l'Industrie Minérale, vol. 15, no. 5, 1919, pp. 275-297. Experience acquired in munition works.

FERROUS ALLOYS

FERRO-ALLOYS. Ferro-Alloys in Alloy Steel Production. Raw Material, vol. 1, no. 3, May 1919, pp. 177-181, 8 figs. Survey of situation, specially of impetus given to alloy industry during the war.

IRON-COBALT ALLOYS. On Some Physical Constants of Iron-Cobalt Alloys, Kôtarô Honda. Science Reports of the Tôhoku Imperial University, vol. 8, no. 1, Apr. 1919, pp. 51-59, 4 figs. Experimental. Measurement of thermal and electrical conductivity, moduli of elasticity and rigidity, and intensity of magnetization.

FLOTATION

COPPER. Recovery of Copper from Flotation by Leaching, Percy R. Middleton. Min. & Sci. Press, vol. 118, no. 23. June 7, 1919, pp. 771-772. Results of roasting and leaching flotation concentrate.

HARDWOOD TAR OILS. Flotation Experiments on Hardwood Tar Oils, L. F. Hawley and O. C. Ralston. Chem. & Metallurgical Eng., vol. 20, no. 11, June 1, 1919. pp. 586-587. Experimental tests. It is concluded that a mixture of different oils is more likely to do good flotation work than any one product alone.

PRACTICE. Flotation for the Practical Mill Man. Frederick G. Moses. Chem. & Metallurgical Eng., vol. 20, no. 11, June 1, 1919, pp. 571-577. Suggestions in regard to overcoming factors tending to produce unsatisfactory results in flotation plant.

SULPHUR. Concentration of Native Sulphur Ores by Flotation, James M. Hyde. Dept. of the Interior, Bur. of Mines, Minerals Investigations Series, no. 18, April 1919, 18 pp. Reported that ores from several districts were treated successfully by flotation. It is claimed that under favorable conditions better than 80 per cent of sulphur should be recoverable as concentrate containing more than 80 per cent of sulphur.

FURNACES

ELECTRIC. Electric Furnace for Melting Non-Ferrous Metals—II, E. F. Collins. Foundry, vol. 47, no. 324, June 1, 1919, pp. 329-333, 4 figs. Statement of melting cost of electric and fuel-fired furnaces.

A New Electric Rotating Brass Furnace, Carl H. Booth. Iron Age, vol. 103, no. 26, June 26, 1919, pp. 1699-1702, 4 figs. Booth in which door has been placed in one end of furnace and tapping hole in other end in order to overcome difficulty which is said to have been experienced in previous models in maintaining lining around combination spout and door.

POWDERED FUEL. Powdered Fuel for Firing Metallurgical Furnaces and Steam Boilers, J. S. Atkinson. Iron & Coal Trades Rev., vol. 98, no. 2672, May 16, 1919, pp. 651-652, 15 figs. on supp. plate Success in burning powdered coal secured, writer believes, by first drying coal down to a point where there is not more than one per cent of moisture left in it, pulverizing to such a degree of fineness, that 95 per cent of coal will pass through a 100-mest sieve and intimately mixing powdered coal with air before admitting it to combustion chamber. Paper read before Sheffield Soc. of Engrs. and Metallurgists.

Use of Pulverized Coal, with Special Reference to Its Application in Metallurgy, L. C. Harvey. Colliery Guardian, vol. 117, nos. 3046 & 3047, May 16 & 23, 1919, pp. 1146-1148 & 1228-1229, 16 figs. "Holbeck" (Bonnot) system, "Quigley," "Fuller," "Bergman," "Covert" and "Stroud" systems. Graphs showing comparison of approximate utilization and waste of fuel supplied to locomotive boiler with hand and powdered-coal firing. taking fuel as delivered to engine tender.

RECUPERATIVE FURNACE. A New Type of Recuperative Furnace, Walter Rosenhain. Engineering, vol. 107, no. 2787, May 30, 1919, pp. 702-704, 8 figs. Recuperator consists of nest or battery of tubes through which incoming air is drawn while products of combustion circulate about interior of tubes.

IRON AND STEEL

AIRCRAFT STEEL. Shop Practice in Respect to Aircraft Steel, H. P. Philpot. Aeronautical Jl., vol. 23, no. 99, Mar. 1919, pp. 112-129, 45 figs. Equilibrium diagrams of solutions of sodium nitrate and water, also iron-carbon equilibrium diagram and graphs indicating variations and physical properties of nickel-chrome steel with varying quenching temperatures.

Allotropy of Metals. The Allotropy of Metals in the Light of Recent Research —II, Clifford W. Nash. Chem. Eng. & Min. Rev., vol. 11, no. 127, Apr. 5, 1919, pp. 192-194. Evidence in favor of existence of allotropic forms of iron. (Concluded.)

Borax. *See Fluxes.*

Cast Iron, Impurities in. Cast-Iron Under Heat Influences, E. Adamson. Jl. of West of Scotland Iron & Steel Inst., vol. 26, part 6, Feb., session 1918-1919, pp. 80-84 and (discussion), pp. 84-88, 2 figs. partly on supp. plate. Experimental tests in regard to separation of impurities.

Cast Iron, Oxygen in. Oxygen in Cast Iron and Its Application, Wilford L. Stork, Bul. Am. Inst. Min. & Metallurgical Engrs., no. 150, June 1919, pp. 951-956. Also Iron Age, vol. 103, no. 25, June 19, 1919, pp. 1636-1637. Purports to give further evidence in support of theories advanced by J. E. Johnson, Jr., in regard to influence of oxygen on strength of cast iron, and to show

Cooling of Hypoeutectic Steels. Effect of Cooling on Micrographic Structure of Hypoeutectic Steels and Alloys of similar Constitution (Effet du revenu sur la structure micrographique des aciers hypoeutectiques et des alliages de constitution similaire), M. A. Portevin. Revue de Metallurgie, vol. 16, no. 2, Mar.-Apr., 1919, pp. 141-148, 16 figs. Examination of photomicrographs of various specimens.

Duplexing. Metallurgical Considerations of Duplexing—II, Richard S. McCaffery. Blast Furnace & Steel Plant, vol. 7, no. 6, June 1919, pp. 287-288 and 297. Suggestion for removal of sulphur and phosphorus.

Fluxes. Boron Derivatives in Relation to Metallurgy. Metal Industry, vol. 14, no. 18, May 2, 1919, pp. 367-369. Uses of borax glass for fluxing purposes at South African, American and Australian gold mines and other applications of borax.

Gathman Process of Ingot Production. Commercial Production of Sound Steel Ingots, Emil Gathman. Raw Material, vol. 1, no. 4, June 1919, pp. 213-216, 5 figs. Gathman process.

Grain Size and Rolling. The Grain Size in Steel as Influenced by Rolling, Iron & Steel of Can., vol. 2, no. 2, Mar. 1919, pp. 42-43, 4 figs. Experiments at Welland Plant of Can. Steel Foundries. It is concluded that composition of all unhardened steel is either pearlite alone, or pearlite associated with ferrite or cementite.

Heat Treatment. Alteration of Steels at Temperatures in the Neighborhood of 500 Deg. Cent. (Sur l'Alteration des aciers aux températures voisines de 500°), M. Grenet. Bulletin et comptes rendus de la Société de l'Industrie Minerale, vol. 15, no. 5 1919, pp. 339-353, 4 figs. These temperatures were found to be particularly harmful to nickel-chrome steels containing carbon and manganese; while not so injurious to other steels, it is nevertheless advised not to keep unnecessarily any steel at this temperature.

Impurities, Non-Metallic. Non-Metallic Impurities in Steel, Henry D. Hibbard. Iron Age, vol. 103, no. 22, May 29, 1919, pp. 1427-1429 & (discussion), pp. 1429-1432. While believing that to forecast effect of sonims on the properties of steel much work is required to be done and interpreted, writer believes that quantity and composition must be ascertained by chemical means, and mode of occurrence as far as possible be by the microscope.

Open Hearths, Cooling Devices for. Cooling Devices for Open Hearths, Wm. C. Coffin. Iron Trade Rev., vol. 64, no. 21, May 22, 1919, pp. 1356-1358, 3 figs. States that furnace life is increased by installing water-cooling equipment having brick covering. Recent developments in door, buckstay, skewback, port and bulkhead coolers are indicated.

Rolling Mills. The New Steel Worm and Rolling Mill at Witkowitz (Die neue Stahl- und Walzwerksanlage des Eisenwerkes Witkowitz.) Montanistische Rundschau, vol. 11, no. 6, Mar. 16, 1919, pp. 156-162, 9 figs. Plant completed in 1916 consists of a 300-ton mixer, three 200-ton Talbot furnaces and thirty-three 60-ton Martin stationary type furnaces. (To be continued.)

Soaking Pit, Electrically Heated. Electrically Heated Soaking Pit, Thaddeus F. Bailey. Iron Age, vol. 103, no. 22, May 29, 1919, pp. 1419-1421 and (discussion), pp. 1421-1422, 4 figs., also Iron Trade Rev., vol. 64, no. 22, May 29, 1919, pp. 1416-1418, 1 fig.
Writer sees coming acceptance of electric soaking pits in commercial operations.

Steel, High-Speed. The Manufacture and Working of High Speed Steel, J. H. Andrew. Engineering, vol. 107, no. 2787, May 30, 1919, pp. 715-720, 36 figs. It is believed that improvement in casting might be made by increasing a thickness of mold walls and lowering the pouring temperature of the metal; also it is recommended that forging temperatures be increased considerably. Similarly other suggestions are speed steel are reviewed and commented on (Concluded). Paper read before Iron & Steel Inst.
High-Speed Tool-Steel Efficiencies, John O. Arnold and Fred Ibbotson. Iron Trade Rev., vol. 64, no. 22, May 29, 1919, pp. 1419-1421, 3 figs. Determined by lathe operations and chemical analyses. Micrographic study of difference between annealed and quenched specimens. Paper presented before Iron & Steel Inst.

Steel, Liquid and Solid. On the Solid and Liquid State of Steel, Cosmo Jones. Engineering, vol. 107, no. 2787, May 30, 1919, pp. 721-722. The properties of an optically clean surface of liquid steel described and similarity to that of polished metallic surface with vitreous film pointed out. Preservation of this surface of liquid steel attributed to presence of atmosphere of iron vaper. Means to determine surface tension qualitatively suggested and it is said that surface tension value varies largely with volume of gases occluded. From lecture delivered to West of Scotland Iron & Steel Inst.

NON-FERROUS ALLOYS

Bronzes, Aluminum. Aluminum Bronzes (L'Etude des propriétés des bronzes d'aluminium), Jean Durand. Génie Civil, vol. 74, no. 16, Apr. 19, 1919, pp. 315-317. Warns against complicating composition of alloy. It is claimed that in all cases a simple alloy can be found of better known properties and possessing advantages equal to those of the complicated alloy.

Bronze and Brass, Inclusions in. Non-Metallic Inclusions in Bronze and Brass G. F. Comstock. Metal Industry, vol. 14, no. 16, Apr. 18, 1919, pp. 330-333. 21 figs. Photomicrographs. Method employed consists in overheating and oxidizing small charge of copper, then cooling it and adding a suitable amount of the element whose oxide it was desired to observe.

Cupro-Nickel, Decarbonization of. Notes on Carbon in 80 :20 Cupro-Nickel Melted in the Electric Furnace, F. C. Thompson and W. R. Barclay. Jl. Soc. Chem. Indus., vol.38, no. 10, May 31,1919,pp. 130T-132T, 4 figs. Account of trouble experienced before decarbonizing process was included in melting.

Gold-Copper Alloys. Hardness and Resiliance of Gold-Copper Alloys (Note sur la dureté et le résilience des alliages or-cuivre), A. Portevin and Jean Durand. Revue de Métallurgie, vol. 16, no. 2, Mar.-Apr. 1919, pp. 149-151, 3 figs. Results of experiments.

Monel Metal. Monel Metal—The Natural Alloy, Hugh R. Williams. Raw Material, vol. 1, no. 4, June 1919, pp. 217-221, 4 figs. Alloy contains 67 per cent nickel and 28 per cent copper and is said to be non-corrodible by ordinary atmospheric agencies and to have unparalleled resistance to chemicals

OCCLUDED GASES

Degasified Steel. Safeguarding Steel Ingot Production. Raw Material, vol. 1, no. 3, May 1919, pp. 172-176, 5 figs. Process outlined consists of production of a "degasified" steel before teeming into mould, by means of ferro-silicon, aluminum or uranium added for purpose of "scavenging" oxides and reduction of size of ingot pipe to minimum by giving lower portion of mold greater heat-absorbing and radiating capacity than top.

METALLOGRAPHY

Non-ferrous Metals. Metallography Applied to Non-ferrous Metals—V & VI Ernest J. Davis. Foundry, vol. 47, nos. 8 & 9, June 1 & 15, 1919, pp. 345-349 & 395-398, 19 figs. Lead alloys and bearing metals discussed from viewpoint of their microstructure; also equilibrium diagram of lead-tin, lead-antimony, copper-lead, nickel-copper and nickel-silver series, and micrographs of various alloys.

Photomicrography. The Study of Alloys (L'Etude des Alliages). Métaux. Alliages et Machines, vol. 12, no. 4, Apr. 1919, pp. 7-12, 9 figs. After discussing what is termed irrational order of conducting investigations of these structures, applications of photomicrograph and the thermic analysis are taken up. Extracts from book published by Witold Broniewski at Librairie Delagrave.

Radio Metallography. Radio Metallography. Times Eng. Supp., vol. 15, no. 535, May 1919, p. 165. Methods of examining metals and various types of material by means of X-ray photography.
The X-ray Examination of Metals, E. Schneider. Engineering, vol. 107, nos. 2784 & 2785, May 9 & 16, 1919, pp. 613-614, and 641-644, 23 figs., also Elecn., vol. 82, no. 20, May 16, 1919, pp. 568-569. Research into industrial X-ray examination of metals at laboratory of Schneider Works are represented as demonstrating that radio-metallography enables visual examinations to be made of ordinary steels, provided their thickness does not exceed 45 mm; this limit in thickness being reduced when steel contains at least one constituent of higher atomic weight. Method developed at Hatfield research laboratory in Sheffield. German work on subject. (Concluded.)

MINING ENGINEERING

BASE MATERIALS

Bauxite. Bauxite Mining in Arkansas, Tom Shiras. Eng. & Min. Jl., vol. 107, no. 25, June 21, 1919, pp. 1074-1075, 5 figs. Ore comes from ground in pieces weighing from few ounces to several hundred pounds and is crushed to a maximum size of 1½ in.

Limestone. The Chart of the Wreford and Foraker Limestones along the State Line of Kansas and Oklahoma, W. H. Twenhofel. Am. Jl. of Sci., vol. 47, no. 282, June 1919, pp. 407-429, claims that observed facts do not harmonize with theories postulating an origin for these charts consequential to weathering, or one of replacement, or of cavity-filling in solid rocks.

Quarries. Modern Methods at McCook Quarry William B. Eastwood. Cement, Mill & Quarry, vol. no. 10, May 20, 1919, pp. 11-14, 4 figs. Plant of U. S. Crushed Stone Co. Output is 500 tons of crushed rock per hour.
Labor Saving in Limestone Quarrying, Oliver Bowles. Dept. of Interior, Bur. Mines, War Minerals Investigation Series no. 1, Sept. 1918, 18 pp. Using labor-saving devices; consideration is given only to methods and type of equipment that are represented as having been tried and approved by quarry operator.
An Electrically-Operated Quarry and Plant for Production of Broken Stone at Gary, Ill. Cement & Eng. News, vol. 31, no. 5. June 1919, pp. 24-26, 5 figs. Electrical operation includes that of loading shovels and haulage system in quarry, and equipment of crushers, rolls, screens and conveyors.

COAL AND COKE

Belgium. Coal Deposits of Belgium (Les Gisements de la Belgique), Armand Renier. Annales des Mines de Belgique, vol. 20, no. 2, 1919, pp. 433-540. Stratigraphic studies of mode of formation. (Third installment).

Boring. Intensive Boring on the Wonthaggi Coal-Field, Victoria, H. Herman. Australasian Inst. Min. Engrs., Proc., no. 32, Dec. 31, 1918, pp. 145-154, 12 figs. partly on 3 supp. plates. Mining under difficulties due to sudden changes in thickness and quality, and presence of dirt bands in seams.

By-Products Plants. Coppee Coal washing and By-Product Coking Installation in Course of Erection at Burnside Colliery. South African Eng., vol. 30, no. 4, Apr. 30, 1919, pp. 66-68, 5 figs. By-product plant designed to deal with gases from 2100 tons of coal per week.

CLAIRION COUNTY, PA. Recovering the Neglected Coal Fields, J. O. Durkee. Coal Industry, vol. 2, no. 6, June 1919, pp. 221-224, 4 figs. Deposits in Clairion County, Pa.

COKE PLANTS. Late Addition to Youngstown Coke Plant. Iron Age, vol. 103, no. 26, June 26, 1919, pp. 1691-1695, 9 figs. Two new batteries, each consisting of 51 Koppers cross-regenerative ovens of 500 cu. ft. capacity.
Mammoth Coke Plant, Frank F. Marquand. Coal Industry, vol. 2, no. 6, June 1919, pp. 224-231, 6 figs. Construction, organization, operation and recovery of by-products at Clairton by-product coke works of Carnegie Steel Co. Paper read before Am. Iron & Steel Inst.

COMPOSITION. The Chemistry and Constitution of Coal, A. C. Fieldner. Coal Age, vol. 15, no. 26, June 26, 1919, pp. 1150-1158, 22 figs. Principally from microscopic investigations carried on in Bur. of Mines Experimental Station.
On the Four Visible Ingredients in Banded Bituminous Coal; Studies in the Composition of Coal, no. 1, Marie C. Stopes. Proc. Roy. Soc., Biological Sciences, vol. 90, no. B-633, May 15, 1919, pp. 470-487, 17 figs. partly on separate plates. Concerning microscopic and microscopic recognition and separation of Fusain, Durain, Clarain and Vitrain bands.

COSTS, MINING. Anthracite Mining Costs, R. V. Norris. Coal Age, vol. 15, no. 25, June 19, 1919, pp. 1124-1128, 5 figs. Based on reports for six months, Dec. 1917 to May 1918 inclusive, as complied by Federal Trade Commission.

ELECTRIC APPARATUS. Routine Examinations and Testing of Colliery Electrical Apparatus, L. Fokes. Colliery Guardian, vol. 117, no. 3043, Apr. 25, 1919, pp. 953-955, 4 figs. Divides general examination under headings of (1) power house, (2) transformers, (3) motors, and (4) cables, and offers suggestions to accomplish each of these.

FORMATION. The Formation of Coal, J. D. Kendall. Can. Min. Inst. Bul., no. 86, June 1919, pp. 600-606, 5 figs. Writer presents arguments in supports of his theory that coal has been produced from woody matter that was drifted into position by water and afterward altered by pressure, heat and chemical change into its present substance. (To be continued).

GEOLOGY. The Geology and Economics of Coal. J. R. Finlay. Eng. & Min. Jl., vol.107 no. 22, May 31 1919, pp. 945-950. Geological aspects of coal formation, occurrence and location of peat swamps, extent of existing deposits and main features of coal-forming period; statistics on coal consumption and distribution.

KENT COALFIELDS. The Evolution and Development of the Kent Coalfield, A. E. Ritchie. Iron & Coal Trades Rev., vol. 98, nos. 2672, 2673 and 2674, May 16, 23 & 30, 1919, pp. 665-700-701, and 735-736, 2 figs. From 1913-1918. From 1907-1918. Establishment and growth of South Eastern Coal Field Extension, Ltd. Plan showing comparative positions of the Greensand and Hastings strata and the "junction" sand bed at three important points of the coalfield.

MIXING PLANT. Coxton Coal Mixing Plant, Lehigh Valley R.R. Ry. Rev., vol. 64, no. 24, June 14, 1919, pp. 885-887, 4 figs. General plan and elevation. Plant mixes bituminous and anthracite silt.

NEW SOUTH WALES. The Coal Industry of New South Wales, A. A. Atkinson. Proc. Australasian Inst. Min. Engrs., no. 31, Sept. 30, 1918, pp. 41-70 and (discussion) pp. 71-80. "Bord and pillar" is adopted method of working, removal of coal effected by aid of electrically-operated coal-cutting machines and ventilation produced by means of exhaust fans.

PREPARATION. Preparation of Bituminous Coal—I, III, IV & V, Ernst Prochaska. Coal Age, vol. 15, nos. 21, 23, 24 & 25, May 22, June 5, 12 & 19, 1919, pp. 943-945, 1030-1033, 1080-1085, and 1118-1122, 19 figs. Writer believes that for best results final screening should be done after washing. Chart showing comparative efficiency of different types of washers. Size of jig screen, comparative size of plunger, length of plunger stroke, rapidity of stroke and thickness of jigging bed considered as factor that influence efficiency in washing. Methods of drives, apparatus for discharge of products and arrangement of jigs.

PYRITES. Coal Pyrite Resources of Tennessee, E. A., Holbrook and Wilbur A. Nelson. Coal Age, vol. 15, no. 24, June 12, 1919, pp. 1077-1079, 3 figs. Experiments are believed to have indicated that pyrite occurring in coal may be commercially extracted.

SEALING UP. Sealing Up Old Abandoned Workings in Gaseous Mines, C. Thompson. Coal Age, vol. 15, no. 25, June 19, 1919, pp. 1110-1111. Method proposed for securing proper ventilation. Paper presented before Ill. Min. Inst.

COPPER

BLAST FURNACES. Exit the Blast Furnace, Oliver E. Jager. Min. & Sci. Press, vol. 118, no. 25, June 21, 1919, pp. 843-844. Disadvantages that have been urged against blast and reverberatory furnaces under Anaconda conditions.

MONEL METAL. Monel Metal and Its Uses, Hugh R. Williams. Iron Age, vol. 103, no. 26, June 26, 1919, pp. 1703-1704, 2 figs. Chemical composition is nickel 67 per cent, copper 28 per cent, and other elements 5 per cent (latter chiefly iron from original ore, and manganese, silicon and carbon added during process of refining metal matte).

NATIVE COPPER. Native Copper and Silver in the Nonesuch Formation, Michigan, Keijiro Nishio. Economic Geology, vol. 14, no. 4, June 1919, pp. 324-334, 6 figs. Their association with carbonaceous matter in sandstone explained by reaction of acetylene gases or like gases upon metallic solutions.
Deposits of Native Copper in Arctic Canada, J. J. O'Neil. Min. & Sci. Press, vol. 118, no. 24, June 14, 1919, pp. 807-811, 5 figs.Outlines conditions to be met in carrying out examination of deposits, such as (1) means of access. (2) amount of time available for actual work, together with time consumed in travel and enforced idleness, (3) climate and general working conditions.

GEOLOGY AND MINES

BRECCIATION. Brecciation in the Niagara Limestone at Rochester, New York, Albert W. Giles. Am. Jl. of Sci., vol. 47, no. 281, May 1919, pp. 349-354, 2 figs. Attributed to irregular cavities distributed through strata.

CHESTER EMERY MINE. Famous Mineral Localities: The Chester Emery Mine, Earl V. Shannon. Am. Mineralogist, vol. 4, no. 6, June 1919, pp. 69-92. Notes on field gathered during writer's expedition.

COLORADO ROCKIES. The Building of the Colorado Rockies, Rollin R. Chamberlin. Jl. Geology, vol. 27, no. 3, Apr.-May 1919, pp. 145-164, 3 figs. By application of method given in Chamberlin and Salisbury's Geology for deducing thickness of earth shell involved in given case of folding. (To be continued).

EARTHQUAKES. The Mechanics of Earthquakes, Carlo Somigliana. Sci. Am. Supp., vol. 87, no. 2269, June 28, 1919, pp. 402-403 & 407. Summary of attempts to explain nature of seismic disturbances. From Scientia.

GEORGIA. Notes on the Geology of Georgia, S. W. McCallie. Jl. Geology, vol. 27, no. 3, Apr.-May 1919, pp. 165-179, 4 figs. Classification of geological system.

GNOMONIC PROJECTION. On the Use of the Gnomonic Projection in the Calculation of Crystals, G. F. Herbert Smith. Mineralogical Mag., vol. 18, no. 86, May 1919, pp. 317-323, 5 figs. Composite gnomonic production suggested.

HYDRATED FERRIC OXIDES. The Hydrated Ferric Oxides, Eugen Posnjak and H. E. Merwin. Am. Jl. of Sci., vol. 47, no. 281, May 1919, pp. 311-348, 4 figs. Compilation of synthetic chemical work leads to assertion that no series of hydrates of ferric oxide exists amoung natural minerals.

MINERALS, DETERMINATION IN ROCK. On the Accuracy of the Rosiwal Method for the Determination of the Minerals in a Rock, Albert Johannsen and E. A. Stephenson. Jl. Geology, vol. 27, no. 3, Apr.-May 1919, pp. 212-220. Repetition of experiments made by Ira A.Williams (Amer. Geol., XXV, 1905, pp. 34-36) in order to compare accuracy of various methods.

MISSOURI. Geology of Missouri, E. B. Branson. Univ. of Missouri Bul., vol. 19, no. 15, May 1918, 172 pp., 58 figs. Compilation of reports of Missouri geological surveys and those of State Bur. of Geology and Mines, including extensive series of references to articles in scientific journals treating various phases of Missouri geology.

PRE-CAMBRIAN. Some Stratigraphic and Structural Features of the Pre-Cambrian of Northern Quebec—II, H. C. Cooke Jl. Geology, vol. 27, no. 3, Apr.-May 1919, pp. 180-203, 12 figs. Detailed areal description. (To be continued).

PYRITE CRYSTALS. Pyrite Crystals from Bald Mountain, Colorado, Herbert P. Whitlock. Am. Mineralogist, vol. 4, no. 6, June 1919, pp. 67-68, 2 figs. Measurements made on a Fuess No. 2 goniometer.

SEDIMENTARY FORMATIONS. The Sedimentary Formations of the Panama Canal Zone, with special Reference to the Stratigraphic Relations of the Fossiliferous Beds. Donald Francis MacDonald. Smithsonian Instn., U. S. Nat. Museum, bul. 103 (extract), 1919, pp. 525-545, 2 figs.
The Biologic Character and Geologic Correlation of the Sedimentary Formations of Panama in their Relation to the Geologic History of Central America and the West Indies, Thomas Wayland Vaughan. Smithonian Inst. U. S. Nat. Museum, bul. 103 (extract) 1919, pp. 547-612. Including tabular statement of age relations to formations.

SEPTARIAN STRUCTURE. On the Origin of Septarian Structure, W. Alfred Richardson. Mineralogical Mag., vol. 18, no. 86, May 1919, pp. 327-338, 9 figs., partly on supplemental plate. Endeavor is made to establish that septarian structure consists of polygonal system of cracks corresponding to a mud desiccation structure and that cracking of nodule is due to desiccation by chemical means of a colloidal center.

TRIDYMITE CRYSTALS IN GLASS. Tridymite Crystals in Glass, N. L. Bowen. Am. Mineralogist, vol. 4, no. 6 June 1919, pp. 65-66, 2 figs. on supp. plate. Formation which took place in French works where, by reason of temporary German occupation and workmen having left fires burning in expectation of returning shortly, glass was maintained at temperature in the neighborhood of 800 deg. cent. for twenty days.

IRON

CANADA. Making Steel in Canada. Can. Machy., vol. 21, no. 23, June 5, 1919, pp. 567-572, 7 figs. With special reference to ore deposits in Eastern section. (To be continued).

LEAD, ZINC, TIN

SPELTER STATISTICS. Spelter Statistics for 1918, W. R. Ingalls. Eng. & Min. Jl., vol. 107, no. 22, May 31, 1919, pp. 958-962. Total production of spelter by ore smelters in 1918 was 525,350 tons against 682,411 tons in 1917.

MAJOR INDUSTRIAL MATERIALS

MANGANESE. Cost of Producing Ferro-Grade Manganese Ores, C. M. Weld. Dept. of Interior, Bur. Mines, Minerals Investigation Series, no. 13, Mar. 1919, 22 pp. Figures compiled with point of view of probable competition between domestic production and Cuba and Brazil.
Uses of Manganese Other Than for Steel Making W. C. Phalen. Dept. of Interior, Bur. Mines, Minerals Investigating Series,no. 16, May 1919, 14 pp. Divided into (1) uses of manganese dioxide ore and (2) uses of manganese bronze.

MINES AND MINING

CYANIDATION AND CHLORINATION. A Metallurgical Journey to Shasta, California—II, Herbert Lang. Min. & Sci. Press, vol. 118, no. 24, June 14, 1919, pp. 812-818, 1 fig. Further historical notes particularly on cyanidation and chlorination.

Drills. Notes on Economies in Hand Drill Steel, H. A. Read. Jl. Chem., Metallurgical & Min. Soc. of South Africa, vol. 19, no. 9, Mar. 1919, pp. 168-177, 6 figs. One of principal losses in hand drilling at Witwatersrand was believed to be that due to shanking of steel under blows of hammer.

Process in the manufacture of Stoping Drills.sEng. & Min. Jl., vol. 107, no. 22, May 31, 1919, pp. 964-966. New designs are said to conform to essentia, conditions required in field which are said to be: Light weight and small size, automatic rotation, satisfactory, regulation of strength of feedwater when drilling in sulphur-bearing ores.

New Type of Stoping Drills. Min. & Sci. Press, vol. 118, no. 23, June 7, 1919, pp. 797-799, 4 figs. Sullivan types.

Drives, Depth. The Increase in the Average Length of a Round in Modern Development, Jas. H. P. Bilbrough. Jl. South African Instn. Engrs., vol. 17, no. 10, May 1919, pp. 211-217. Vertical depth of drives referred to ranged between 5280 ft. below datum for the 24th drive and sea level for the 29th drive.

Explosives. The Use of Explosives in Mines, H. Y. Russel. Can. Min. Inst. Bul., no. 86, June 1919, pp. 589-600. Practices of various mines. Employing special blasters is considered advantageous even in small mines.

Mining Laws. Acquisition of Rights and Powers in Connection with Mines and Minerals Iron & Coal Trades Rev., vol. 98, no. 2674 & 2675, May 30 & June 6, 1919, pp. 730-731 and 770-771. Report of Acquisition and valuation of Land Committee of Ministry of Reconstruction. Committee does not think it is in national interest that question, whether minerals should be worked or not should be left to decision of adjoining owner or mineral worker. (Concluded).

Some Common Violation of the Mining Laws, W. J. Heatherman. Coal Age, vol. 15, no. 26, June 26, 1919, pp. 1159-1160. Recklessness and ignorance believed to be chief obstacles to mine safety. Many mine officials, according to writer, lack proper conception of their responsibility and do not attempt to enforce precautionary measures.

Waste in Working Minerals. Colliery Guardian, vol. 117, no. 3048, May 30, 1919, p. 1290, also Quarry, vol. 24, no. 268, June 1919, pp. 156-159. Recommendations of Land Committee for acquisition and valuation. (Continued).

Prospectors. Returned Soldiers as Prospectors, C. M. Harris. Queensland Government Min. Jl., vol. 20, no. 227, Apr. 15, 1919, pp. 149-151, 7 figs. Scheme arranged jointly by Mines Dept. of Western Australia and Federal Repatriation Board.

Shafts. The Advantages of Circular Shafts—II, H. Stuart Martin. South African Min. & Eng. Jl., vol. 28, part 2, no. 1438, April 19, 1919, pp. 217-218. Effect of area and friction resistance; circular vs. rectangular shafts. First part appeared in issue of January 18.

Shaft Sinking. A Peculiar Experience in Shaft-Sinking, Arthur Jarman. Min. Sci. Press, vol. 118, no. 25, June 21, 1919, pp. 851-854, 4 figs. Sinking made difficult by pocket of mud encountered at depth of 35 ft.

Squeeze Prevention. Method Employed in Working the Crescent Mine, Ralph W. Mayer. Coal Age, vol. 15, no. 23, June 5, 1919, pp. 1028-1029, 3 figs. Prevention of squeeze accomplished through combined use of machine and pick mining.

Timber. Preservation of Mine Timber, Noah Williams. Colliery Guardan, vol. 117, no. 3046, May 16, 1919, pp. 1145-1146. Decay and insects are estimated to cause 50 per cent of loss of timber used in mines; as much of this loss is considered preventable by adoption of preservation treatment. American method of treating wood with sodium fluoride is recommended as efficient and economical.

Ventilation. The Ventilation of Coal Mines, H. W. Chadbourne. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 341-347, 7 figs. Natural, furnace and mechanical methods of ventilation; electric-motor-driven fan equipment and air courses.

Washington (State). A Summary of Mining in the State of Washington, Arthur Homer Fisher. Eng. Experiment Station, Univ. of Wash., bul. no. 4, Nov. 1918, 124 pp. Including bibliography of 547 articles relating to mining and mineral resources in State of Washington.

MINOR INDUSTRIAL MATERIALS

Saltpeter. Saltpeter in Guatemala, Hoyt S. Gale, Eng. & Min. Jl., vol. 107, no. 24, June 14, 1919, pp. 1025-1031, 6 figs. Made from leachings of soils about native villages, work of separating and refining salt being performed mostly by women.

Magnesium. Magnesium Sulphate Deposits at Basque, B. C., George C. Crux. Can. Chemical Jl., vol. 3, no. 6, June 1919, pp. 179-181, 3 figs. Salts occur in solidified masses of various shapes and sizes, surrounded by mud rings.

Natural Deposits of Salts of Magnesium and Sodium near Clinton, B. C., L Reinecke. Can. Chemical Jl., vol. 3, no. 6, June 1919, pp. 182-186, 4 figs. Texture and structure, topographical and geological relations, composition, origin, commercial value. Deposits consist of calcium carbonate, magnesium carbonate, gypsum and epsomite.

OIL AND GAS

Asphaltum. Physical Tests of Asphaltum, John W. Newton and F. N. Williams Petroleum Age vol. 6, no. 6, June 1919, pp. 241-245, 1 figs. Discusses value of such tests as pliability, volatility, penetration, melting point, etc. Fourth article Previous articles detail tests for gasoline, illuminating oils and fuel oil respectively.

California. Proposed Safety Orders for Petroleum Industry in California. Min. & Oil Bul., vol. 5, no. 6, May 1919, pp. 331-332 & 351, 2 figs. As revised by Safety Orders Committee of Industrial Accident Committee.

Crude-Oil Statistics. Summary of the Crude Oil Situation. Oil-dom, vol. 10, no. 6, June 1919, p. 9. Statistics of production during February and March 1919.

Ecuador. Petroleum in Ecuador, Walter M. Brodie. Eng. & Min. Jl., vol. 107, no. 22, May 31, 1919, pp. 941-944, 3 figs. Account of geology and occurrence, together with data as to legal asoects of concessions in that republic.

Florida. Observations of a Florida Sea-Beach with Reference to Oil Geology, J. F. Kemp. Ecomonic Geology, vol. 14, no. 4, June, 1919, pp. 302-323, 7 figs. Tests and surveys conducted in order to explain what appeared to writer puzzling accumulation of land and marine organic remains.

Gasoline. Status of Refinery Practice with Regard to Gasoline Production, E. W. Dean. Jl. Soc. Automotive Engrs., vol. 4, no. 5, May 1919, pp. 372-374. Estimates made by Bur. of Mines apparently indicate that refiner may be able, to augment his production of gasoline from crude petroleum by from 35 to 40 per cent.

Microscope. Petroleum Under the Microscope, James Scott. Petroleum World, vol. 16, no. 224, May 1919, pp. 194-197, 3 figs. In reference to geological aspect of search for oil. (Concluded.)

Natural Gas. Safeguarding the Future Natural Gas Supply, Clifton W. Sears. Gas Age, vol. 43, no. 11, June 2, 1919, pp. 588-590. Discusses effect of price for gas upon quantity consumed. Paper presented before Natural Gas Assn.

Oil Pools. Petroliferous Provinces, E. G. Woodruff. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 150, June 1919, pp. 907-912, 1 fig. Analyses, from regional standpoint, conditions that control presence or absence of oil pools.

Roumanian. Roumanian Oil Fields. Universal Engr., vol. 29, no. 5, May 1919, pp. 37-46, 8 figs. Problems presented to producers by conditions arising from extensive subdivision of fields. Oil produced is of high gravity with paraffine base.

Shales. Value of American Oil Shales, Charles Baskerville. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 150, June 1919, pp. 957-960. Discusses fundamental features concerning economic development of shale-oil industry.

The Winning of Oil from Rocks, Arthur J. Hoskin. Min. & Sci. Press, vol. 118, no. 21, May 24, 1919, pp. 697-707, 10 figs. Practices followed in oil-shale industry in Scotland.

France and Germany are quoted and conclusions drawn as to what writer believes we may and should accomplish with similar shales in this country.

Oil-Shales, Dean E. Winchester. Jl. Franklin Inst., vol. 187, no. 6, June 1919, pp. 689-703. Optimism is expressed concerning capability of furnishing from shales the oil needed for future operation of motors; it is observed, however, that before this raw material can be used some treatment must be devised that will permit efficient and economical elaboration.

Statistics. Statistical Treatise on Petroleum, Fred. A. Lichtenheld. Colorado School of Mines Mag., vol. 9, no. 6, June 1919, pp. 143-150, 1 fig. Stratigraphic distribution of petroleum production and notes on early history. (To be continued.)

Water in Petroleum. The Evaporation and Concentration of Waters Associated with Petroleum and Natural Gas, R. Van A. Mills and Roger C. Wells. Dept. Interior, U. S. Geol. Service, bul. 693, 1919, 104 pp., 9 figs. Conclusion arrived at as result of investigation in regard to association of saline waters with petroleum and natural gas is that brines are result of a complex and long-continued evolution in which waters of sedimentation, together with ground waters from other sources have undergone deep-seated evaporation and concentration accompanied by chemical changes.

Water in Oil and Gas Wells, F. B. Tough. Petroleum Times, vol. 1, nos. 17 & 18, May 3 & 10, 1919, pp. 357-358 & 391, 1 fig. Dump-bailer method for cementing hole. Remarks on tubing method. (Concluded.)

PRECIOUS MINERALS

Gold, British Columbia. Notes on the Placer Mines of Cariboo, British Columbia, J. B. Tyrrell. Economic Geology, vol. 14, no. 4, June 1919, pp. 335-345, 4 figs. Historical account, topograph, conditions and development of drainage.

Gold, Ontario. The Origin of the Gold Deposits of Metachewan District, Northern Ontario, H. C. Coke. Economic Geology, vol. 14, no. 4, June 1919, pp. 281-301, 6 figs. Internal structure of ore bodies, described as pegmatic vein, middle zone of mineralized and altered rock on each side, and outer zone of altered rock without mineralization, which grades into unaltered country rock with irregular and embayed contacts, assumed as evidence that deposits in schist have been formed by alteration and mineralization of country rock by solutions coming up along Central vein.

Silver Mining, Nevada. Revival of Silver Mining at Cherry Creek, Nevada, Geo. H. Ryan. Salt Lake Min. Rev., vol. 21, no. 4, May 30, 1919, pp. 19-22, 4 figs. Geology of ore deposits and remarks as to possibilities of camp.

South Wales. Sulphide Corporation Limited Works, Cockle Creek, S. W. Proc. Australasian Inst. Engrs., vol. 31, Sept. 30, 1918, pp. 2-39, 27 figs. Nine articles covering various phases of treatment and manipulation of ore. Upwards of 200,000 tons of various materials are dealt with annually, there being produced from treatment of this tonnage about 31,000 oz. of gold, 2,500,000 oz. of silver, 28,000 tons of lead and 320 tons of antimonial lead.

TRANSPORTATION

Locomotives Headlights. Headlights for Locomotives in Mines, K. W. Mackall. Coal Industry, vol. 2, no. 6, June 1919, pp. 232-233, 3 figs. Spring suspension claimed as principal feature of new type described.

Mine Haulage. Vesta Coal Co.'s Modern System of Mine Haulage, Ralph W. Mayer. Coal Age, vol. 15, no. 21, June 12, 1919, pp. 1072-1076, 5 figs. System includes electric-motor transportation from coal face to central underground station where motors leave their loads, and tailrope which handles the cars from this point to tipple.

MUNITIONS AND MILITARY ENGINEERING

Army Base Service. Military Stores at Port of New York (Entrepots Militaires du Port de New York), P. Calfas. Génie Civil, vol. 74, no. 20, May 17, 1919, pp. 385-391, 13 figs. Description of Brooklyn Army Base.

Ballistics. A Method for Computing Differential Corrections for a Trajectory, Gilbert Ames Bliss. Jl. U. S. Artillery, vol. 50, no. 4, June 1919, pp. 455-460, 1 fig. To account for disturbances in flight of projectiles of magnitude of of those caused, for example, by wind.

High Burst Ranging, C. H. Birdseye. Jl. U. S. Artillery, vol. 50, no. 4, June 1919, pp. 417-453, 8 figs. Explanation of methods now in use and suggestion in regard to changes which writer deems desirable.

Camps. The Operation and Maintenance of Utilities at Army Camps and Cantonments, George A. Johnson. Boston Soc. Civil Engrs., vol. 6, no. 5, May 1919, pp. 181-224 and (discussion), pp. 224-233. Special reference is made to conditions brought about by shortage of labor and materials and congestion of transportation facilities.

Guns. The British Eight-Inch Howitzer—I, William Chubb. Am. Mach., vol. 50, no. 25, June 19, 1919, pp. 1189-1194, 11 figs. Consists of A-tube, wire-wound over chamber and portion of bore, inner A-tube of practically same length, and jackets shrunk over wire and a portion of A-tube.

Motor-Transport Service. Keeping 40,000 Army Motor Trucks in Operation, G. E. Rundles. Jl. Soc. Automotive Engrs., vol. 4, no. 6, June 1919, pp. 497-499, 1 fig. Floor plan and layout of mechanical repair shop for Motor Transport Corps.

Navy. The New Navy, VI, Mar. Engr. & Naval Architect, vol. 4, no. 505, June, 1919, pp. 265-268, 4 figs. General features of battle cruisers "Renown" and "Repulse."

Railway Artillery. New American Railway Artillery, E. D. Campbell. Ry. Rev. vol. 64 no. 294, June 14, 1919, pp. 869-874, 9 figs. Sixteen-inch howitzer railway mount; sliding railway mount for 12-in. and 14-in. guns; 12-in. seacoast mortar on railway mount.

Railway Engineers. Work of a Regiment of Railway Engineers in France, R. F. Fowler. Nat. Service, vol. 6, no. 1, July 1919, pp. 16-20, 3 figs. 100,000 cu. yards of rock were removed from one cut.

Sanitation. Sewage and Water Disposal for the United States Army, Leonard S. Doten. Proc. Am. Soc. Civil Engrs., vol. 45, no. 5, May 1919, pp. 233-248, 9 figs. Review of work undertaken by Sanitation Section of Construction Division, U. S. Army.

Shells. Manufacturing the 9.2-In-Howitzer Shell—III, S. A. Hand. Am. Mech., vol. 50, no. 23, June 5, 1919, pp 1089-1093, 10 figs. Washing, fitting and riveting base plug, varnishing, baking and final inspection both by shop and government inspectors. Last article.

Shop Trains. Engineer Portable Shop Train, Philip C. Nash. Power Plant Eng., vol. 23, no. 11, June 1, 1919, pp. 511-513, 3 figs. Equipment furnished U. S. Engineering troops in France.

Target Practice Rod. Making the Hollifield Target Practice Rod, Donald A. Hampson. Can. Machy., vol. 21, no. 26, June 26, 1919, pp. 651-658, 8 figs. Device said to give army recruit all of actual rifle practice without either recoil or noise.

Tunneling. Tunneling at the Front, R. W. Coulthard. Can. Min. Inst. Bul., no. 86, June 1919, pp. 606-620. Best arrangement said to have been found was to divide tunnelers into five sections. Every two days a relief was sent into trenches, where it remained for six days, then returned to rest billets for four days.

ORGANIZATION AND MANAGEMENT

ACCOUNTING

Cost Accounting. Cost Accounting to Aid Production—IX, G. Charter Harrison. Indus. Management, vol. 57, no. 6, June 1919, pp. 483-487, 1 fig. Predicts revolution in which retrospective systems will disappear because unfitted to meet demands of an industrial executive who must know before he can do.

Inventory. How We Keep Our Inventory Correct, H. F. Harris. Factory, vol. 22, no. 6, June 1919, pp. 1181-1185, 17 figs. Practice of Republic Motor Truck Co. Record forms are illustrated.

EDUCATION

Cripples. Human Rehabilitation and Its Value, Douglas C. McMurtrie. Min. & Oil Bul., vol. 5, no. 6, May 1919, pp. 325-326 & 328, 4 figs Method of dealing with men followed at Red Cross Inst. for crippled and disabled men at New York City

Electrical Fittings. The Training of the Disabled Man from the Electrical Engineer's Point of View, F. H. Taylor. Electricity, vol. 31, no. 1491, June 6, 1919, pp. 349-352, 5 figs. Example illustrating training given in electrical fitting, installation, maintenance, repair work and similar occupation at various educational centers.

Executives. The New Science, James A. Bowie. Eng. & Indus. Management, vol. 1, no. 17, June 5, 1919, pp. 519-520. Discussing need of training for industrial administration and refers to work in this direction at College of Technology at Manchester.

Shipyard Labor. Intensive Training of Shipyard Labor, Harry H. Tukey. Indus. Management, vol. 57, no. 6, June 1919, pp. 452-456, 4 figs. Methods and results of Submarine Boat Corporation.

FACTORY MANAGEMENT

Committee System. Committee System in American Shops, William Leavitt Stoddard. Indus. Management, vol. 57, no. 6, June 1919, pp. 473-476. Review of acceptance of some form of representative shop committee, with reference to experience in Great Britain. Three types of such committees are differentiated and the relations of trade unionism and shop committees are discussed.

Control Boards. How Control Boards Can Help Manage, B. L. Van Schack. Factory, vol. 22, no. 6, June 1919, pp. 1172-1176, 6 figs. Control boards, it is said, must back up facts with proof without too much detail or they will tend to confuse rather than explain.

Control of Production. Graphic Control on the Exception Principle, Frank B. Gilbreth. Eng. & Indus. Management, vol. 1, no. 14, May 15, 1919, pp. 433-434, 2 figs. No cost system or charge system should be considered as really satisfactory, in opinion of writer, unless it determines (1) what quantities of individual output should be, (2) prompt records of individual outputs, (3) what costs should be, (4) prompt records of costs, (5) causes of fluctuations and deviations of outputs and costs from prophesied outputs and costs.

Dispatching Department. Organization of a Carburetor Plant, Fred H. Korff. Machy. (N. Y.), vol. 25, no. 10, June 1919, pp. 916-918. Work of mechanical and dispatching departments and practice in foundry. Second article.

Employee Co-Operation. Co-operation Profitable to Employer and Worker, Harry Tipper. Automotive Industries, vol. 40, no. 23, June 5, 1919, pp. 1208-1209. Plant of "industrial democracy" as operated at tobacco-pipe manufacturing plant of Wm. Delmuth & Co. at Richmond Hill, Long Island, where 900 men and women are employed.

Employment Management. Employment-Management at the Eagle Mines, Robert Nye. Min. & Sci. Press, vol. 118, no. 24, June 14, 1919, pp. 821-822. Labor turnover said to have dropped from 32.9 per cent to 11.58 per cent after power of hiring and firing of all men was taken from superintendent and foremen and given to employment manager.

Factories. The Design and Construction of Factories—III, Arthur F. Wickenden. Eng. & Indus. Management, vol. 1, no. 16, May 29, 1919, pp. 498-499, 1 fig. Types of structure.

Fatigue. Devices to Prevent Unnecessary Fatigue, James F. Butterworth. Eng. & Indus. Management, vol. 1, no. 18, June 12, 1919, pp. 556-558, 9 figs. Studies in planning out work so as to shorten number of motions that arms and hands should make while under load, arranging materials to be dealt with in sequence of use and placing materials in such positions that it can be grasped, transported and released in shortest possible time and with least possible effort.

Industrial Efficiency from the Psychological Standpoint—III, Charles S. Myers. Eng. & Indus. Management, vol. 1, no. 13, May 8, 1919, pp. 395-397. Investigations of industrial fatigue, particularly Taylor's research of loads a man can carry, also security against danger as psychological factor tending to increase output. Lecture delivered at Imperial College of Sci. & Technology.

Foremen's Co-operation. C. P. R. Shop Production Methods, E. T. Spidy. Ry. Mech. Engr., vol. 93, no. 6, June 1919, pp. 320-325, 9 figs. Establishes that it is absolutely impracticable to get any results from any system unless co-operative effort from all foremen in all departments is secured. Canadian Pacific practice is quoted as instance of efficient co-operation, and how its productive department ties into the shop organization is shown by diagram.

French War Industries. Taylor Methods in French War Industries. Bul. Taylor Soc., vol. 4 no. 3, June 1919, pp. 8-15 and (discussion), pp. 29-35 Circular of the Ministry of War to the Under-Secretaries of State for Aeronautics, for Health and for Military Justice, the Military Governors General of Paris and Lyons, the Generals commanding districts and the General commanding the French troops of North Africa.

Garment Trades. Factor Management in Garment Trades, Mack Gordon. Indus. Management, vol. 57, no. 6, June 1919, pp. 446-451, 10 figs. Purchasing and storekeeping methods.

Layout. The Design and Construction of Factories—II, Arthur F. Wickenden. Eng. & Indus. Management, vol. 1, no. 15, May 22, 1919, pp. 458-459, 1 fig. Arrangement of site and general layout.

Machine-Tool Plant. Organization and Management of a Machine Tool Plant. Machy. (Lond.), vol. 14, no. 317, May 22, 1919, pp. 213-219, 11 figs. Principles, of management discussed in case of medium-size machine-tool manufacturing plant making single line of machines. First article.

Machinery Selection. Continental Plant Layout Facilitates Production—II. J. Edward Schipper. Automotive Industries, vol. 40, no. 22, May 29, 1919. pp. 1168-1173, 11 figs. Exemplifying machines used to facilitate production. Deals with semi-automatic compound machine in piston department, said to be capable of turning and grooving 100 pistons per hour.

Office Management. Application of Scientific Principles to Office Management, Walter D. Fuller. Bul. Taylor Soc., vol. 4, no. 3, June 1919, pp. 8-15 and (discussion), pp. 15-28. Method of procedure adopted by Standardization Division of Curtis Publishing Co. It includes provision for paying employees extra for all production above a determined standard at a fixed rate.

Output Restriction. Industrial Efficiency from the Psychological Standpoint—IV, Charles S. Myers. Eng. & Indus. Management, vol. 1, no. 14, May 15, 1919, pp. 427-429. Factors which may bring about a restriction of output. Question is discussed with reference to causes arising both from side of employer and that of employee. (Concluded.) Lecture delivered at Imperial College of Science & Technology.

PLANNING. High Production Tooling Methods as Applied to the Machine-Gun Tripod, Model 1918, Albert A. Dowd and Donald A. Baker. Am. Mach., vol. 50, no. 22, May 29, 1919, pp. 1029-1036. Planning and organization. First article.

A Planning System for Non-Repetition Work. Machy. (Lond.). vol. 14, no. 347, May 22, 1919, pp. 223-225, 4 figs. Nucleus of system proposed for application to ship machinery assembly consists of car index of items and a series of specially prepared sheets made from arrangement drawings of the various systems of machinery and piping in vessel under construction.

Speeding-up Production, John A. Davenport. Eng. & Indus. Management, vol. 1, no. 13, May 8, 1919, pp. 391-394, 8 figs. Working out a time chart and rearranging it, in order to study possibilities for improvement.

Planning the Industrial Plant—I, Hugh M. Wharton. Indus. Management, vol. 57, no. 6, June 1919. pp. 433-437, 4 figs. Discussion of industrial plants as a whole, including general scheme, design, construction, layout and permanent equipment of buildings and yards. Three types of construction are shown and adaptability of each one pointed out. (To be continued.)

Planning a Machine Tool Shop for Systematized Manufacture. Erik Oberg. Machy. (N. Y.), vol. 25, no. 10, June 1919, pp. 905-913, 20 figs. Discussion based upon ideas embodied in plant of R. K. LeBlond Machine Tool Co., Cincinnati.

PRODUCTION DEPARTMENT. Details of Production Department, M. H. Potter. Iron Trade Rev., vol. 64, no. 22, May 29, 1919, pp. 1410-1412, 7 figs. Method of classifying and checking work at every important stage, with suggested forms of transferring material in course of production.

PROGRESS DEPARTMENT. Planning a Progress Department, I & II. W. J. Hiscox. Eng. & Indus. Management. vol. 1, nos. 15 & 17, May 22 & June 5, 1919, pp. 472-474 & 526-528, 3 figs. Illustrating scope for activities of department afforded in manufacture of airplane engines. Forms of record cards.

PROMOTION. The Three Position Plan of Promotion, Frank B. Gilbreth and L. M. Gilbreth. Eng. & Indus. Management, vol. 1, no. 17, June 5, 1919, pp. 521-523. Emphasizes (1) necessity of attracting desirable applicants, (2) necessity of holding, fitting and promoting those already employed and (3) the interdependence of these two.

Transfer and Promotion of Employees. Iron Age, vol. 103, no. 23, June 5, 1919, pp. 1518-1519. Classifying capabilities and characteristics of workmen for the purpose of effecting transfers and promotions. Report prepared by Transfer and Promotion Committee of Chicago council, Nat. Employment Managers' Assn.

ROUTING. Where Power Transmission Machinery is made. Foundry, vol. 47, no. 324, June 1, 1919, pp. 325-328, 7 figs. Special attention is given to arrangement of plant for routing of material from pattern shop through foundry and cleaning room into machine shop.

SAVINGS. Savings Facilities for Employees make for Stability of Organization, Harry Tipper. Automotive Industries, vol. 40, no. 22, May 29, 1919. pp. 1180-1181. Suggests that plan be without taint of paternalism and that workers be allowed freedom of dealing at will with regularly recognized financial institutions.

SCIENTIFIC MANAGEMENT. The Determination of Standards in Scientific Management, Henry W. Allingham. Eng. & Indus. Management, vol. 1, no. 17, June 5, 1919, pp. 536-540. Claims that much of opposition to scientific management is based upon misunderstanding, and in a measure to manner in which it has been advocated. Paper read before Indus. Reconstruction Council.

Scientific Management, with Especial Reference to Incentives and Motion Study, James F. Butterworth. Eng. & Indus. Management, vol. 1, nos. 16 & 17, May 29 and June 5, 1919. pp. 502-505 and 534-535 (6 figs). 1. Emphasizes particularly adoption of standards throughout works, not only for machinery and tools, but also in method of performance, mnemonic symbols, phrasing on instruction cards, and even standard clothing to be provided by management. II. Henry R. Towne's system of gain sharing, H. L. Gantt's task with bonus system, Gilbreth three rate, with increased rate, F. A. Parkhurst's differential bonus system of compensation and Taylor's differential-rate piece system.

Productive Capacity and Industrial Property, H. L. Gantt. Eng. & Indus. Management, "Idleness expense chart," indicating cost of inefficient management. Based on writer's paper, Efficiency and Democracy (Mech. Eng., Jan. 1919, p. 43), read before Am. Soc. Mech. Engrs.

SKILL OF WORKERS AND PRODUCTION. Modern Methods of Transferring Skill, Frank B. Gilbreth and L. M. Gilbreth. Eng. & Indus. Management, vol. 1, no. 18, June 12, 1919, pp. 559-560. After pointing out that increased productivity is usually attempted from angle of longer hours or more rapid rate of production, writers urge instead fundamental necessity of increasing skill of workers.

TELAUTOGRAPH. The Close Control of Steel Processes. Iron Age, vol. 103, no. 24, June 12, 1919, pp. 1569-1571, 3 figs. Uses of telautograph as substitute for telephone communication and transmitting figures and diagrams.

TOOL STORES. The Modern Tool Stores, Herbert C. Armitage. Eng. & Indus. Management, vol. 1, no. 18, June 12, 1919, pp. 551-553, 6 figs. Arrangement, organization, construction and equipment. (To be continued.)

INSPECTION

CHEMICALS AND EXPLOSIVES. Inspection of Explosives and Chemicals During the War Period, J. Richardson Donald. Can. Chemical Jl., vol. 3, no. 6, June 1919, pp. 187-191. As carried out for Imperial Ministry of Munitions, Can. Address delivered at Convention of Chemists, Montreal.

LABOR

CLUBS. An Employees' Engineering Club, F. O. Wells. Indus. Management. vol. 57, no. 6, June 1919, pp. 443-445. Membership is paid for, dinners are given, speakers are invited in—all for purpose of developing and increasing spirit of organization to deal with technical problems. Plan devised on lines of organization of Am. Soc. Mech. Engrs.

Luxurious Factory Club and Roof Garden. Iron Age, vol. 103, no. 24, June 12, 1919, pp. 1575-1577, 9 figs. All employees are eligible to membership after 30 days in service. Officers and board of directors elected by individual vote of all employees.

DISCONTENT. The Human Side of Engineering, F. Danvers Power. Proc. Australasian Inst. Min. Engrs., no. 31, Sept. 30, 1918, pp. 131-144. Following causes of discontent are analyzed: Desire for better ratio between rate of pay and cost of living: bosses whose idea of efficiency is to speed up work and cut down wages; men put to class of work for which they are unsuited; monotony of work and uncongenial surroundings.

INDUSTRIAL RELATIONS. Relations between Employers and Labour, Evelyn Wallers. South African Jl. of Industries, vol. 2, no. 4, Apr. 1919, pp. 376-380. Question is dealt with more particularly with reference to mining industry. Address delivered before Transvaal Chamber of Mines.

LEAGUE TO ENFORCE INDUSTRIAL PEACE. A League to Enforce Industrial Peace, L. K. Comstock. Elec. World, vol 73, no. 22, May 31, 1919, pp. 1164-1167. Tentative legislative program concerning private industry upon which it is proposed to build league.

RADICALISM. Humanity and Tolerance will solve U. S. Labor Problems, Harry Tipper. Automotive Industries, vol. 40, no. 25, June 19, 1919, pp. 1394-1398. Writer contends that radicals in labor circles have flourished through being opportunists and endeavors to ascertain causes which have produced recent strikes.

RESTAURANTS. Feeding Factory Workers. Iron Age, vol. 103, no. 24, June 12, 1919, pp. 1579-1580, 2 figs. Plan said to be arranged for minimum route from storeroom to serving counters.

Technical Features of Disston Cafeteria, Arthur N. Blum. Safety Engineering, vol. 37, no. 5, May 1919, pp. 247-253, 1 fig. Direct benefits claimed to be derived from industrial restaurants in report drawn by committee appointed by Ministry of Munitions are: (1) marked improvement in health of worker; (2) less sickness; (3) less absence and broken time; (4) less tendency to alcoholism; (5) increased efficiency and output. Plant in Philadelphia is quoted as example of results.

STOCK OWNERSHIP BY EMPLOYEES. Coming Status of the Employee in Industry, Charles F. Lang. Eng. News-Rec., vol. 82, no. 22, May 29, 1919, pp. 1050-1051. Points out advantages of stock ownership by employees, and credits employee with ability to exercise salutary influence upon management of company. From address before Convention of Nat. Machine Tool Builders' Assn.

TEMPERAMENT. Getting the Employee, Ralph Elsman. Am. Gas Eng. Jl., vol. 110, no. 21, May 24, 1919, pp. 437-438. Believes that temperament is important factor, but which neverthless has not received sufficient attention from executives of Utility Companies.

TURNOVER. Principles of Employing Labor, E. H. Fish. Indus. Management, vol. 57, no. 6, June 1919, pp. 478-482. Devoted to non-financial conditions influences and details of shop policy that causes men to leave and seek work elsewhere. (Concluded).

WAGES. Fundamentals of Wage Payment. Ry. Mech. Engr., vol. 93, no. 6, June 1919, pp. 297-299, 3 figs. Equations and graphs aiming to prove that all systems of labor compensation, including piece work and the various bonus systems, as well as the straight time basis, if properly administered, are nearly equally effective.

My Objections to the Piece Rate Method of Wage Payment—I, Harrington Emerson. Indus. Management, vol. 57, no. 6, June 1919, pp. 470-472. Author discusses practical or immediate objections, administrative or proximate objections, and psychological or ultimate objections.

WOMEN. Attendance and Turnover Records of Women Workers. Automotive Industries, vol. 40, no. 23, June 5, 1919, pp. 1222-1224. Comparison of lost-time factors with male and female operators, effects of illness, hours of labor and idle shop time; value of rest rooms and rest periods. Statistical data are quoted from 115 establishments.

LEGAL

COMPENSATION. Computation of Earnings, Chelsea C. Sherlock. Am. Mach., vol. 50, no. 22, May 29, 1919, pp. 1037-1039. Determining for purpose of compensation to injured workman what should constitute annual earning for year preceding accident.

DEPENDENCY. The Riddle of Dependency—I & II, Chelsea C. Sherlock, Am. Mach., vol. 50, nos. 25 & 26, June 19 & 26, 1919, pp. 1174-1176 & 1226-1228. Distinguishing between persons whose dependency is conclusively presumed and who have only to establish their relationship to deceased workman to obtain compensation, and those others who must prove their dependency in order to recover.

FRANCE. Compilation of Laws, Decrees, Devisions and Other Acts Concerning Mines, Quarries, Sources of Mineral Waters, Steam Apparatus and Operation of Railroads, published under authority of Minister of Public Works (Recueil de lois, décrets, arrêtés et autres actes concernant les mines, les carrières, les sources d'eaux minérales, les appareils à vapeur et l'exploitation des chemins de fer). Annales des Mines, 11th series, vol. 7, Oct. 4, 1918, pp. 337-478. Deals with last quarter of 1918.

HEATING AND VENTILATION. Heating and Ventilating Plants and Mechanic's Liens, Arthur L. H. Street. Heating & Ventilating Mag., vol. 16, no. 6, June 1919, pp. 32-35. Review of Appellate Court decisions defining circumstances under which security is available. (Concluded).

MINES AND MINING. Abstracts of Current Decisions on Mines and Mining, J. W. Thompson. Dept. of Interior, Bur. Mines, bul. 179, law serial 18, 1919, 166 pp. Report extends over period from September to December 1918. Including subjects of minerals and mineral lands, quarry operations, damages for injuries to miners, interstate commerce and explosives.

LIGHTING

RECONSTRUCTION PERIOD. Illumination During the Reconstruction Period, S. E. Doane. Trans. Illuminating Eng. Soc., vol. 14, no. 4, June 10, 1919, pp. 209-214. Sees problems for near future as largely educational.

SHOPS. Shop Illumination (L'éclairage deans les usines), Jacques Deschamps. Technique Moderne, vol. 10, no. 9, Sept. 1918, pp. 413-417, 8 figs. Technical study with reference to selection of type of lamp and reflector and determination of total lighting power required in works.

RECONSTRUCTION

MACHINERY, AMERICAN. Business Outlook for American Industry, Frederick H. Payne. Indus. Management, vol. 57, no. 6, June 1919, pp. 465-468. Particularly in machinery building and metal-working.

MUNICIPAL ENGINEERING. Municipal Engineers and Problems of Reconstruction, E. J. Elford. Surveyor, vol. 55, no. 1427, May 23, 1919, pp. 379-380 and (discussion) pp. 380-381. Labor-saving appliances and cost reduction. Paper read before Instn. Mun. & County Engrs.

SOCIAL RECONSTRUCTION. Social Reconstruction. Survey, vol. 42, no. 10, June 7, 1919, pp. 402-409. Proposals for Federal Legislation affecting education, civil rights, probation, insurance and pensions, health, country life, conservation, labor, housing, public works, etc. Report of Committee on Nat. Program.

SAFETY ENGINEERING

ACCIDENTS, INDUSTRIAL. The Prevention of Industrial Accidents, H. M. Vernon. Eng. & Indus. Management, vol. 1, no. 16, May 29, 1919, pp. 494-495, 1 fig. From records of four large industrial plants. Lecture delivered before Roy. Soc. of Medicine.

CHEMICAL COMPOUNDS. The Chlorates, F. M. Griswold. Safety Eng., vol. 37, no. 6, June 1919, pp. 291-295, 2 figs. Dangers of fire and explosion from chemical compounds. Suggestions and references to accidents

DUST. Health Risks from Dust caused by Buffing, Polishing and Grinding Metals, John Roach. Safety Eng., vol. 37, no. 5, May 1919, pp. 236-243, 3 figs. Relation between vitality and normal lung function illustrated by respiration during average workday in terms of expenditure of energy; thus it is said that respitation during average workday corresponds to lifting 7 tons 1 ft.

Grain Dust Explosions and Fires, David J. Price. Safety Eng., vol. 37, no. 6, June 1919, pp. 296-300, 1 fig. Direct appeal to workmen and the results.

FENCING. The Silent Watchman Over Industry. Iron Trade Rev., vol. 64, no. 25, June 19, 1919, pp. 1609-1612, 6 figs. Quotes from experience of protecting industries during war time and considers question of protecting them in peace times in light acquired by experience in war.

FIRE PROTECTION. San Francisco's High Pressure Fire Service. Mun. Jl. and Public Works, vol. 46, no. 25, June 21, 1919, pp. 454-455, 4 figs. Formerly maintained as reserve supply, now used as main fire-fighting system.

Private Fire Protection. Mun. Jl. and Public Works, vol. 46, no. 25, June 21, 1919, pp. 449-451. Report of Committee of Am. Waterworks Assn. giving recommendations for installation of private fire devices.

Fire Prevention in the Metal Trade—II, R. E. Swearingen. Metal Trades, vol. 10, no. 6, June 1919, pp. 261-263. Principles to be observed when installing automatic sprinkler system.

The Fire at Millennium Mill, Victoria Docks Silvertown, London, on January 19th, 1917. A memorandum prepared by Ellis Marsland for "Red Books" of the British Fire Prevention Committee—no. 208, London 1917, 46 pp. 38 figs. Points out that reinforced-concrete frame remained standing throughout fire said to have been of exceptional severity — without material portion collapsing, while all other materials were practically consumed or destroyed.

GAS MASKS. Use of Army Gas-Masks in Atmospheres Containing Suplhur Dioxide, A. C. Fieldner and S. H. Katz. Min. & Sci. Press, vol. 118, no. 23, June 7, 1919, pp. 773-777, 5 figs. Results of tests. Warning is issued against indiscriminate use of gas masks for any and all purposes; poisonous gases used in warfare are chemically active and therefore combine readily with absorbents of mask, but they will easily penetrate mask when present in quantities of 1 or 2 per cent.

HEALTH, INDUSTRIAL. Industrial Health and Efficiency. U. S. Dept. Labor, Bur. Labor Statistics,' bul. 249, Feb. 1919, 374 pp., 20 figs. Final report of the British Health of Munition Workers' Committee, published at request of Council of National Defense, in order to "investigate conditions affecting health and welfare of workers . . . . so that the salient features thereof may be made applicable to conditions pertaining in the U. S. A. . . . "

MINE ACCIDENTS. Metal-Mine Accidents in the United States during the Calendar Year 1917, Albert F. Fay. Dept. of Interior, Bur. Mines, technical paper 224, 1919, 80 pp. Including supplemental labor and accident tables for the years 1911 to 1917, inclusive.

POWER PRESSES. Safety Practice in Power-Press Work. Am. Mach., vol. 50. no. 25. June 19, 1919, pp. 1177-1184, 29 figs. Discussion and illustrations of various types of guards. From pamphlet published by Nat. Safety Council.

SAFETY CODES. National Industrial Safety Codes. Safety Eng., vol. 37, no. 5, May 1919, pp. 231-235. Proposal for an American Standards Association, Report of Committee of Three, appointed by conference on industrial safety codes at Bureau of Standards.

TRANSMISSION MACHINERY. Safety Precautions for Transmission Machinery. Eng. & Indus. Management, vol. 1, no. 13, May 8, 1919, pp. 398-402, 12 figs. Based upon reports by Home office inspectors of dangerous trades.

TRANSPORTATION

ARMY TERMINALS. Army Supply Bases Useful Adjuncts to Railroads. Ry. Age, vol. 66, no. 26, June 27, 1919, pp. 1809-1812, 6 figs. Adapting port and terminal facilities made necessary by war to peace-time conditions.

RURAL MOTOR EXPRESS. Development of Rural Motor Express, F. W. Fenn. Can. Engr., vol. 36, no. 24, June 12, 1919, pp. 539-541. Including statements in regard to motor-truck performances. Paper read at Can. Good Roads Congress.

TRUCKS, ELECTRIC. Electric Trucks and Transportation, E. E. Laschum. Elec. Rev., vol. 74, no. 23, June 7, 1919, pp. 931-933. Operating data of American Railway Express Co.

EXPORT

BRAZIL. Entering the Latin-American Markets, Percy F. Martin. Eng. & Indus. Management, vol. 1, no. 15, May 22, 1919, pp. 474-476. Opportunities offered by Brazil.

EUROPE. American Machine Tools in Many Markets, I. W. Alwyn-Schmidt. Am. Mach., vol. 50, no. 24, June 12, 1919, pp. 1135-1137. Survey of European field.

PAYMENT FOR EXPORTS. Export of Industrial Products, Edward Prizer. Am. Mach., vol. 50, no. 24, June 12, 1919, pp. 1130-1132. Establishes that U. S. A. must learn to take foreign stocks and bonds and share interest in local enterprises, in payment of her exports. Paper read before Sixth Nat. Foreign Trade Convention.

RAILROAD ENGINEERING

DEVELOPMENTS. Railway Developments in Foreign Countries. Ry. Age, vol. 66 no. 23, June 6, 1919, pp. 1371-1375. Materials required for Mexican and Siberian railways, transportation in Italy.

GREAT BRITAIN. Railway Transport in the United Kingdom, H. Kelway-Bamber. Jl. Roy. Soc. Arts, vol. 67, no. 3470, May 23, 1919, pp. 426-438 (discussion) pp. 438-442, 7 figs., also Iron & Coal Trades Rev., vol. 98, no. 2673, May 23, 1919, pp. 696-697. Considering that welfare of a country largely depends upon provision of cheap and efficient system of transportation, writer endeavors to show how, in his opinion, this could best be effected. Statistical data of track mileage, costs and traffic.

SPEEDS, TRAIN. European Train Speeds. Ry. Gaz., vol. 30, no. 20, May 16, 1919, pp. 836-838, 3 figs. Survey of highest, longest and fastest nonstop runs, speed of trains between two places and geographical distribution of important services. German railways. (Continuation of serial).

CONSTRUCTION

TRACK. Using Modern Appliances in Track Construction, W. L. Whitlock. Elec. Ry. Jl., vol. 53, no. 21, May 24, 1919, pp. 995-998, 10 figs. Illustrating how equipment served in Denver construction to increase speed and economy.

ELECTRIC RAILROADS

LOCOMOTIVES. Brown-Boveri Locomotives for the Swiss Federal Railways, J. Buchi. Engineering, vol. 107, no. 2784, May 9, 1919, pp. 589-592, 8 figs. Electric locomotive with single-axle drive, Tschanz system. (Concluded).

Oerlikon Locomotives for the Swiss Federal Railways. Engineering, vol. 107, no. 2788, June 6, 1919, pp. 727-729 and 740, 7 figs. partly on supplement plates. Two types, 2-6-2 and 2-4-4-2, both single-phase. Some of the dimensions are: voltage, 15,000; maximum drawbar pull, 30,000 lb. and 40,000 lb., respectively; maximum speed, 47 m.p.h.; total weight, 91 and 113 tons, respectively.

Electric Locomotives of Moderate Weight and Power, A. B. Cole. Elec. Ry. Jl., vol. 53, no. 24, June 14, 1919, pp. 1152-1154, 4 figs. With reference to freight-handling requirements on electrified steam-road branch lines and interurban electric-railway lines.

New York Central's Latest Motor Cars. Elec. Ry. Jl., vol. 53, no. 24, June 14, 1919, pp. 1134-1138, 10 figs. Design follows steam-railroad standards in so far as electrical equipment permits.

REGENERATIVE BRAKING. Regenerative Direct-Current Electric Railways, E. Austin. Electrical Review, vol. 84, no. 2168, June 13, 1919, pp. 705-707, 3 figs. Principle involved and schematic diagram for connections used in systems installed in locomotives of Chicago, Milwaukee & St. Paul R.R. and on those of the Metropolitain underground, Paris

Regenerating Braking as Applied to Electric Locomotives. What it Really Is, Il. Ry. & Locomotive Eng., vol. 32, no. 6, June 1919, pp. 186-187, 1 fig. Schematic diagram showing single-phase regulation connections.

THIRD RAIL. Types of Third-Rail Used in Railway Electrification. Elec. Ry. Jl., vol. 53, no. 24, June 14, 1919, pp. 1143-1148, 19 figs. Considerations involved in selecting rail section, location and protective covering. Leading types are described and their relative advantages and disadvantages are discussed.

Methods Used in Third-Rail Bonding, G. H. McKelway. Elec. Ry. Jl., vol. 53, no. 24, June 14, 1919, pp. 1154-1156, 8 figs. It is observed that high conductivity is first essential, and ease of installation and maintenance are important considerations.

TRACK CIRCUIT. Some Things Learned About the Track Circuit, A. R. Fugina and J. B. Weigel. Ry. Signal Engr., vol. 12, no. 6, June 1919, pp. 195-199, 1 fig. Ballast leakage, rail bonding and minimum working voltage of battery are some of the factors that require further study.

ELECTRIFICATION

CONTACT SHOES. Electrification Facts and Factors, A. J. Manson. Elec. Ry. Engr., vol. 10, no. 6, June 1919, pp. 189-191, 3 figs. Construction details of contact shoes used on over-running and under-running third rails, FRANCE. Partial Electrification of French Railways; Experience Acquired in France and in Other Nations in Regard to Electrification of Extensive Systems (Programme d'électrification partielle des chemins de fer français; expérience actuellement acquise en France et à l'étranger dans l'électrification des grandes lignes—III & IV. M. A. Mauduit. Bul. de la Société Française des Electriciens, vol. 9, nos. 79 & 80, Apr. & May 1919, pp. 273-303, 333-360, 16 figs. Single-phase, three-phase and monophase-three-phase and direct current systems. Orelikon and Brown-Boveri regenerative braking systems. (Concluded).

FUEL SAVING. Methods for More Efficiently Utilizing Our Fuel Resources—XXVI & XXVII, W. J. Davis, Jr., and F. Parkman Coffin. Gen. Elec. Rev., vol. 22, no. 3, Mar. 1919, pp. 196-199, and 212, 4 figs. Possible saving of fuel by railway electrification. Estimates and comparisons. Problems involved in connection with preparation, handling, and burning of powdered fuels on shipboard.

GREAT BRITAIN. British Railway Electrification, Philip Dawson. Times Eng. Supp., vol. 15, no. 535, May 1919, pp. 153-154. Governing conditions of future extension.

SWITZERLAND. The Electrification of the Swiss State Railways (Die Elektrifizierung der Schweiz Bundesbahnen.) E. Huber-Stockar. Schweizerische Bauzeitung, vol. 73, no. 16, Apr. 19, 1919, pp. 181-184, 5 figs. Writer believes that electrification will hardly reduce fares, since it has become very expensive to electrify roads.

EQUIPMENT

AXLE GENERATORS. A Discussion of Axle Generators and Pulleys. Ry. Elec. Engr., vol. 10, no. 6, June 1919, pp. 175-178, 5 figs. New York Car Lighting Club debates on truck-hung vs. body-hung machines and solid vs. perforated pulleys.

HEADLIGHTS. Care of Locomotive Electric Headlights. Elec. Ry. Engr., vol. 10, no. 6, June 1919, pp. 186-188, 3 figs. Rules, regulations and system of records adopted for maintenance of Big Four Railroad's equipment.

TRAIN LIGHTING. Report on Train Lighting and Equipment. Ry. Age, Daily Edition, June 23, 1919, pp. 1667-1670 and (discussion) pp. 1671-1673, 9 figs. Tests conducted by Committee of Am. R R. Assn. to determine (1) rating of axle generators, (2) method of testing to determine this rating, and (3) relation between capacity as found on the stand test as compared to capacity in actual service.

LABOR

SUITABILITY TESTS. Suitability Tests for Railway Men, A. Schreiber. Eng. & Indus. Management, vol. I, no. 16, May 29, 1919, pp. 491-493, 4 figs. Tests applied at Dresden aim to determine how far individual is endowed with four characteristics—intelligence, decision, tranquility and endurance. From Umschau.

LOCOMOTIVES

BRITISH. New 2-8-0 Type Locomotive for Mixed Traffic, Great Western Railway. Railway Gazette, vol. 30, no. 23, June 6, 1919, pp. 934-935, 4 figs. Coupled wheels have a size of 5 ft. 8 in.

CARBONIZATION IN VALVE CHAMBERS. Carbonization in Valve Chambers and Cylinders of Superheated Steam Locomotives, F. P. Roesch. Ry. Age, daily edition, vol. 66, no. 25e, June 25, 1919, pp. 1762-1765, 4 figs. Review of practices of various railways to remedy effects on lubrication and maintenance.

MAINTENANCE. New Locomotive Maintenance Program Pennsylvania Lines West. Ry. Rev., vol. 64, no. 25, June 21, 1919, pp. 913-922, 24 figs. Work involves many new shop structures and much new equipment.

MALLET. Simple Mallet Locomotive with Short Maximum Cut-Off. Ry. Age, Daily Edition, June 23, 1919, pp. 1675-1681, 11 figs. Boiler in three parts: Conical course with minimum outside diameter at front end of 96 in., straight combustion chamber 110 in. in outside diameter ,and firebox. Two sets of simple cylinders. Longest port opening 50 per cent of stroke. Tractive effort estimated at 135,000 lb.

METER GAGE. New Meter Gauge Locomotives; Bombay, Barode & Central India Railway. Ry. Gaz., vol. 30, no. 21, May 23, 1919, pp. 868-869, 3 figs. Engine are of 4-6-4 and 4-4-4 types and are equipped with superheating apparatus and piston valves, the latter actuated by Walschaerts valve gearing.

PACIFIC. Pacific Type Locomotive, Lehigh Valley R.R. Ry. Rev., vol. 64, no. 22, May 31, 1919, pp. 785-786, 1 fig. Designed to utilize mixed anthracite and bituminous fuel.

THREE-CYLINDER. Three-Cylinder Locomotives, H. Holcroft. Engineer, vol. 127, no. 3307, May 16, 1919, pp. 485-489, 19 figs. General survey of development of locomotives with reference to characteristics in Great Britain. France and America, together with presentation of valve gears for three-cylinder locomotives.

VALVE MOTION AND FUEL CONSUMPTION. Fuel Conservation Section of the United States Railroad Administration Tests of Locomotives for Fuel Losses. Ry. & Locomotive Eng., vol. 32, no. 6, June 1919, pp. 169-172, 2 figs. Concluded that condition of valve motion vitally affects fuel consumption, and irregular steam distribution makes proper adjustment of draft apparatus impossible.

MAINTENANCE

DERAILS. Wide Variety of Practices Shown in Use of Derails. Ry. Maintenance Engr., vol. 15, no. 6, June 1919, pp. 199-203. Tabulation of practice in use on various America railroads.

Derails and Where They Should Be Used. Ry. Age., vol. 66, no. 23, June 6, 1919, pp. 1361-1367, 2 figs. Tabulated data covering practices on 48 representative railroads in United States and Canada in regard to conditions governing installation of derails at other than interlocking plants.

Use of Derails Varies Greatly on Railroads. Ry. Signal Engr., vol. 12, no. 6, June 1919, pp. 203-209, 3 figs. Table showing general practice on various American railroads.

FREIGHT-CAR EQUIPMENT. Maintenance of Freight Car Equipment, H. E. Shipman. Ry. Rev., vol. 64, no. 24, June 14, 1919, pp. 894-896. Recommends more uniformity between roads in freight-car repairs and proposes their classification. Paper read before Western Ry. Club.

LIGHTING. Some Notes on Railway Lighting and Maintenance, A. Cunnington. Illum. Engr., vol. 12, no. 3, Mar. 1919, pp. 59-76 and (discussion) pp. 76-86, 11 figs. Advocates adopting standard minimum of illumination in each class of lighting which shall insure comfort for the passenger, efficient working conditions for the railway man and safety for both.

NEW CONSTRUCTION

BIG FOUR. Big Four Increases Capacity at Congested Points. Ry. Age, vol. 66, no. 25, June 20, 1919, pp. 1545-1548, 8 figs. Concerning construction of 87 miles of second track and reduction of grades.

OPERATION AND MANAGEMENT

BOARD OPERATION. The Operation of Federalized Railways Under War Conditions, Carl R. Gray. Off. Proc. St. Louis Ry. Club, 24, no. 1, May 9, 1919, pp. 14-29. Difficulties which, writer believes, caused congestion of railways. Chaotic conditions are said to have resulted from "Lane Commission" taking men's earningsinstead of their ratings as basis for equitable arrangements and relationships between wages.

BRIDGE RECONSTRUCTION AND TRAFFIC MAINTENANCE. Maintaining Traffic During Erection of Louisville Bridge. Eng. News-Rec., vol. 82, no. 22, May 29, 1919, pp. 1061-1064, 7 figs. By bunching trains to pass over bridge at noon hour or about 4 p.m. and diverting some trains to other bridges at critical stages in work, operation was maintained throughout two years, during which time about one mile of steel superstructure was erected.

CONNECTORS, AUTOMATIC. Train Line Connectors on the Copper Range R.R. Ry. Rev., vol. 64, no. 25, June 21, 1919, pp. 941-943, 4 figs. Report of tests with automatic connectors.

DRAWBAR PULL-CUT-OFF CALIBRATION. Drawbar Pull-Speed-Cut-Off Calibration as an Adjunct to Efficient Locomotive and Train Operation, B. B. Milner. Ry. Age, daily edition, vol. 66, no. 25e, June 25, 1919, pp. 1766-1768, 3 figs. Tests conducted to determine precise cut-off which must be used at various speeds in order to develop maximum drawbar pull.

FUEL ECONOMICS. Locomotive Fuel Losses at Terminals, J. M. Nicholson. Ry. Rev., vol. 64, no. 21, May 24, 1919, pp. 752-754, also Railroad Herald, vol. 23, no. 7, June 1919, pp. 36-37. Suggests when locomotive is brought to terminal that fire be turned down to such a point that it will not be necessary to rebuild it in order to get water level in boiler to proper heat before knocking fire. Points out practices which are said to result in useless waste. Paper read before Int. Ry. Fuel Assn.

Reducing Fuel Combustion, Northern Pacific R.R., M. A. Daly. Ry. Rev., vol. 64, no. 24, June 14, 1919, pp. 868-869. Practice of road in schooling enginemen and others in elementary technology of combustion.

Transportation Department and Fuel Economy, H. C. Woodbridge. Ry. Rev., vol. 64, no. 24, June 14, 1919, pp. 865-868, 8 figs. Recommendations to transportation department officials.

LOCOMOTIVE OPERATORS, INSTRUCTION OF. Locomotive Operation—Uniform Instructions, J. R. Alexander. Ry. Club of Pittsburgh, vol. 18, no. 4, Mar. 27, 1919, pp. 86-128. Suggestions intended to bring about concerted action in eliminating waste.

LUBRICATION. Lubrication and Care of Journal Boxes Under Passenger and Freight Equipment, M. J. O'Connor. Off Proc. Car Foremen's Assn. of Chicago, vol. 14, no. 7, Apr. 1919, pp. 22-32. Suggests establishing standard instructions and practices on all points on any one railroad; for the maintenance of which writer proposes assignation of experienced men to follow up the work exclusively.

OFFICE MANAGEMENT. Mechanical Appliances in Railway Offices. Railway Gazette, vol. 30, no. 22, May 30, 1919, pp. 900-906, 9 figs. Great Western Railway's method for preparing accounts for goods train traffic.

POWER PLANTS. Management of Railway Power Plants, William Olsen. Ry. Rev., vol. 64, no. 24, June 14, 1919, pp. 858-859. Suggestions in regard to securing fuel economy.

STATISTICAL DEPARTMENT. Checking Percentages by Chart, William Wycr. Ry. Age, vol. 66, no. 26, June 27, 1919, pp. 1826-1828, 1 fig. Practice of operating statistical section of Railroad Administration.

Compilation of Operating Statistics Report. Ry. Age, vol. 66, no. 23, June 6, 1919, pp. 1360-1373, 17 figs. Standard forms for all roads and methods used by various roads in gathering figures.

VIADUCTS, SMOKE UNDER. Tests to Free Under Side of Railroad Viaducts from Smoke, Robt. H. Moulton. Eng. News-Rec., vol. 82, no. 24, pp. 1162-1164, June 12, 1919, 2 figs. Special arrangement of ducts, air chambers and fans are believed to promise solution of problem of low head-room.

WIND RESISTANCE. The Wind Resistance on a Train, C. F. Dendy Marshall. Engineer, vol. 127, no. 3307, May 16, 1919, pp. 473-474, 4 figs. Graphs showing ratio of train speed to wind speed, also horsepower requirements for every square foot of transverse surface for various speeds.

PERMANENT WAY AND BUILDINGS

TIES. Reinforced-Concrete Railway Ties (Un nuvvo experimento di traverse in cemento armato). Rivista Tecnia della Ferrovie Italiana, vol. 15, no. 4, Apr. 15, 1919, pp. 134-143, 19 figs. partly on two supplement plates. Enclosed wire frame forming two circular ends connected by series of straight bars constitutes reinforcement. Blocks of wood to which rails are fastened are embedded in circular ends. Patented.

TRACK. The Best Methods of Raising Railway Track. Can. Ry. & Mar. World. no. 256, June 1919, pp. 294-295, 5 figs. Report of committee of Road Masters and Maintenance of Way Assn.

TURNTABLE. A Turntable of Unique Design. Ry. Mech. Engr., vol. 93, no. 6, June 1919, pp. 329-332, 6 figs., also Elec. Ry. Engr., vol. 10, no. 6, June 1919, pp. 193-197, 5 figs., and Ry. Age, vol. 56, no. 24, June 13, 1919, pp. 1415-1418, 6 figs. Pennsylvania 110-ft. turntable designed for three-point support and adjustable center.

PUBLIC REGULATION

A Suggested Plan for Control and Operation. Railroad Herald, vol. 23, no. 7, June 1919, pp. 14-16. Suggestion contemplating private ownership and operation under government control.

RAILS

BONDING. The Importance of Rail Bonding, E. Steck. Coal Age, vol. 15, no. 26, June 26, 1919, pp. 1167-1168. Poor track honding considered as chief difficulty in coal operation, because it cuts down voltage delivered to mine motors.

ROLLING STOCK

DRAFT GEARS. Draft Gear Tests by the United States Railroad Administration. Ry. Rev., vol. 64, no. 18, May 3, 1919, pp. 641-644, 6 figs Testing arrangement consists of piece of straight track on which are operated two 50-ton gondola cars, equipped with draft gears to be tested.
When Freight Cars Bump, Prof. J. Hammond Smith. Sci. Am., vol. 120, no. 23, June 7, 1919, pp. 602&615. Recent tests of draft gears, and the resulting developments.

DUMPERS. Car Dumpers, Jas. A. Jackson. Gen. Elec. Rev., vol. 22, no. 5, May 1919, pp. 366-372, 12 figs. Explains operation of two principal types: Turnover, and lift and turn-over, both of which dump sidewise.

COPPER AND GONDOLA CARS. P. R.R. Maximum Tonnage Hopper and Gondola Cars. Ry. Age (Daily Ed.), vol. 66, no. 24a, June 18, 1919, pp. 1461-1466, 12 figs. Designed for maximum loading of six 6-in. by 11-in. M.C.B. axles. Said to be able to carry 120 tons.

SAFETY AND SIGNALLING SYSTEMS

FLAGGING. Flagging and Its Relation to Railroad Accidents, C. C. McChord. Ry. Age, vol. 66, no. 25, June 20, 1919, pp. 1528-1530. Urges making position of flagman a preferred job investing it with more importance and dignity than is at present the case. Review of American experiences with flagging rule represented as evidencing that most accidents are due to inefficiency and carelessness of flagmen.

GREAT BRITAIN. Signalling at Southport, Lancashire & Yorkshire Railway. Ry. Gaz., vol. 30, no. 21, May 23, 1919, pp. 871-881, 14 figs. Power-operated signal boxes containing 160 levers.
Block Signalling Practice on a British Railway, F. B. Holt and A. B. Wallis. Ry. Signal Engr., vol. 12, no. 6, June 1919, pp. 188-191, 3 figs. Use of track circuits, signal repeaters and lamp indications. Position of arm shown while pyrometer indicates if lamp is lighted. Second of three articles.

SODA CELLS. Testing Soda Cells for Railway Signalling, R. W. Irwin. Ry. Signal Engr., vol. 12, no. 6, June 1919, pp. 201-202, 1 fig. Test consists of discharging a soda cell at one ampere continuously, except during short period each day when a set of intermittent readings are taken.

TRANSMISSION MAINS. Supply and Transmission for Modern Railway Signalling—11, A. E. Tattersall. Railway Engineer, vol. 40, no. 473, June 1919, pp. 127-130, 4 figs. Formulæ to calculate sags and stresses on transmission mains.

SHOPS

AUTOMATIC MACHINERY. Automatics in Railroad Shops, M. H. Williams. Ry. Mech. Engr., vol. 93, no. 6, June 1919, pp. 303-310, 21 figs. Description of typical machines of the three primary types, set-ups for a variety of jobs.

COST—OUTPUT FORMULA. Locomotive Repair Shop Output. Henry Gardner. Ry. Mech. Engr., vol. 93, no. 6, June 1919, pp. 335-337, 6 figs. Proposed formula for measuring and comparing cost of repairs in relation to output.

ENGINE HOUSE DESIGN. Modern Tendencies in Engine house Design, Edwin M. Haas. Ry. Rev., vol. 64, no. 22, May 31, 1919, pp. 787-791, 8 figs. General considerations governing selection of types with illustrations of structures in use by principal railroads. Paper read before Western Society of Engineers.
Rectangular Engine House, Long Island R.R., L. V. Morris. Ry. Rev., vol. 64, no. 22, May 31, 1919, pp. 796-797, 4 figs. Built for rapid handling of equipment. Structure is of reinforced concrete.

ERIE AVENUE SHOP, P. & R. Erie Avenue Engine Terminal, Philadelphia & Reading Ry. Ry. Rev., vol. 64, no. 24, June 14, 1919, pp. 859-865, 13 figs. In conjunction with plant concrete coaling station has been erected, and a system of electric precipitation wherewith to clarify smoke issued from locomotives is to be installed.

GLENWOOD SHOPS, B. & O. Glenwood Shop Improvements, Baltimore & Ohio R.R. Ry. Rev., vol. 64, no. 21, May 24, 1919, pp. 747-752, 8 figs., also Ry. Mech. Engr., vol. 93, no. 6, June 1919, pp. 288-296, 13 figs., and Ry. Age, vol. 56, no. 24, June 13, 1919, pp. 1401-1404, 6 figs. Site selected for new plant is occupied by old shop building and it was required that shop services should be continued in these buildings during erection of new shops. Shop is of longitudinal type with 21 pits and space is provided for storehouse for mechanical stores.

STEEL CAR SHOPS, N. Y. C. New York Central Steel Car Shop. Ry. Mech. Engr., vol. 93, no. 6, June 1919, pp. 315-319, 10 figs. Brick building, 431 ft. 3 in. long and 243 ft. 6 in. wide.

TOOLS FOR LOCOMOTIVE VALVE PARTS. Tools for Locomotive Valve Parts, Frank A. Stanley. Am. Mach., vol. 50, no. 24, June 12, 1919, pp. 119-122, 11 figs. Equipment is made up of box tools, boring tools, valve-seating reamers, taps, dies, etc.

WATER-GAGE FITTINGS. Making Water-Gage Fittings in a Railroad Shop, Frank A. Stanley. Am. Mach., vol. 50, no. 25, June 19, 1919, pp. 1171-1173, 5 figs. Set of tools for turning, boring, facing, threading and otherwise machining various parts entering into construction of gage cocks and fittings, used at California shops of Southern Pacific R.R.

GENERAL SCIENCE

CHEMISTRY

ANALYSIS, AIR. The Estimation of Small Quantities of Acetone, Alcohol and Benzene in Air, Major Elliot and J. Dalton. Analyst, vol. 44, no. 517, Apr. 1919, pp. 132-136, 1 fig. Apparatus consists of four narrow measuring cylinders fitted with Folin tubes. Experiments said to have shown that when air was drawn through at rate of about 10 liters an hour, only one cylinder was necessary for complete absorption in each case.

ANALYSIS, ALCOHOL. Determination of Small Amounts of Benzene in Ethyl Alcohol, F. W. Babington and Alfred Tingle. Jl. of Indus. & Eng. Chemistry, vol. 11, no. 6, June 1919, pp. 555-556. Standard method adopted by Inland Revenue Dept. of Canada.

ANALYSIS, BRASS. The Analysis of Brass Ingots from Swarf, R. H. Deakin. Chem. News, vol. 118, no. 3080, Apr. 25, 1919, pp. 193-194. Process for estimating Cu, Zn, Pb, Sn, Fe, Al, Ni.

ANALYSIS, GAS. The Accurate Determination of Carbon Monoxide in Gas Mixtures, J. Ivon Graham. Colliery Guardian, vol. 117, no. 3043, Apr. 25, 1919, pp. 955-956, 1 fig. Writer suggests improving his apparatus (see Trans. Chem. Soc. 1914, 1915, 1916), by replacing beaker of water, used for heating purposes, by small steam bath.

ANALYSIS, STEEL. Determination of Uranium, Zirconium, Chromium, Vanadium and Aluminium in Steel—II, Charles Morris Johnson. Chem. & Metallurgical Eng., vol. 20, no. 11, June 1, 1919, pp. 588-589. Suggested laboratory methods.

ANALYSIS, WOOD. The Proximate Analysis of Wood, W. H. Dore. Jl. of Indus. & Eng. Chemistry, vol. 11, no. 6, June 1919, pp. 556-563. Methods of analysis of woods are described and analysis of five Californian wood samples by these given. It is said that sawdust was found most satisfactory for analysis.

CHEMICAL CONSTANTS. Speed of Evaporation and Condensation and Calculation of the Chemical Constants from the Density of the Condensate. (Verdampfungs-und Kondensationsgeschwindigkeit und die Berechnung der chemischen Konstanten aus den Dichten der Kendensate), Max Trautz. Zeitschrift für anorganische und allgemeine Chemie, vol. 105, no. 3, Jan. 24, 1919, pp. 97-111. Table of chemical constants. The chemical constant becomes the logartihm of the proportion of maximum values of condensation and evaporation speed; it increases with the increasing molecule diameter, with increasing molar volume and decreasing density of molecules.

EMULSIONS. The Modern Conception of Emulsions, W. Clayton. Jl. Soc. Chem. Indus., vol. 38, no. 10, May 31, 1919, pp. 113T-118T- Emulsion of oil in water is produced according to writer, if emulsifying agent is a colloid soluble in water, or more easily wetted by water than oil.

SELENIUM DERIVATIVES. Selenic Acid and Copper Selenate, L. M. Dennis and J. P. Koller. Jl. Am. Chem. Soc., vol. 41, no. 6, June 1919, pp. 949-970. Separation of selenium from tellurium by crystallization of selenious acid.

STRUCTURE OF MATTER. The Arrangement of Electrons in Atoms and Molecules, Irving Langmuir. Jl. Am. Chem. Soc., vol. 41, no. 6, June 1919, pp. 868-934, 16 figs. Extension of Lewis theory of "cubical atom." ((See Jl. Am. Chem. Soc., vol. 38, 1916, p. 762.)

MATHEMATICS

ANALYTIC FUNCTIONS. On the Analytic Function whose Modulus is a Rational Integral Function of the Imaginary Part of Its Argument, Tsuruichi Hayashi. Science Reports of the Tohoku Imperial University, vol. 8, no. 1, Apr. 1919, pp. 17-30. Theorem concerning form of models of complex variable when its uniform analytic function is defined in a domain containing (0,0) in Argand diagram.

ERRORS, LAW OF. Bravais' Law of Errors (Sur la loi des erreurs de Bravais), A. Guldberg. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 16, Apr. 22, 1919, pp. 815-817. Its derivation in space of P dimensions by method of continuous probabilities.

FRACTIONS, PERIODIC CONTINUOUS. Irrationality of Periodic Continued Fractions (Über irrationalität unedlicher Kettenbruche), Matsusaburo Fujiwara. Science Reports of Tôhoku Imperial University, vol. 8, no. 1, Apr. 1919, pp. 1-10. Basing his work on study of that of F. Bernstein and Szász, writer, agreeing with their point of view, derives some new irrationality formulæ for continued fractions with positive terms.

GREEN'S THEOREM. A General Form of Green's Theorem, P. J. Daniell. Bul. Am. Math. Soc., vol. 25. no. 8, May 1919, pp. 353-357. Form relates to potential Functions which satisfy general integral form of Poisson's equation.

INTEGRALS. True Value of Definite Integrals (Sur la vraie valeur des intégrales définies), Arnaud Denjoy. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 17, Apr. 28, 1919, pp. 848-851. Gives theorem assigning Cauchy's value to function which is measurable and limited to function satisfying various conditions.

LINEAR POINT SETS. A Theorem on Linear Point Sets. Henry Blumberg. Bul. Am. Math. Soc., vol. 25, no. 8, May 1919, pp. 350-353. Theorem is: The relative exterior measure of every linear point set exists and is equal to 1 at every one of its points, with the possible exception of those of a set of measure 0.

SERIES. The Generalization of Tauber's Formula of Series (Uber die Verallgemeinerung des Tauherschen Satzes auf Doppelreihen), Matsusaburô Fujiwara. Science Reports of Tôhoku Imperial University, vol. 8, no. 1, Apr. 1919, pp. 43-50. Writer attempts to prove a generalization of Tauber's formula, using for this purpose a modification of Lanlau's method.

SUMMABILITY, THEORY OF, APPLICATIONS. Application of the Theory of Summability to Development in Orthogonal Functions, Charles N. Moore. Bul. Am. Mathematical Soc., vol. 25, no. 6, Mar. 1919, pp. 258-276. Summary of theory and examples of its application to problems in flow of heat and electricity.

VORTICES. Rotating Cylinders and Rectilinear Vortices, H. Bateman. Bul. Am. Math. Soc., vol. 25, no. 8, May 1919, pp. 358-374. Three cases; (1) Rectilinear vortex and rotating cylinder in a stream of incompressible fluid: (2) two rotating vortices and a rotating circular cylinder in a stream of fluid; and (3) vortices in a compressihle fluid.

PHYSICS

ETHER OF SPACE. On a Possible Means of Determining the Two Characteristic Constants of the Ether of Space, Oliver Lodge. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 221, May 1919, pp. 465-471. Suggests splitting beam of light and sending each half in opposite directions around closed optical circuit in such a way that when they meet, they shall form interference bands.

KINETICS OF HETEROGENEOUS EQUILIBRIUM. An Electromagnetic Hypothesis of the Kinetics of Heterogeneous Equilibrium, and of the Structure of Liquids, Wm. D. Harkins. Proc. Nat. Acad. Sciences, vol. 5, no. 5, May 15, 1919, pp. 152-159, 1 fig. Indicating general nature of distribution of a component between a set of phases from a knowledge of the properties of only the pure component and of those of the phases before any of this component has heen added to them.

PHOTOELECTRONS. The Passage of Photoelectrons Through Metals, K. T. Compton and L. W. Moss. Physical Rev., vol. 13, no. 5, May 1919, pp. 374-391, 11 figs. Experiments mentioned as indicating that photoelectrons, excited with a metal, lose the initial kinetic energy as results of single and definite collisions rather than by a gradual process or succession of small energy losses.

RADIATION MEASUREMENTS. Radiation Detection in X-Ray Work, R. E. Slade' Chem. Engr., vol. 27, no. 6, June 1919, pp. 131-134, 3 figs. Research of relation between photographic action and wave length of radiation. Paper based on work done in laboratory of British Photographic Research Assn., and read hefore Faraday Soc.

Modification of Fluormetric Method of Measuring X-Rays and Its Application to Measuring Radiation of Coolidge Tubes (Sur une modification à la méthode fluorométrique de mesure des rayons X, et son application à la mesure du rayonnement des ampoules Coolidge), R. Richard. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 17, Apr. 28, 1919, pp. 851-854. Suhstituting 6-mm. screen for series of screens of 0.2 mm. in thickness each.

SOUND MEASUREMENTS. A Complete Apparatus for Absolute Accoustical Measurements, Arthur Gordon Webster. Proc. Nat. Acad. Sciences, vol. 5, no. 5, May 15, 1919, pp. 173-179, 5 figs. Requisites are: source of sound producing a simple tone of known intensity, instrument for measuring in absolute units a constantly maintained simple tone, and series of experiments on propagation of sound from one to other in order to check theory of two instruments. Combinations embodying forms said to have been found suitahle after research work are given.

SOUND, PROPAGATION OF. On the Propagation of Sound in the Free Atmosphere and the Acoustic Efficiency of Fog-Signal Machinery: An Account of Experiments Carried Out at Father Point, Quebec, September, 1913, Louis Vessot King. Phil. Tran. Roy. Soc., Lond., Series A, vol. 218, 1919, pp. 211-293, 26 figs. Tests described as having demonstrated successful use of Webster phonometer for measuring characteristics of pure-toned sound waves of ordinary intensity.

SPECTRA. Measurements of Wave-Lengths in the Spectrum of Neon, Kelvin Burns, W. F. Meggers and P. W. Merrill. Chem. News, vol. 118, no. 3080, Apr. 25, 1919, p. 194. Wave lengths of 55 lines lying in region 3369A to 8495A is reported to have been measured by means of interferometer.

Superposed or Duplicated Spectrum Fringes, Carl Barus. Proc. Not. Acad. Sciences, vol. 5, no. 5, May 15, 1919, pp. 149-152, 2 figs. Experiments showing that fringes (monochromatic) due to differences of inclination of rays and fringes (dispersion) resulting from differences in wave length of rays may be made of nearly equal size by dispacing any mirror of rectangular interferometer normal in itself.

An Approximate Law of Energy Distrihution in the General X-Ray Spectrum, David L. Webster. Proc. Nat. Acad. Sciences, vol. 5, no. 5, May 15, 1919, pp. 163-166. Based principally on graphs of intensity against potential at constant frequency and total energy measurements by R. T. Beatty. (Proc. Roy. Soc., London, A89, 1913, pp. 314-327.

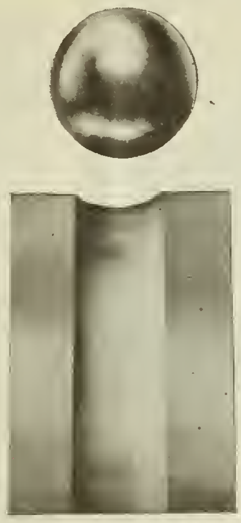
The Logarithmic Law Connecting Atomic Number and Frequency Differences in Spectral Series, Gladys A. Anslow. Physical Rev., vol. 13, no. 5, May 1919, pp. 326-336, 7 figs. Equations derived are considered as indicating that adjustments to Bohr-Sommerfeld theory of atomic structure are necessary in order to extend it so as to predict optical series.

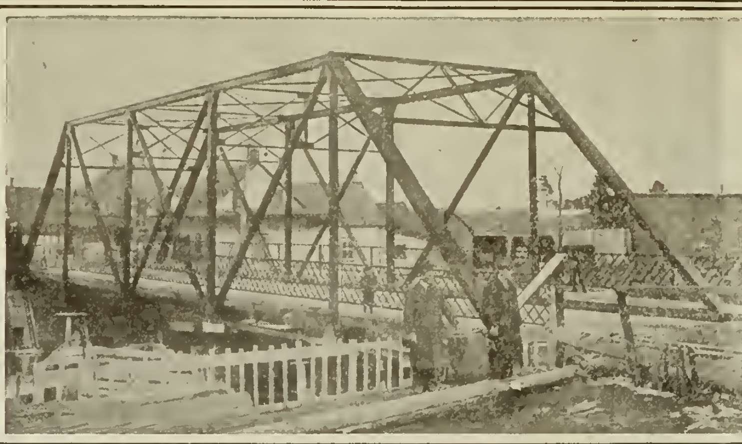
STRUCTURE OF MATTER. Remarks on the Constitution of the Atom and the Properties of Line Spectra (Remarques sur la constitution de l'atome et les propriétés des spectres de bandes), H. Deslandres. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 18, May 5, 1919, pp. 861-868. Bohr's theory, Vegard's calculations and Nagaoka's researches and mathematical analysis are quoted and conclusions are derived in reference to atomic structure as devolved from nature of phenomena of spectra as postulated by these investigators.

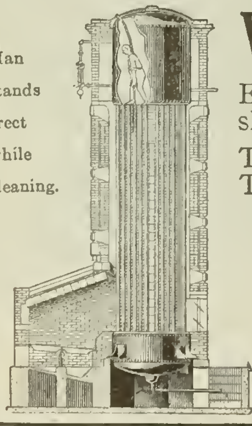
TUNING FORKS. On the Characteristics of Electrically Operated Tuning Forks, H. M. Dadourian. Physical Rev., vol. 13, no. 5, May 1919, pp. 337-359, 12 figs. Experimental determination of changes in period produced by massiveness of base, variation of constants in electrical circuits containing electromagnet increase in length of gaps between contact springs and contact points and temperature changes.

VIBRATION. On the Resultant of a Number of Unit Vibrations. Whose Phrases Are at Random over a Range Not Limited to an Integral Number of Periods, Lord Rayleigh. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 221, May 1919, pp. 498-515, 7 figs. A number of points is distributed at random in a straight line of finite length. Probability that deviation of center of gravity of points when their number is very great, lies between x and $x+dx$, is found mathematically.

WATER. Temperature Coefficient of Tensile Strength of Water, S. Skinner and R. W. Burfitt. Proc. Phys. Soc. Lond., vol. 31, part III, Apr. 15, 1919, pp. 131-136, 1 fig. Liquid was forced under pressure through a capillary constriction between two limbs of a U-tube.







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FIFTH GENERAL PROFESSIONAL MEETING

ST. JOHN, N.B., SEPTEMBER 10-11-12, 1919.

SEPTEMBER 1919

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Bomb-Proofing the Wimereux Viaduct

By Lieut.-Col. B. Ripley, C.B.E., D.S.O., M.E.I.C.,
Commanding the 1st Battalion, Canadian Railway Troops, in France.

During the spring of 1918 enemy bombing had reached a state where it was necessary to take vigorous steps to preserve not only the bridges and railway structures at the front, but also strategic points on the main railway lines as far back as the very coast itself.

The Wimereux Viaduct was a heavy double track masonry arch viaduct, comprising 3 arches of 50′ each and about 70′ high, at Wimereux, a few miles north-easterly from Boulogne on the Boulogne-Calais Railway. This was a very important double track main line on which the greater part of the Belgian front depended for the getting up of all those supplies, munitions, etc., required in the carrying on of the war. The civil population also of Calais, Dunkerque, St. Omer, Hazebrouck, Bergues and smaller places were dependent, almost solely, on this line for their supplies. There was great use being made of this line as a troop carrier and, generally speaking, the loss of this line to the Allies at that time would have been rather a serious business, considering the extreme tension along the whole front.

The writer, at this time, was at the headquarters of his battalion, the First Battalion, Canadian Railway Troops, at Boubers-sur-Canche, a small town through which the battalion were constructing a new standard gauge cut off line between Hesdin and Frevent. This line, although it might be referred to as a strategic line, we will say little about. It was completed but never used to any advantage for the reason that the Hun, on the other side of the line, failed in his designs, the carrying out of which would have made the Hesdin-Frevent line a very important one and one worthy of considerable mention. The enemy had succeeded in bombing a very important railway bridge not many miles distant from Wimereux and numerous attempts had been made to destroy the Wimereux Viaduct itself. The First Battalion, Canadian Railway Troops, had never anticipated that it would be required to do work of this nature as far back as the coast and certainly never dreamed that it would be called upon in connection with the preservation of the Wimereux Viaduct, a work afterwards carried out by it and which it is now intended briefly to describe.

In order to give the readers a more vivid impression of the carrying out of such a work under war conditions, most of the correspondence, including the very first instructions in connection with the work, is included herein.

On the evening of June 3rd the following telegram was received from Epagnette:—

To 1st Canrail. Boubers-sur-Canche.

Wish you, in conjunction with O.C. 6 Survey Section, Major Boothby, at St. Omer to make reparation to RIPON Viaduct in case of necessity AAA BONNER will explain situation to you this afternoon AAA addressed 1st Canrail, repeated C.R.C.E.*, G.H.Q.*, and No. 6 Survey Section.

From R.C.E. Commns.*

**C.R.C.E.—Chief Railway Construction Engineer.*

**R.C.E. Commns.—Railway Construction Engineer, Lines of Communication.*

**G.H.Q.—General Headquarters.*

Perspective View of the Wimereux Viaduct.

On the evening of June 3rd, the following telegram was also received from Epagnette:—

To 1st Canrail. Boubers-sur-Canche.

In case of necessity detachment 1st C.R.T. will make reparation to RIPON Viaduct AAA Suggest material can be garaged at site, plant and personnel at TERLINGTHUN AAA Unskilled labor to be drawn if required from 264th. Coy. AAA Arrange meeting as early as possible tomorrow with 1st C.R.T. representative at site AAA C.R.T. is obtaining drawings of bridge, you possibly can get these more quickly through BRULARD at Boulogne AAA Addressed 6 Survey Section, St. Omer, repeated C.R.C.E., G.H.Q., and 1st Canrail Boubers-sur-Canche.

From R.C.E. Commns.

The above telegrams were the first intimations received that we were to carry out the work, and the writer, after having his adjutant look up the necessary code words and perceiving that the work was near Boulogne, made arrangements along with his second in command, Major A. R. Ketterson, D S.O., to visit the site of the viaduct and to meet Major Boothby, R.E., there.

R.C.E. Communications. B/79/5.

WIMEREUX VIADUCT

Reference your wires Nos. 95 and 96 of 3rd instant.

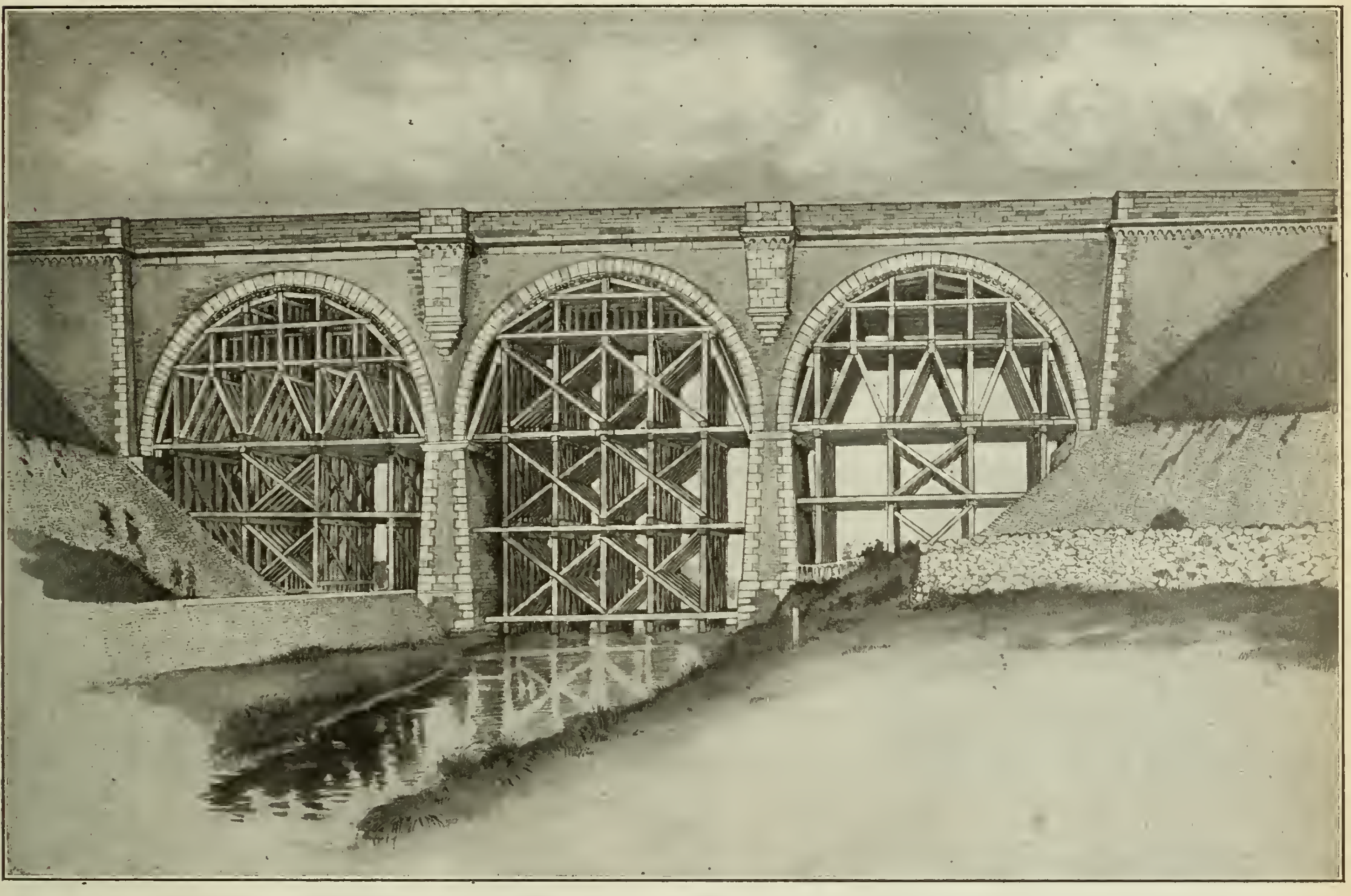
1. I met O.C., 1st C.R.T. this morning at the site and inspected this bridge. The plan had not arrived and M. BRULARD had sent his only remaining copy to C.R.C.E. yesterday, but he was able to supply a sketch plan to scale from which leading dimensions were ascertainable.

O.C., 1st C.R.T. has this sketch plan and will requisition certain material which is bound to be required.

2. O.C., 1st C.R.T. will camp his detachment near the site and material can be unloaded off the dead end siding running back to the viaduct from WIMEREUX station.

3. I am of opinion that it is improbable that the piers themselves will collapse in the vent of the viaduct being struck; also it is not probable than an arch span will be so destroyed as to cause collapse of the pier from the unbalanced thrust of the adjoining arch, and I do not think this contingency should be provided for in advance except by cutting timbers to lengths.

4. C.S.K.P. has steel girder spans up to 60 feet and these might be made use of for carrying track across a damaged arch span between piers. The thrust from the undamaged spans would be taken by timber needle beams if the break was small, but if a large one trestles bedded on the road or invert would have to be erected for the thrust block and struts.



Sketch of the Wimereux Viaduct with Centering in Position.

5. I understand that O.C., 1st C.R.T. is seeing you tomorrow and that you are also sending me in a drawing of the bridge and I will send sketches of these proposals as soon as I receive it.

6. I asked M. BRULARD to dump a turnout at the CALAIS side of the viaduct as probably single track only would be got over at first in the event of a break, and he agreed to do this and said he could also draw on the Nord dumps of rails and sleepers in the vicinity.

7. It seems advisable to send out two 5 ton travelling cranes, one to be stabled at TERLINGTHUN and the other at a dead end at AUBENGUE so that they would be in readiness for handling material at either end of a break.

B. W. B. Boothby,
Major, R.E.,
O.C., No. 6 Rly. Survey Section (Commns.)

A.P.O., S 2

4.6.18.

Copy to O.C., 1st C.R.T.

* * *

File X8/1079 A.

In the Field, June 5th, 1918.

R.C.Ry. Communications.

WIMEREUX BRIDGE

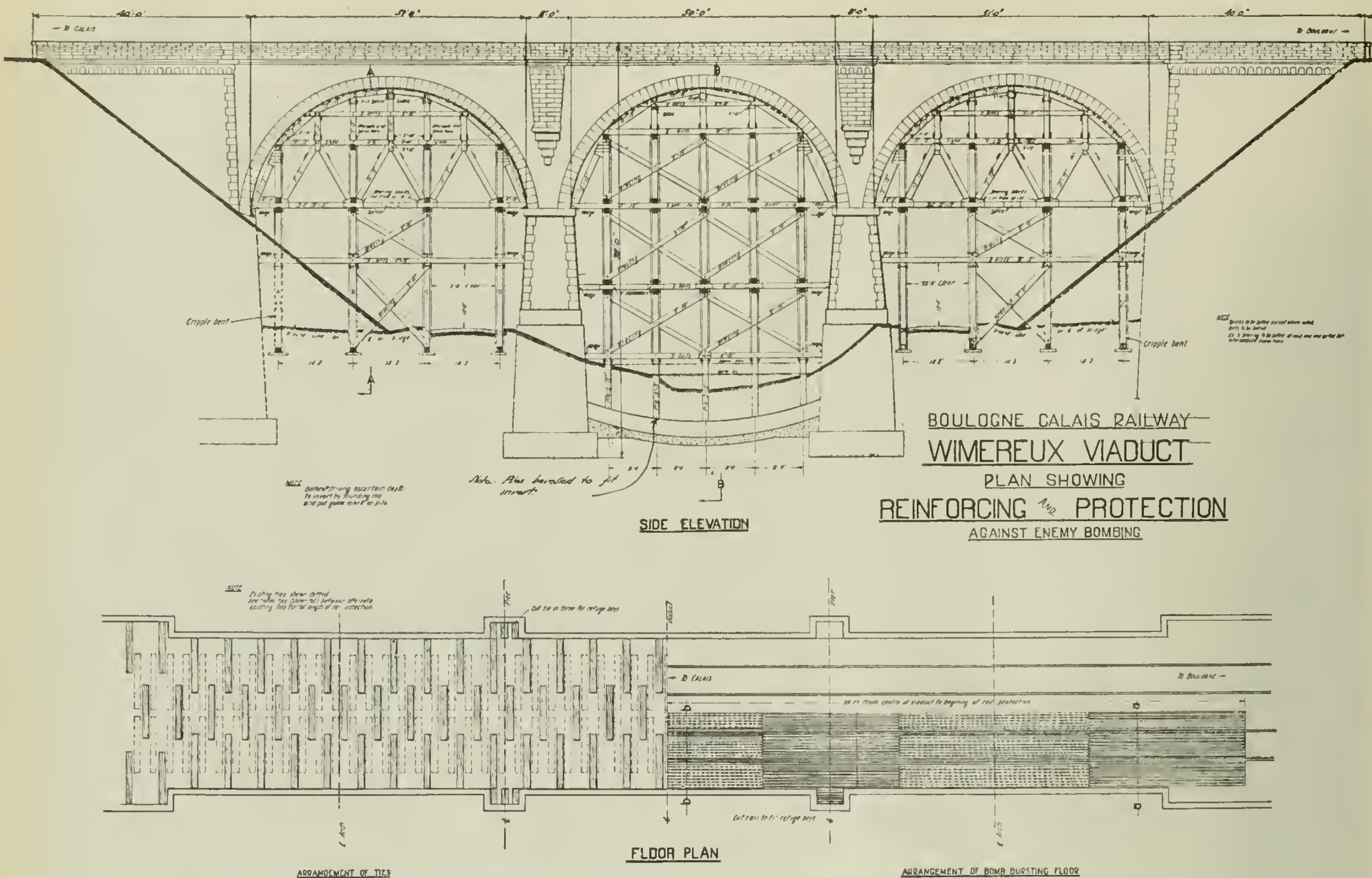
In compliance with your wire of June 3rd, in connection with the marginally noted subject, I visited the site of this bridge yesterday, along with Major Boothby. We did not have a plan of the bridge at the time, and really no method of taking care of the structure was discussed.

This morning I have been placed in possession of a skeleton plan of the structure, and the taking care of the structure is a rather serious proposition, and the importance of keeping the line open between Boulogne and Calais must determine the nature of the work to be undertaken now.

I am rather inclined to think that the keeping of the line open will warrant the re-centering of each of the three arches, as I have shown in red on attached plan. In case an arch were broken it seems to me that this method would have to be adopted anyway, whether or not the floor system was made good by timber stringers or a steel span, the "thrust" has got to be taken care of in any event.

The centre span will very likely be a pile proposition, although on one sketch furnished me by the French Engineer at Boulogne, a masonry invert, from 4½ to 5 feet in thickness was put in, to take certain stresses that were thought might be encountered, on account of the peculiarity of the foundation. This invert might be used to take the loading, which could be put on blocking or crib, but the existence of this invert will have to be taken upon the ground by sounding.

I believe that, with this bridge centered as I have shown on the sketch and treated with a floor of steel rails, (as I have also shown on the sketch), to explode any bombs that might be dropped upon the bridge, it would have a very good chance of remaining in position, although it were bombed. In any event I think that very little of the timber centering would be effected by any bomb that might be dropped on the top of the bridge, and this timber would permit



the making good of the bridge very quickly. The posts could be continued up to the proper height and capped to receive stringers, which would carry the track. The effect of the steel rail floor would be to explode the bomb before it had penetrated. It would distribute the shock over a large area and with the aid of the centering the arch should be able to stand the shock.

Regarding the proposal to stock the material on the ground, to make reparation in case of bombing, this would probably be alright. Provision would have to be made however, in the event of an arch being broken, for the closing of the bridge to traffic. It could not be much less than a week, especially if the centre span was effected.

It might be a good idea to have a double cross-over installed at either end of the bridge, to permit the using of one track, in case the bridge were bombed and only one track put out of commission.

In making the above suggestions and proposals, I quite realize that the importance of the line, the supply of timber, etc., will determine just how elaborate a scheme will be carried out, and I would like to have your decision in the matter, as soon as this is arrived at. In the meantime I have ordered sufficient timber, including stringers, to take care of one of the arches.

I will immediately investigate the supposed existence of the masonry invert, in the centre opening, and if there is no invert, will order a land pile driver on to the ground at once. The piling might be driven in this opening without the doing of any further work if desired, but I do not favour the idea, for the reason that the falling arch would probably render these useless.

I am despatching one Officer and 25 Bridgemen to the site of this bridge, so that they will be there on arrival of the material which has been ordered.

B. Ripley,
Lieut.-Colonel.
O.C., 1st Battalion, Canadian Railway Troops.

E.C. 1011/68.

Secret and Urgent

C.R.C.E.

WIMEREUX VIADUCT

1. In accordance with your wire E.R. 82 of the 2nd inst., (received 3rd inst.), I took steps regarding the methods to be adopted towards this bridge, should it be damaged by enemy action.

Capt. BONNER, R.E., was sent to H.Q., 1st Battn. C.R.T. to explain the situation and request that Lieut.-Colonel RIPLEY should make himself responsible for any repairs that may become necessary, and that he should generally discuss the question with Major BOOTHBY, R.E.

These officers met at WIMEREUX yesterday morning; unfortunately I was unable to get them out the plans in time, so it was impracticable for them to formulate a joint report.

2. I beg to hand you herewith:—

(a) Report and plan from C.O., 1st. Battn., C.R.T.

(b) Report from O.C., No. 6 Survey Section.

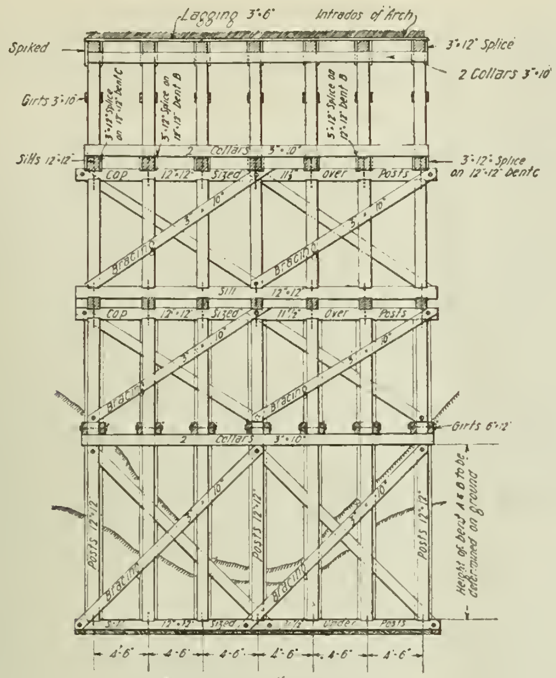
Colonel RIPLEY came in to see me this morning, and at my request prepared the report and plan referred to.

3. The whole affair appears to resolve itself into a matter of policy as to:—

(i) How much one is prepared to risk.

(ii) What are the consequences attached to a lengthy delay in effecting reparations.

I have discussed the matter with Commandant TISSERAND and Capt. VICTOR today, and they are both in favour, as far as possible, of having such remedial work as may be necessary done in advance.



SECTION A-A

In principle, I absolutely agreed, the guiding factor appearing to be as to whether the timber is available and can be spared for the purpose.

4. There are apparently two ways by which damage can occur:—

(A) By a direct hit.

(B) By a bomb falling alongside the structure.

(A) From observation at ETAPLES, it is fairly apparent that the bomb which partially destroyed the arch there exploded after penetration and before percolation. Consequently (I assume that the explosive effect of a bomb is outwards and upwards) no damage would be done to the under-structure except by debris falling by gravity.

(The suggested decking of rails would hasten the explosion). This should do no serious hurt to preliminary timbering. This timbering would act laterally as a counterfort, and should an arch be destroyed, will take up the thrust from the adjoining one; in plan it divides the spans so that it will act vertically as the supports of comparatively light stringers.

(B) I do not think that a bomb falling alongside the bridge would do a great deal of harm: the possible consequences appear to be:—

Undermining of the foundations.
Damage to abutments or piers.
Partial destruction of preparatory false work.

All should be easily remedied.
The headway is such that I do not think the arch would be damaged.

5. Conclusion.

The preparations made should be either:—

(1) On the assumption that a complete span is to be put over a damaged arch.

(2) That false work be built up and a series of short spans subsequently interposed, if necessary.

(1) It will, I think, be a long job to get large girders in position; much masonry would have to be cut away to prevent having to raise the rails abnormally on both sides. There is no room for a centre girder, and consequently both roads would have to be dealt with, even if only one were damaged.

(2) I am entirely in favour of this scheme, which resolves itself into whether the trestling shall be placed in position before (with a possibility that it will hold up the whole structure, and a possibility that it may be knocked out), or after the event.

6. I have wired for the timber asked for by C.O., 1st Battn., C.R.T.

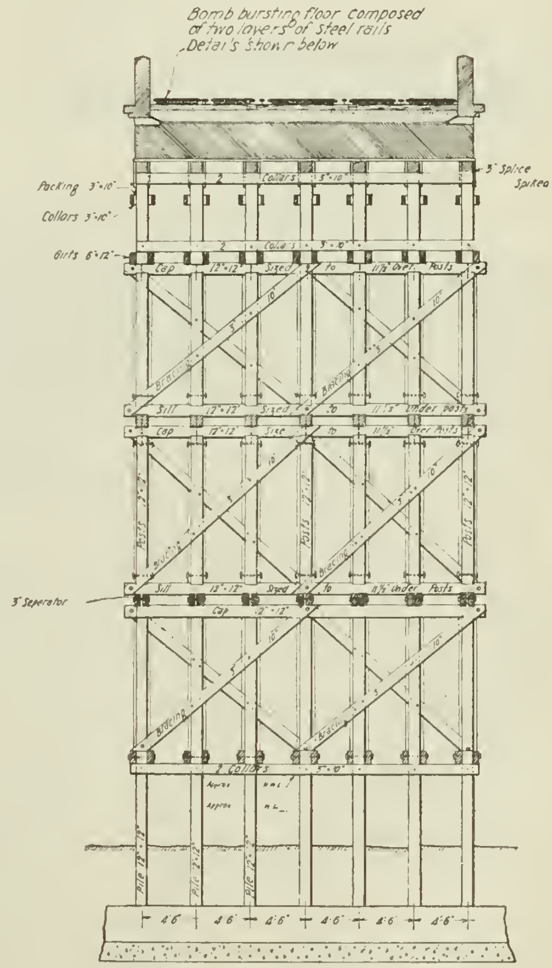
Will you please let me have your instructions in the matter.

W. W. Wilson,
Lieut.-Colonel, R.E.,
R.C.E. Communications.

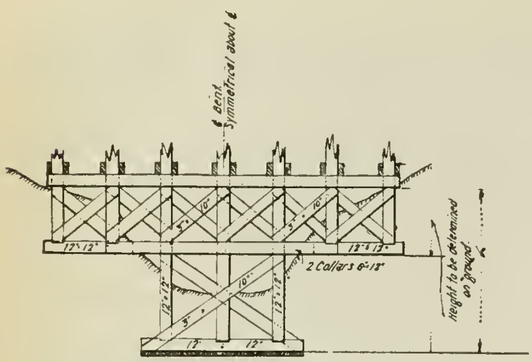
Enclos. (plan.) Will you kindly send copies of the plan accompanying Col. RIPLEY'S report to Major BOOTHBY, R.E., Commandant TISSERAND, and myself.

Copies to — C.O., 1st. Battn., C.R.T.
O.C., No. 6 Survey Section.
Commandant TISSERAND, without enclosures.

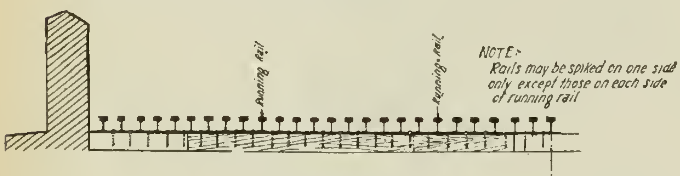
A.P.O. S.I.
5/6/18.
H.



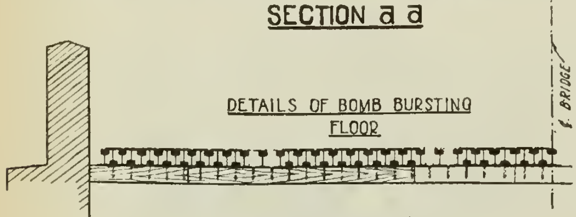
SECTION B-B



DETAIL SHOWING BOTTOM OF CRIPPLE BENTS



SECTION a a



SECTION b b

FOR HALF RAIL LENGTH ON EACH SIDE OF CROWN

In connection with the preparing of the plan and general scheme on which the work was carried out, there was nowhere any precedent to follow, and at the same time the supply of timber available determined to a great extent the dimensions used. At home we would order the various sizes required, but in France we used what we could get; hence, economic considerations scarcely enter into the case at all. The roadways on either side of the stream were important and had to be maintained at their full width. The presence of the concrete invert, at first, was looked upon as an obstacle as it was intended to cut off the piles in the centre span slightly above the water line.

The work in connection with the flanking spans was started first, the bents being placed on substantial blocking or mud sills. On driving the first pile in the centre span it was found that the mud overlying the masonry invert was so dense that the pile would stand vertically unsupported and that the layer of mud next the invert was more like a blue clay than was anticipated. This allayed greatly our fears that the loaded piles would have a tendency to shift or slide on the invert, which is seen from the plan to follow a slight curve. It was then decided to cut off the piles at a considerable height above the water, as is shown on the plan, and to cap them at that point.

On account of the shallowness of the mud and clay overlying the invert and the curved surface of same, it was decided to further insure the stability of the piles by stiffly strutting them, both in the direction of the bridge and transversely, with double 6" x 12" timbers well secured to the piles. The bracing above this line was intended to further secure the position of the piles below the line of the struts, in case there should be any tendency of the piles to shift on the invert.

The second deck of bents was arranged with cut-off, or cap elevation, at such a height as to receive or support 12" x 12" longitudinal sills or struts at the springing line of the arches, in order to take care of the thrust in the event of damage to any of the arches from enemy bombing. The existence of good liberal stone copings at the springing line of the arches facilitated the work considerably and assisted in the support of the 12" x 12" arch ribs.

From the springing line upwards the erection was rather difficult on account of the large amount of framing and fitting, as the arches were not by any means true, and derricks could not be used on account of the overhead obstruction by the masonry structure itself. Strong hooks made from Decauville railway rails were made and secured to the parapet walls above, and the timber was hoisted into place by two hoisting engines operated from below.

On account of a very marked irregularity in each of the arches great difficulty was experienced in the framing and fitting of the arch ribs. This difficulty was accentuated by the small space left for erection.

There was little difficulty in placing the lagging, which was intended to have only a snug or slightly loose fitting in any case.

To Canrail, Boubers.

June 6, 1918.

Rippon Viaduct AAA Your proposals agreed in entirety AAA Should be got down to at once AAA Send me indents for necessary material AAA Submit design for overhead cover underside fifteen feet above rail carrying bags of stone two deep for bursting purposes AAA Addressed 1st Canrail Boubers, repeated 6 Survey Section St. Omer.

From R.C.E. Commns. (Epagnette).

To R.C.E. Commns.

Please have me wired authority to commence work at Ripon Viaduct AAA French sentinels have no authority about this AAA Wish to dig test pits tomorrow.

From B. Ripley.

To 1st Canrail, Boubers near Frevent.

Authority to commence work given by French AAA Passes will be issued to Colonel Ripley, Major Ketterson and Major Holland.

From R.C.E. Commns. (Epagnette).

While it might appear from the complete correspondence that about two months were occupied in carrying out the work, it might be stated that one month would be more nearly correct. During July, 1918, or the second month, the majority of our C. Company men at Wimereux were building bomb-proof dug outs, or tunnels, for Canadian Nursing Sisters at Boulogne, and the balance of the men were doing such work as placing lagging, which was not considered of utmost importance. There was also a delay of about a week in getting the necessary timber and plant on to the ground. Little time was occupied, however, in rushing these men to Amiens, to join the other three companies of the battalion in their work there, when the Hun gave way early in August.

The placing of steel rails, two deep, on the deck of the bridge was intended to explode any bomb, before the bomb had penetrated, that might be dropped on to the bridge, and to distributed the shock over a greater area. These rails were secured to the ties, additional ties having been placed under and between the tracks as shown on the plan. The first layer of rails were spiked down in the ordinary way, using angle bar splices as the track was on a slight curve, and the second layer was dropped in between, ball down. The rails, used in this bomb-bursting floor would make about 1¼ miles of track.

The bomb-proofing of the Wimereux viaduct was, of course, not a guaranteed piece of work, but, judging from the effect of bombs that had been dropped in the neighborhood especially in the vicinity of Etaples, the writer had confidence in the scheme. With the steadily increasing size of bombs and the terrible effect of the explosives used, the readers, and those who have seen the effects of bombing in the war zone, must judge for themselves as to the merits of the work carried out. The scheme was, however, whole heartedly endorsed by both the British army authorities, and the French army authorities in Paris. It was probably the only attempt, on a large scale, to bomb-proof any structure in the Allied war zone, there being nearly a quarter of a million feet of timber alone in this one bridge.

The work, under the supervision of Major A. R. Ketterson, D.S.O., A.M.E.I.C., (Assistant Engineer, Canadian Pacific Railway, at Montreal,) was carried out by C. Company of the 1st Battalion, Canadian Railway Troops, under the command of Major R. R. Holland, formerly District Engineer, National Transcontinental Railway. Major W. Monds, A.M.E.I.C., Chief Engineer of the Battalion, was engaged on other special work at the time near Etaples and, consequently, was not available for this work. The Honourable, the Minister of Militia, General Mewburn, and other prominent Canadians visiting the front on special missions, viewed this work and expressed themselves as greatly pleased with what seemed to them the boldness of the scheme and the quick and workmanlike way in which it was carried out.

Lt.-Col. B. Ripley, O.C., 1st Bn., C.R.T., B.E.F. — France, June 7th, 1918.

COL. LYELL approves of your scheme for the reparation of the WIMEREUX VIADUCT, near BOULOGNE, and requests that you go ahead with the work immediately.

R.C.E. Comms. will be able to give you detailed instructions and advise you officially.

J. W. Stewart,
Brig.-Gen.,
G.O.C., Corps Canadian Railway Troops.

A.P.O., S 33,
B.E.F.

File X8/1079. A.
In the Field, June 13th, 1918.

R.C.E. Communications.

I am sending you herewith in triplicate, blue prints showing details of the work in connection with the viaduct at WIMEREUX. It may be necessary to make slight alterations on account of variations in material supplied, but there will be no change to upset in any way the purpose for which the plan is intended.

Regarding the submitting of a design for an overhead covering, 15 feet above the rail, carrying bags of stone two deep, for bursting purposes, mentioned in your wire of the 6th, this matter has not yet been fully considered, it has, however, been considered to the extent that it is deemed inadvisable that this, if adopted, should be connected with the work now being done. If the two schemes are both to be carried out, I think that theyshould have entirely independent means of support.

The overhead scheme, if adopted, is going to entail a large amount of work, and my own opinion at this time is, that is if the scheme now being carried out has not the maximum of confidence, that the work and material that would be involved in the overhead scheme, might possibly be added to the scheme shown on the attached plan, which could be still more elaborated.

B. Ripley,
Lieut.-Colonel,
O.C., 1st Battalion, Canadian Railway Troops.

Copy. Secret.

(E.C. 1011)
Chief Railway Construction Engineer, E.R. 8233 15-6-18

R.C.E. Comms.

WIMEREUX VIADUCT

Reference your E.C. 1011/57, dated 14/6/18, I approve of the arrangements for timbering shewn on your plan 11-2/2, dated 14/6/18.

I agree with Colonel RIPLEY and overhead cover need not be fixed. The rail cover should take the form of that shewn in the top and bottom sections of your plan, viz.: B.B. and A.A.

I presume that your are sending this plan to Commandants VICTOR and TISSERAND to let them know what we are doing.

(Sgd.) David Lyell,
Chief Railway Construction Engineer

G.H.Q.,
15th June, 1918.

Japanese Lines in Manchuria

Japan is displaying renewed activity in Southern Manchuria which is within her sphere of influence. Six railway schemes have been proposed, one of which is the extension of the Changchun-Kirin line to the Korean boundary at Hoi-yang. This is an important proposal, since the new line will afford a connection between Manchuria (Eastern and Northern) and Chhyong-yin, the new port of North-east Korea, which will be the actual terminus of the line, and which affords good shelter and deep water facilities, allowing 10,000 ton vessels to approach close to the shore. The new railway which will be constructed as soon as possible, is likely to divert a good deal of traffic from the Chinese Eastern Railway in Northern Manchuria, and to make Chhyong-yin a serious competitor with Vladivostock, besides tapping for Japan's benefit, the existing and potential wealth of Inner Manchuria. (*Peking Leader Feb. 11, 1919.*)

The Design and Construction of Reinforced Concrete Covered Reservoirs.

By R. DeL. French, M.E.I.C.

Introduction

Covered concrete reservoirs for water storage are discussed in this paper from the standpoint of structural design only. It does not deal with their location nor capacity.

Primarily, charts are presented by means of which rough estimates of cost may be easily made, and the most economical design quickly selected, having given the required capacity. Secondarily, certain formulas, diagrams and tables are offered, which it is thought will shorten the actual work of detailed design. It has been assumed that the reader is familiar with ordinary reinforced concrete design, so that no explanation of its general principles is given. Finally, a table of data and costs relating to reservoirs of various types and sizes is annexed, together with drawings of typical reservoirs, and a bibliography of the more important recent articles dealing with these structures and with questions relating to them.

Water Storage

Ground water, or water which has been filtered, should be stored in the dark to prevent the growth of light-loving micro-organisms, which, though in themselves innocuous, impart disagreeable tastes or odors, or both, to the water in which they live. Covered reservoirs have also other advantages, although these are of less importance. They keep water cooler in summer and warmer in winter than do open reservoirs, they do not suffer such a large diminution in effective capacity, due to ice formation in cold weather, their contents are better protected against dirt and gross pollution, and their roof areas are available for park, playground or other purposes. The rapid increase in the number of water filtration plants in Canada and the United States during the past two or three decades has, of course, led to a corre ponding increase in the number of covered reservoirs required as adjuncts to these plants.

Construction Materials

The covered reservoirs of Great Britain and the Continent, where filtration became common at a much earlier date than here, have generally been built of brick or stone masonry, and only recently has there been a noticeable tendency toward the use of concrete. In North America, however, the beginning of the period of great activity in filtration practically coincided with the beginning of the present era of concrete. It is not surprising, therefore, that substantially all of the covered reservoirs on this continent have been built of concrete, either plain or reinforced, since this material is peculiarly adapted to the purpose on account of its flexibility in design. The larger structures have very generally been constructed with gravity or semi-gravity walls, groined arch roofs, inverted groined arch floors, and little or no reinforcement. The smaller ones, on the other hand, are almost always of reinforced concrete. The present trend seems to be away from the first type and toward the second, possibly because there have been a number of failures of groined arch roofs, because there is no well accepted method of designing them, and because more economical reinforced concrete design is being rapidly developed.

Economical Dimensions

Covered reservoirs are usually either rectangular or circular, although there is no good reason why they should not be of different shapes, if required by topographical or other considerations. Their capacity is determined by local factors in each case. Having determined this, it remains to decide upon the most economical combination of depth and area. The depth may sometimes be governed by allowable variations in pressure, or by similar factors, and the area by the size of the site, but both may generally be varied within fairly wide limits by the designer. The depth of a reservoir, measured from the under side of the roof to the floor, is always somewhat greater than the depth of water below the level of the overflow. The latter must be less than the former by at least the head required to discharge the maximum inflow through the overflow, if there is to be no upward pressure on the roof. The clearance is usually greater than this.

There is a prejudice on the part of some engineers against allowing water to rise above the soffits of the roof beams. This prejudice does not seem to be well grounded, as, with proper air vents and an adequate overflow, there is no danger of lifting the roof with a rising water level, nor of imposing an excessive atmospheric load upon it with a falling one. Neither is there any reason to suppose that the concrete in the roof will be more subject to damage from alternate wetting and drying than that in the walls, which is unavoidably subject to such conditions.

Attempts have been made to find analytically the most economical depth, and hence the required area for a given capacity, but without much success, since any mathematical treatment must perforce be either very complex or rest upon a foundation of numerous assumptions. The best design for any given case can be most satisfactorily arrived at by the trial and rejection of many tentative ones. To facilitate this process, the charts of Figures 1, 2, 3 and 4 have been prepared, from which the concrete and steel quantities required in rectangular reservoirs may be taken off. Before plotting these diagrams, a large number of designs were carefully made, and the unit quantities in each computed. These quantities were then plotted, as shown by the curves. It may be remarked that, while *all* the points did not fall on the smooth curves given, most of them fell in astonishingly regular order. In selecting permissible stresses, etc., for these designs, the rulings of the Special Committee on Concrete and Reinforced Concrete of

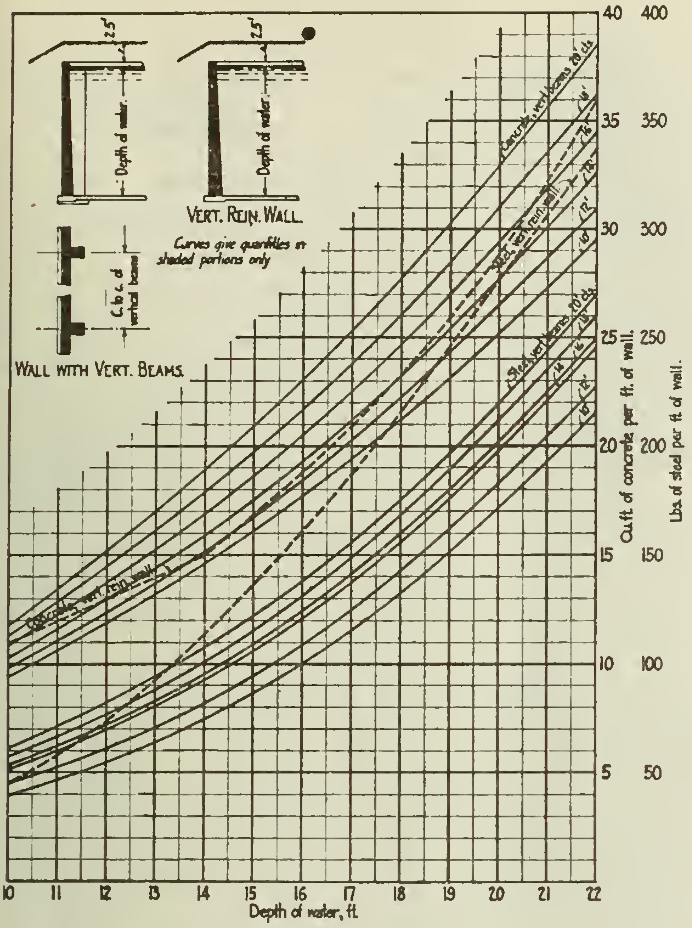


Fig. 1.—Concrete Covered Reservoirs.

the American Society of Civil Engineers were followed, except in the calculations for flat slabs, where the regulations of the Chicago Department of Buildings were adopted.

In the design of walls, as shown in Figure 1, two conditions were investigated. In the first case, with reservoir full, hydrostatic pressure due to the full depth of water was assumed as acting on the inside face of the wall, while earth pressure due to a fill 2.50 ft. lower than the height of the wall acted on the outside face. Earth was taken as having a slope of repose of slightly over 1 to 1 (ϕ = 47°30′), which is equivalent to a fluid weighing 15 lbs. per cu. ft. In the second case, with reservoir empty, the pressure on the outside of the wall was taken as that due to an earth fill 2.50 ft. higher than the top of the wall. Here the slope of repose was taken as approximately 1¾ to 1 (ϕ = 33°00′), which corresponds to a fluid weighing 33 lbs. per cu. ft. In both cases, the vertical height of the wall was assumed as 6 ins. greater than the depth of water, and earth was assumed to weigh 100 lbs. per cu. ft. In calculating the weight of reinforcement required, a liberal allowance was made for lap and bond lengths and for spacing bars.

Although Figure 2 gives quantities for flat slabs only, it is approximately correct for slab and beam roofs, since it was found that there was no marked difference between the quantities for these two types, although there may be in their respective unit costs. The roof was designed for a safe load of 300 lbs. per sq. ft., not including the weight of the slab itself.

Figure 3 gives the safe capacity of square and round columns of different sizes and with various percentages of longitudinal steel. For square columns, this is based on the gross area of the section, while for hooped columns only the area inside the reinforcement was considered. With the help of the small table at the bottom of the figure, the quantities in such columns may be easily calculated. The spiral hooping in the circular columns represents approximately an additional 1% of steel.

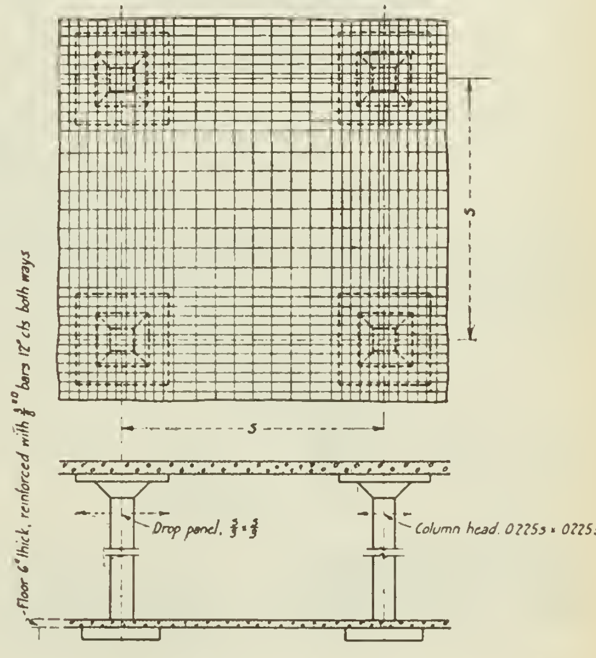
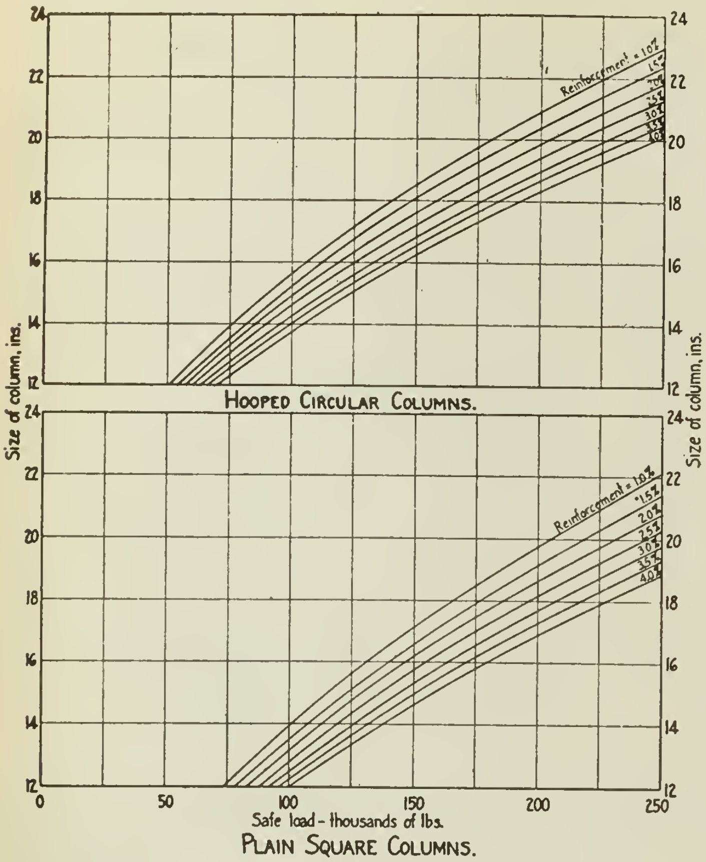


Fig. 2.—Concrete Covered Reservoirs.



Volume of concrete in columns, cubic feet per lin foot

Size of column, ins	12	14	16	18	20	22	24
Square.	1.00	1.36	1.78	2.25	2.78	3.36	4.00
Circular.	0.79	1.07	1.40	1.77	2.18	2.64	3.14

Hooping in circular columns assumed 1½" from surface of concrete: capacity based on area of core only
Capacity of square columns based on total area

Fig. 3.—Concrete Covered Reservoirs.

Figure 4 gives the quantities of steel and concrete in square footings for various column loads and soil bearing capacities. An approximate estimate of the quantities in wall footings may be easily made, and as these will vary widely, it was not thought practicable to plot curves for them. In any event, they represent only a small percentage of the total quantities in a reservoir, unless it be of very limited capacity, and a comparatively large error here will seldom have much influence on the final result.

Excavation and fill are easily calculated, and vary in each case. If there is no reason for a different procedure, the bottom elevation of the reservoir should be so fixed as to make the cut and fill balance, paying due regard to an allowance for shrinkage. Piping, gatehouses, etc., are not subject to much variation in cost for reservoirs of the same capacity but of different depth and area, and hence may properly be omitted from comparative estimates.

In the case of circular reservoirs, Figures 2, 3 and 4 may be used, and a rough design for the wall worked out by the aid of Formulas 15, 16 and 17. It is well to note, however, that these formulas give a thickness of wall which is greater than that used in many satisfactory designs, hence they are by some considered ultra-conservative.

Basis of Design

There is, naturally, considerable latitude in regard to the assumptions to be made preliminary to the design of a concrete covered reservoir. The stresses to be allowed in the concrete and steel, etc., should conform either to the recommendations of this *Institute*, or to those of some other recognized authority. Some engineers advocate the use of lower stresses than these, on the ground that much of the load is uncertain and cannot be accurately computed, but it is thought to be the better practice to estimate the loads with liberality, and then to use stresses which have proved satisfactory in building construction. Comparatively speaking, a covered reservoir is a simple structure, and it should be possible with ordinary care to get at least as high a quality of materials and workmanship in it as in the case of buildings, which are generally far more complicated.

The preliminary estimates will have established the best spacing of columns. There are practically no limitations to the arrangement of the latter, since no use is made of the floor space in a reservoir. If a slab and beam roof is preferred to a flat slab, the economy of equal column spacings in both directions, and slabs reinforced both ways, should be investigated. Two and a half feet of fill over the roof should be sufficient for most parts of Canada and the northern United States, but in some extreme cases it may be advisable to increase this depth. Five feet was adopted for some small reservoirs in the Rocky Mountains, on account of the intense and long-continued cold there, and the infrequent change of the water stored. Fifty lbs. per sq. ft. live load, in addition to the weight of the fill on the roof, is ordinarily ample. The most severe conditions of roof loading probably occur while the fill is being placed, due to teaming, the use of scrapers, etc. Experience shows that a roof designed for a total load of 300 lbs. per sq. ft., exclusive of the weight of the slab, will safely withstand this test.

Turning to the walls, the type will have been settled by the preliminary investigations, and it remains to determine the probable earth pressure. The whole matter of earth pressure is in such an unsatisfactory state, that reducing it to an *eqivalent fluid* seems to be as convenient and logical as any method of treatment. An *equivalent fluid* is one which will produce the same pressure on the wall at any depth as is given by earth. The unit weight of such a fluid will vary with the assumed weight of earth and with its angle of repose. A curve of equivalent fluid weights, earth being assumed to weight 100 lbs. per cu. ft., is given in Figure 5, which is based on the familiar formula of Rankine. With the reservoir empty, the maximum probable earth pressure should be considered as acting. With the reservoir full, it is safer practice to assume that the internal hydrostatic pressure is resisted by earth pressure from dry material having the lowest conceivable angle of repose. Owing to the possibility that shrinkage cracks may open between the wall and the back-fill, it is also better to omit the resisting pressure of the earth, with full reservoir, for some distance down from the top of the fill. No definite rule can be given for locating the point where this resisting pressure begins to act, but 5 ft. below the surface of the fill should be enough for any ordinary soil.

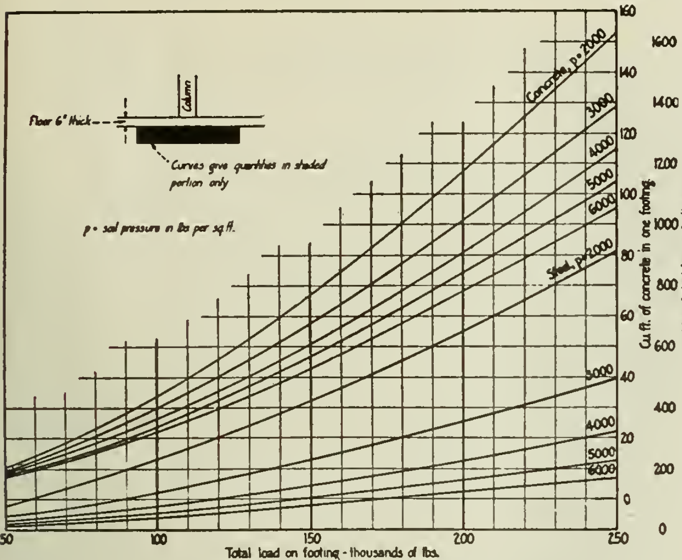


Fig. 4.—Concrete Covered Reservoirs.

If the ground water plane is above the floor of the reservoir, its effect upon the load on the wall must be considered. In Figure 6, let the ground water level be as shown. Assuming a slope of repose for dry earth of 1½ to 1, and a unit weight of 100 lbs. per cu. ft., the equivalent fluid weight, from Figure 5, will be 28 lbs. per cu. ft., and, consequently, $p_1 = 28$ h. If earth under water weighs 70 lbs. per cu. ft., and its slope of repose is 2½ to 1, the equivalent fluid weight is then $46 \times \frac{70}{100} = 32$ lbs. per cu. ft. Hence, that part of p_2 due to a depth h_2 of earth under water is $32\ h_2$. But there are also additional pressures at this point from the earth above the ground water level and from the water below this plane. The former is $46\ h_1$ and the latter is $62.5\ h_2$, so that the total $p_2 = 32\ h_2 + 46\ h_1 + 62.5\ h_2 = 46\ h_1 + 94.5\ h_2$. For example, let $h_1 = 4$ ft., and $h_2 = 6$ ft. Then.

$a = 28\ h_1 = 28 \times 4 =$ 112 lbs. per sq. ft.
$b = 46\ h_1 + 94.5\ h_2 = (46 \times 4) + (94.5 \times 0) = 184$ lbs. " "
$c = 46\ h_1 + 94.5\ h_2 = (46 \times 4) + (94.5 \times 6) = 751$ lbs. " "

Having these unit pressures, it is a simple matter to find the total pressure on the wall and the location of its point of application. The true pressure diagram probably follows some curved line, near the ground water level, shown dotted in Figure 6, rather than the full line, with its abrupt change.

The view to be taken in the design of the floor varies according to the character of the foundation. In ordinary dry soils, it is regarded as a pavement, the function of which is merely to prevent leakage. In wet ground, the assumptions may vary from the view just stated, to regarding the whole reservoir as a box subject to flotation, and hence requiring a heavily reinforced floor to withstand the uplift. In one case of this sort, check valves opening inwards were used to prevent the possibility of an upward pressure on the floor. Obviously, this expedient could not be adopted where the ground water was polluted and unsafe for use, nor without some special provision for cleaning the reservoir, when necessary.

Design of Walls

Reservoir walls may be classed as
(a.) Gravity.
(b.) Semi-gravity.
(c.) Cantilever.
(d.) Counterfort and buttress.
(e.) With vertical beams.
(f.) Vertically reinforced.
(g.) Circular.

(*a*) *Gravity Walls.*

Gravity walls are seldom used for covered reservoirs. Their design presents no difficulties.

(*b*) *Semi-gravity Walls.*

Semi-gravity walls have been frequently used in reservoirs built with groined arch roofs. Their design is a matter of precedent and judgment. The table below gives the ratio of width of base to height of wall for a number of semi-gravity walls.

TABLE I

Semi-gravity Walls

	Reservoir	Ratio of base to height
1.	Tentative design, F. H. Carter....	0.16
2.	Brookline, Mass................	.14
3.	Kamloops, B.C..................	.19
4.	Plumsted, Eng..................	.21
5.	Shooters' Hill, Eng...............	.17
6.	Hornsey Wood, Eng..............	.25
7.	Burton-on-Trent, Eng............	.26
8.	Montreal, Que. (filter plant).......	.20
	Average =	0.20

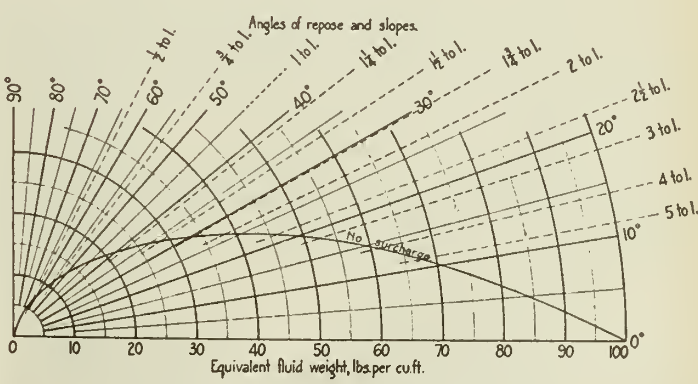


Fig. 5.—Concrete Covered Reservoirs.

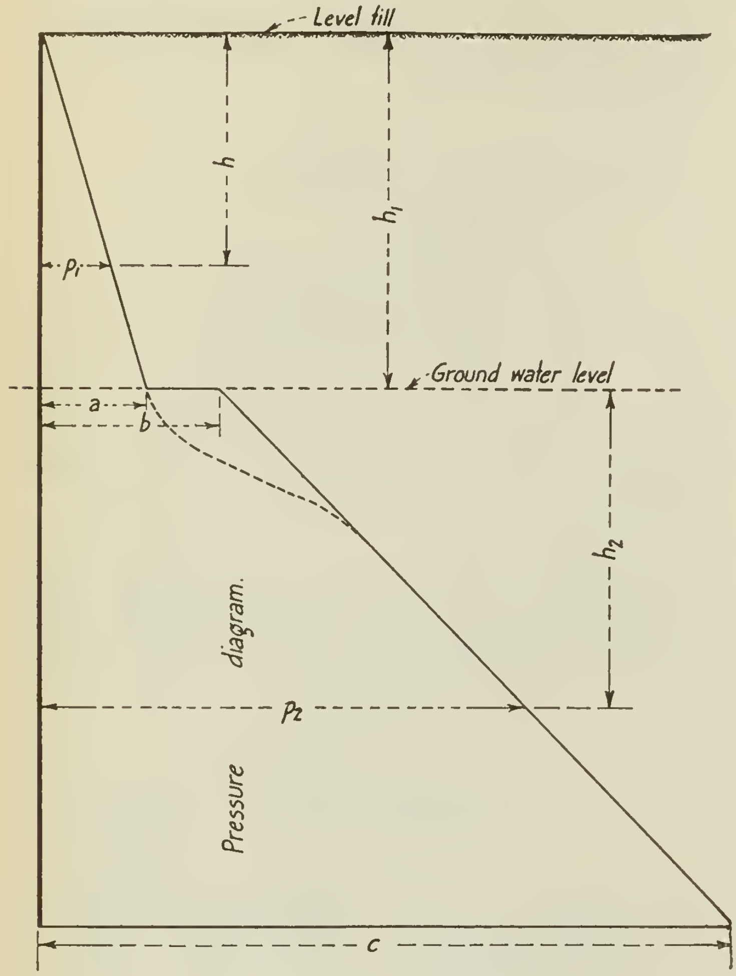


Fig. 6.—Concrete Covered Reservoirs.

It will be noted that this ratio is less than 0.40, a commonly accepted figure for retaining walls. It must be remembered, however, that there are forces, such as the load, and thrust, if any, from the roof, imposed on the wall of a covered reservoir, which are not present in a simple retaining wall, and that therefore the two are not strictly comparable.

(c-d.) Cantilever, Counterfort and Buttress Walls.

Reinforced concrete cantilever, counterfort and buttress walls have been used to some extent. The method of design is not substantially different from that used in the case of simple retaining walls of the same types.

Note.

The five types of walls so far discussed do not take full advantage of the support afforded by the roof and floor, which is an important factor and should not be neglected.

(e). Walls with Vertical Beams.

Walls with vertical beams are horizontally reinforced, and the reactions of the slab are carried by the vertical beams to the roof and floor. These beams are usually located on the center lines of the columns, though there may be intermediate ones. M = WL/12 applies to the intermediate panels of the wall slab, and M = WL/10 to the end panels, if these are restrained at the corners of the reservoir, otherwise, M = WL/8 should be used here.

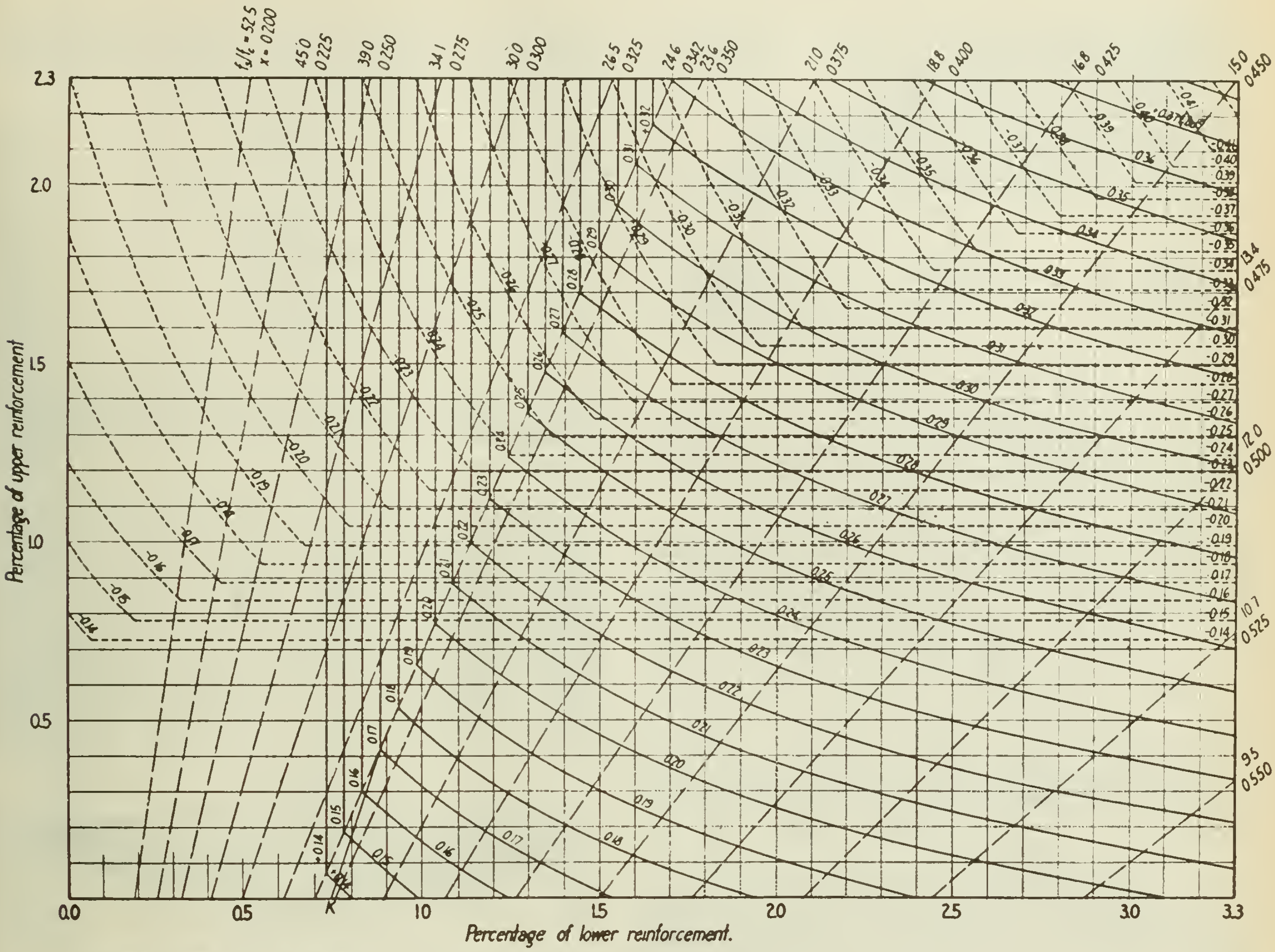
Since this slab is necessarily reinforced on both faces, it might be made thinner than is required by Formulas 1, 2, 3 and 4 for single reinforcement, and also less steel might be used. This is seldom done, although the calculations, which are tedious if performed arithmetically, are greatly simplified by the use of Figure 8. Shear at the ends, and not the moment, will usually determine the theoretical thickness, while the practical thickness is generally fixed from considerations of water-tightness. Five inches is recommended by one writer as the minimum allowable thickness, but most engineers would hesitate to use less than 10 or 12 inches.

Formulas for Horizontally Reinforced Walls (Single Reinforcement).

Having determined upon the earth pressure to be taken, convenient formulas may be derived for the thickness and reinforcement of the wall. Consider a strip one foot wide vertically, and let

L = span of slab, center to center of vertical beams, feet.
k_1 = equivalent fluid weight of earth, reservoir full, lbs. per cu. ft.
k_2 = equivalent fluid weight of earth, reservoir empty, lbs. per cu. ft.
h_1 = " head " of earth on center of strip, reservoir full, feet.

Fig. 7.—Concrete Covered Reservoirs.



This diagram is adapted from Steinman's translation of Prof. J Melan's "Plain and Reinforced Concrete Arches"

Fig. 8.—Concrete Covered Reservoirs.

h_2 = "head" of earth on centre of strip, reservoir empty, feet.
h_3 = head of water on centre of strip, reservoir full, ft.
t = thickness of slab from compression face to center of gravity of steel, inches.
A_s = area of steel required in given strip, sq. inches.
f_s = allowable stress in steel = 16,000 lbs. per sq. inch.
f_c = allowable stress in concrete = 650 lbs. per sq. inch.
n = ratio of moduli of steel and concrete = 15

Then for reservoir full and M = WL/12,

$$t = 0.0278\,L\,\sqrt{62.5\,h_3 - k_1 h_1} \qquad (1)$$

And for reservoir empty and M = WL/12,

$$t = 0.0278\,L\,\sqrt{k_2 h_2} \qquad (2)$$

The coefficients in these formulas become 0.0304 and 0.0340 for M = WL/10 and M = WL/8, respectively. In all cases,

$$A_s = 0.0923\,t \qquad (3)$$

or, if t is greater than is required by the moment,

$$A_s = \frac{M}{14{,}000\,t} \qquad (4)$$

In (4) the effective depth is taken as 7/8 t.

It is highly desirable for convenience in construction to so arrange the spacing of the horizontal bars that as few different sizes will be used as possible. Under the ordinary assumptions as to load, there will be sufficient steel in the compression face of the slab to take care of the negative bending moment over the vertical beams, as the inward and outward moments are usually about equal. If these are radically different, it may be necessary to introduce some extra bars across the beams on the face having the lighter reinforcement. The vertical beams may be considered as free or as only slightly restrained. If they are framed into roof beams, and securely tied into the floor, with possibly a bracket there, 85% to 90% of the calculated bending moment with

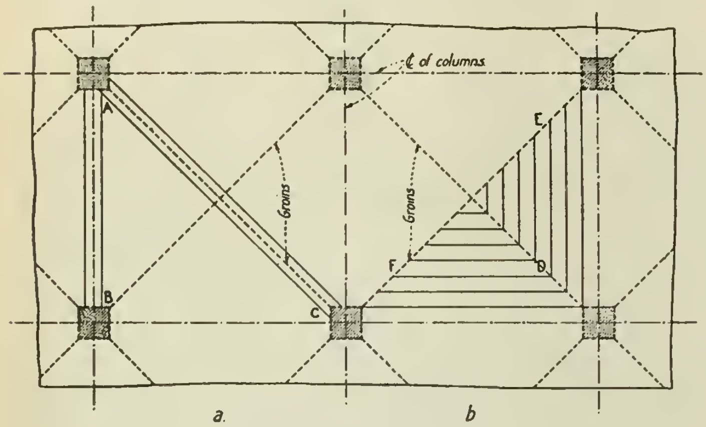


Fig. 9.—Concrete Reservoirs.

free ends is advisable, otherwise the full calculated bending moment should be used. The loading diagram with reservoir empty will be trapezoidal, and may be assumed as triangular for full reservoir without serious error.

The chart of Figure 7 is useful in finding the reactions and point of maximum moment due to a trapezoidal load. The formula for x.h applies, of course, to any portion of the trapezoidal load, as is shown by the following example. Let a = 250 lbs., b = 1,000 lbs. and h = 10 ft. Then a/b = 250/1000 = 0.25. From the curve, x = 0.40, and therefore $R_1 = \frac{0.40 \times 10}{2}(250 + 1{,}000) = 2{,}500$ lbs.

Similarly, $R_2 = \frac{(1.00 - 0.40) \times 10}{2}(250 + 1{,}000) =$ 3,750 lbs. Also y = 0.548 from the curve, and y.h = 0.548 × 10 = 5.48 ft. The unit pressure at the point of maximum moment $= 250 + \left\{\frac{5.48}{10} \times (1{,}000 - 250)\right\} = 661$ lbs. = b′. Now a/b′ for the portion of the load above the point of maximum moment = 250/661 = 0.38, whence x = 0.428 and x.h = 0.428 × 5.48 = 2.35 ft. for this portion of the load. Therefore, M = (2,500 × 5.48) — (2,500 × 2.35) = 2,500 × (5.48 — 2.35) = 7,825 ft. lbs. = 93,900 in. lbs. M should be calculated for the assumed loading, i.e., with ends free. If the construction is such that some fixity at the ends may be counted upon, some reduction may be made in the moment thus found, as suggested in the preceding paragraph, and the reduced moment used in computing the required depth of beam and the reinforcing steel.

For determining the web reinforcement, the most satisfactory method is to plot the shear diagram from end to end of the vertical beam. This is a comparatively simple matter, and easily done if a little system is used in making the necessary computations.

In a beam under triangular load, let

M = maximum positive moment, in. lbs.
M_1 = negative moment at end where intensity of load = 0, in. lbs.
M_2 = negative moment at end where intensity of load = max., in. lbs.
W = total load, lbs.
h = span, ft.
x = distance from end where intensity of load = 0 to point of maximum moment, ft.
y, y_1 = distances from end, where intensity of load = 0, to points of inflection, ft.
V = total shear at any point, z ft. from end where intensity of load = 0.

Then, for a beam with ends free,

$M = 1.540$ Wh. (5)
$x = 0.577$ h (6)
$V = W/3 - Wz^2/h^2$ (7)

and, for a beam with ends fixed,

$M = 0.515$ Wh (8)
$M_1 = 0.800$ Wh (9)
$M_2 = 1.200$ Wh (10)
$y = 0.237$ h (11)
$y_1 = 0.807$ h (12)
$x = 0.548$ h (13)
$V = 3W/10 - Wz^2/h^2$ (14)

The vertical beams may be located either entirely within or entirely without the reservoir wall, or in some intermediate position. Their position with respect to the wall determines whether tee action may be counted upon to resist inward or outward moment. There is not usually much difference between these, although cases may occur in which it is large, depending altogether upon the assumptions made with regard to earth pressure with reservoir full and with reservoir empty. It is, of course, desirable to so place the vertical beams that the larger moment will be resisted by tee action, but this is not the only factor to be considered. From the point of view of the contractor, it is preferable to have the beams entirely within the reservoir, although this decreases the capacity somewhat. If the roof is of the slab and beam type, this location of the vertical beams reduces the

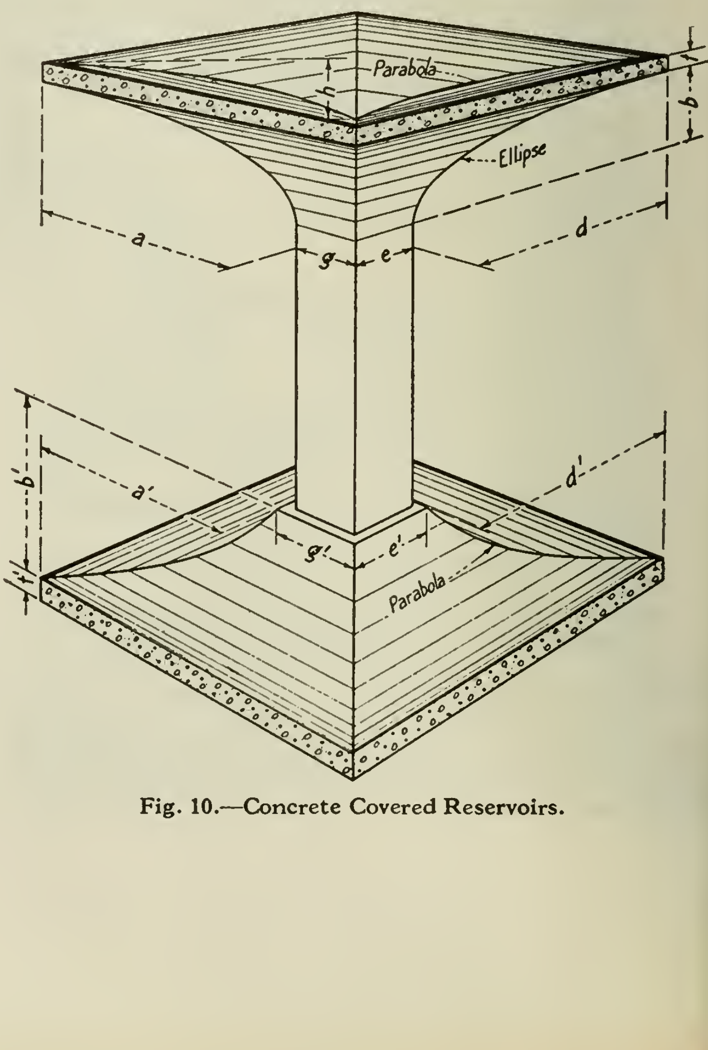


Fig. 10.—Concrete Covered Reservoirs.

span of the end roof beams, which is desirable, since the moment in these beams is larger than in the intermediate ones, the span in the two cases being the same.

Vertical beams must be thoroughly tied into the roof system at the top, and into the floor at the bottom, to take care of the end reactions. This may be accomplished by bending some of the reinforcing steel in these beams into the roof and floor, respectively, or by means of special stirrups. The stress on these bars is direct tension, and is equal to the end shear on the beam. How far it is necessary to embed them in the concrete of the roof or floor cannot be exactly calculated, as there is no data as to how the stress is transferred to the concrete. In one case, ties at the tops and bottoms of the vertical beams were provided clear across the panel next to the wall, and one-half of this area of steel was carried across the next adjoining bays. In another design, the ties projected only 8 ft. into the concrete of the roof and floor.

(*f*). *Vertically Reinforced Walls.*

Vertically reinforced walls dispense with the necessity for vertical beams, and are much simpler as regards form work. The method of design follows that just given for vertical beams. For a considerable height above the floor, their thickness will usually be determined by shear. From 0.15% to 0.35% of horizontal steel is required in these walls to guard against temperature cracks. This should be in the form of small bars, well distributed over the cross section of the wall.

Double Reinforcement.

Formulas 1 to 4, inclusive, do not take account of the double reinforcement in the walls, although some economy may be realized by considering it. While it is a difficult problem to handle analytically, a simple chart (Figure 8) adapted from a diagram published in Steinman's translation of Professor J. Melan's "Plain and Reinforced Concrete Arches", removes most of the tedium.

For example, assume an outward bending moment of + 780,000 in. lbs., and an inward moment of —530,000 in. lbs. Taking f_c = 650 lbs. per sq. in., f_s = 16,000 lbs. per sq. in., and assuming 12 ins. as the width of the beam and 20 ins. as its depth, there results

$$m = \frac{+\ 780.000}{12 \times 20 \times 20 \times 650} = +\ 0.25$$

or

$$m = \frac{-\ 530,000}{12 \times 20 \times 20 \times 650} = -\ 0.17$$

The full curve, m = + 0.25, intersects the dotted curve, m = — 0.17, at the point 2.14 on the axis of abscissas, and 0.89 on the ordinate axis, thus showing that 2.14% of reinforcement is needed on the outer face, and 0.89% on the inner. This is not the most economical combination, however. Moving along the + 0.25 curve to the left, at the break, the co-ordinates are found to be 1.30 and 1.36, respectively, i.e., 1.30% reinforcement in the outer face and 1.36% in the inner. This point falls very close to the — 0.25 curve, that is, the negative resisting moment has been increased by this change in reinforcement in the proportion of 17 to 25, although the total amount of steel has been reduced. From the sloping dotted lines, it is found that the value of f_s/f_c at the point 1.30, 1.36 is 24.6, so that, for a moment of + 780,000 in lbs.,

$$f_c = 650 \text{ lbs. per sq. in.}$$

and

$$f_s = 24.6 \times 650 = 16{,}000 \text{ lbs. per sq. in.}$$

The point 1.36, 1.30 gives f_s/f_c = 23.4. Since the full negative resisting moment is not developed, the stresses for a moment of — 530,000 in. lbs. would be

$$f_s = \frac{17}{25} \times 16{,}000 = 10{,}900 \text{ lbs. per sq. in.}$$

and

$$f_c = 10{,}900 \div 23.4 = 465 \text{ lbs. per sq. in.}$$

The most economical combinations of outer and inner reinforcement will always be found along the line of f_s/f_c = 24.6, except near the bottom of the chart, where they will lie along the line marked K. The above analysis applies, of course, with equal emphasis to walls with double reinforcement.

(*g*) *Circular Walls.*

Walls for circular reservoirs are sometimes designed on the assumption that the circumferential reinforcing steel takes all the stress, which, for a truly circular ring, is pure tension. In this case the concrete is regarded merely as a waterproofing and cover for the steel. If the

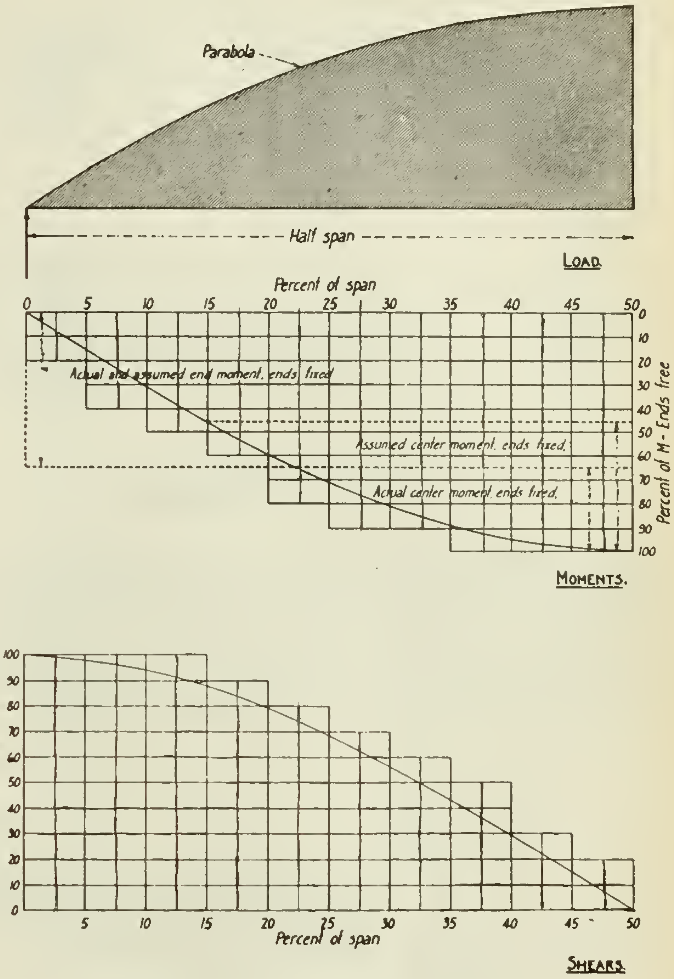


Fig. 11.—Concrete Covered Reservoirs.

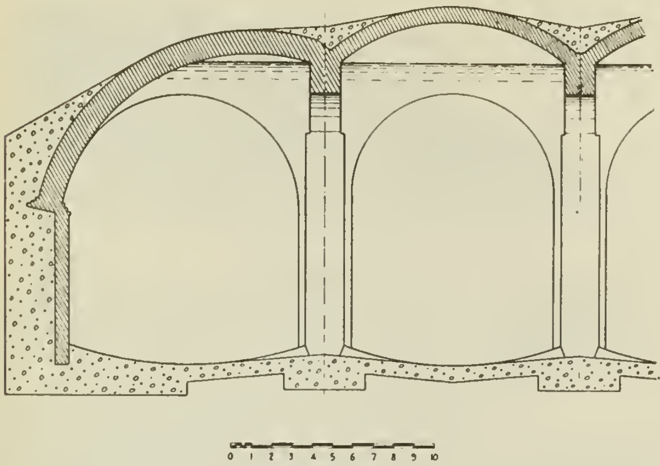


Fig. 12.—Concrete Covered Reservoirs.

steel is stressed, it must stretch, and therefore some tension must be thrown into the concrete, the thickness of which should be calculated with this in mind. Formulas 15, 16 and 17 below were derived by H. B. Andrews. They take into account the tension in the concrete, and give a thickness of wall which is greater than has been used in some reservoirs in satisfactory service.

$$A_s = \frac{pr}{s} \quad (15)$$

$$D = \frac{12a}{A_s} \quad (16)$$

$$t = \frac{pr - (n - 1)\ A_s c}{12c} \quad (17)$$

in which

A_s = area of steel per foot height of wall, sq. inches.
D = vertical distance between two layers of bars at point selected, inches.
t = thickness of wall at point selected, inches.
p = water pressure at point selected, lbs. per sq. foot.
r = radius of reservoir, feet,
s = stress in steel, on assumption that concrete carries no tension, lbs. per sq. inch.
c = allowable tensile stress in concrete, lbs. per sq. inch.
n = ratio of moduli of concrete and steel, = 10, for 1:1:2 mixture.

These formulas are the familiar ones for ring tension, and the debatable point in them is the safe value for c, the allowable tensile stress in concrete. Andrews recommended 290 lbs. per sq. in. as a value for c for a 1:1:2 mixture. This appears to be rather high. Buell and Hill state that the ultimate tensile strength of concrete may safely be taken as 10% of its compressive strength, which would seemingly give from 200 to 300 lbs. per sq. in. as the ultimate tensile strength of the common 1:2:4 mixture.

The connection between the wall and the roof, and the wall and the floor, of a circular reservoir ought either to be heavily reinforced to take care of the moments at these points, or be so designed as to allow the wall to slip when its circumference increases under water pressure. The latter is now considered the better practice, and is a condition easily and naturally met in the case of the connection at the roof. This provision at the joint of the wall and the floor is not so common: it requires the use of some form of construction at the same time elastic and watertight. In the surge tank of the Ontario Power Co. at Niagara Falls, Ont., R. D. Johnson used a smooth and flat floor, upon which the side walls rest, there being a thin layer of clay between the two. Other engineers have developed designs in which graphite is the joint lubricant and asphalt the sealing medium.

Frost Proofing

On account of restricted area, or for other reasons, it is sometimes necessary to omit the customary earth fill against the walls of a reservoir. If the climate be a cold one, it is then desirable to frost proof these walls in some manner. At Regina, Sask., a hollow tile wall was planned to be built outside of the concrete wall. In another case, two brick walls, with air spaces between, were placed outside the concrete. The roof slab was carried out over these, and a low parapet wall was used to retain the roof fill.

Design of Roof

Reservoir roofs may be divided into the following classes:—

(a.) Groined arches.
(b.) Slab and beam.
(c.) Flat Slab.

(*a*) *Groined Arches.*

Groined arches have the advantage that they do not require reinforcement, although a small amount of steel is sometimes used to care for construction stresses, or to provide for the contingency of very unequal loading. The first cost of the forms is relatively high, but, if the roof be of any considerable area, these may be used many times, and thus the unit cost of forms may be low enough to compare favorably with that for reinforced roofs. The thrust from a groined arch roof is considerable,

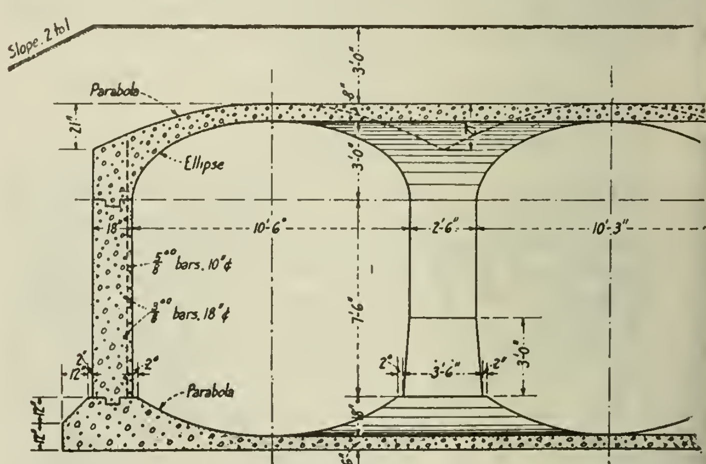


Fig. 13.—Concrete Covered Reservoirs.
Montreal Filter Plant.

and must be provided for in the design of the walls upon which it rests. There have been failures of these roofs, in some cases accompanied by loss of life, and this, coupled with the fact that there is no well-recognized method of designing them, has probably prejudiced many engineers against their use.

by that from an exactly similar one, with its axis at 90° to that of the first, and a reaction along the line of the groin. That is, in Figure 9b, the thrust from DE is balanced by that from DF and an upward force along the groin. Each of the small barrel arches may be analyzed by the usual methods, and the thrusts from the

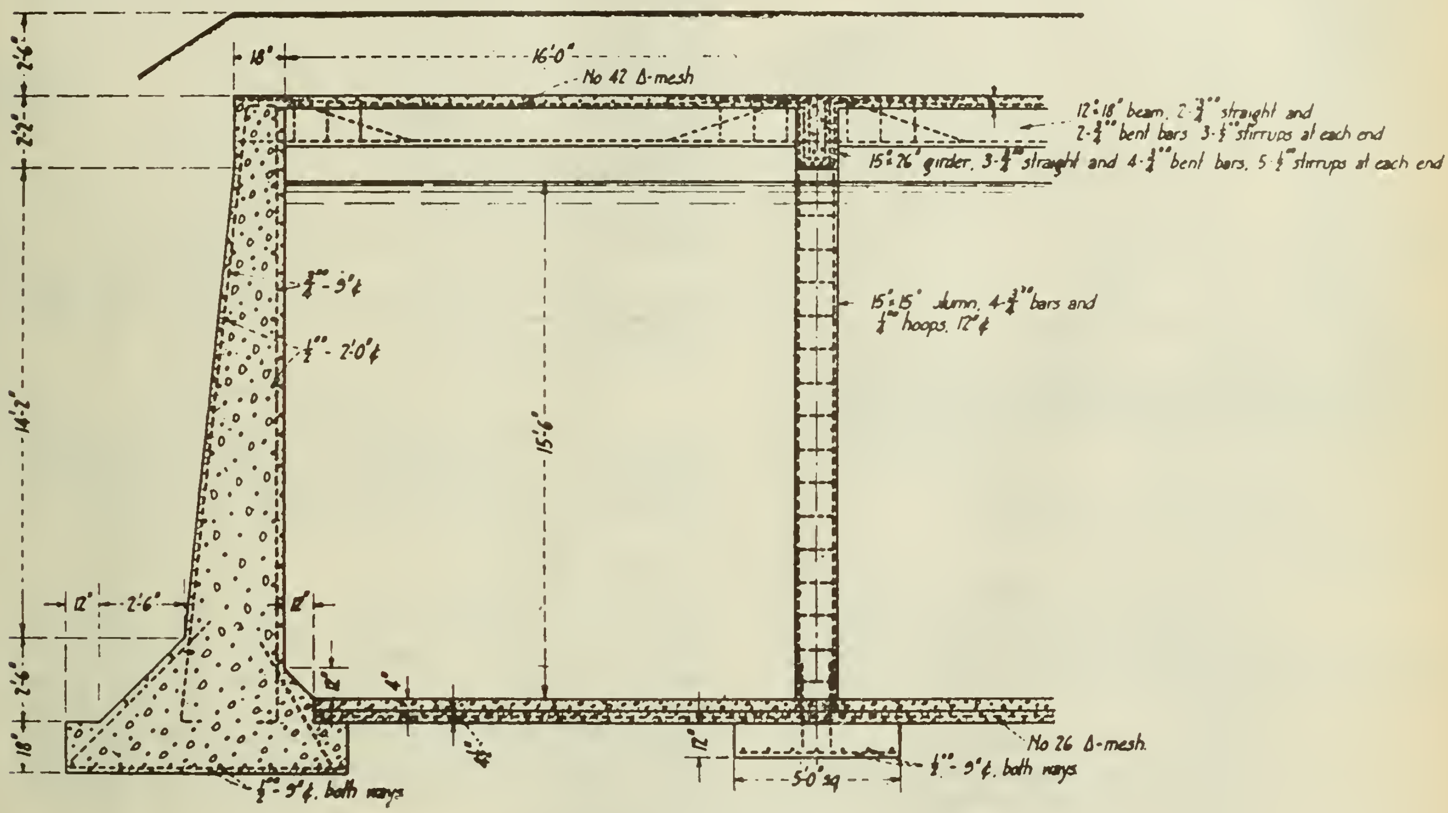


Fig. 14.—Concrete Covered Reservoirs.
Kamloops, B.C.

series combined to give the line of pressure of the groin. The groin itself may then be examined.

Allen Hazen, M.E.I.C., who has built many groined arch roofs for filters and reservoirs, has developed a semi-empirical method of computation, in which the vault is divided into segments, as is shown in Figure 9a. Consider AB: the total crown thrust is equal to the unit load at the crown multiplied by the radius of curvature of the arch axis at the crown. For instance, if the load were 300 lbs. per sq. ft., and the radius of curvature were 20 ft., the total thrust would be 300 × 20 = 6.000 lbs. per foot width of arch. If the crown thickness were 6 ins., the stress at the crown would be 12,000 lbs. per sq. ft., or 83 lbs. per sq. inch, if uniformly distributed over the whole section. On the segment AC, it would be twice this figure. Hazen assumes that the line of thrust passes through the crown joint near the limits of the middle third, and that therefore the maximum intensity of stress is about twice the average. Thus, if an examination of a segment such as AB showed an average stress of 83 lbs. per sq. in., he would consider that the maximum possible stress at the crown of AC would be 2 × 2 × 83 = 332 lbs. per sq. in.

Another way to treat a groined arch is to divide it into barrel arches, the thrust from each being balanced

Formulas for the volume of concrete in groined arch roofs and floors, given by T. H. Wiggin, are as follows:—

$$\text{Volume of roof} = m + n - p \qquad (18)$$

$f = d + e/2 =$ half longer span.

$c = a + g/2 =$ half shorter span.

$$m = 4\,b\left\{cf + \frac{2.n.d}{3} - \frac{(cd + af)}{4}\right\} \qquad (19)$$

$$n = 4\,f\,c\,t \qquad (20)$$

$$p = 2\,fch/3 \qquad (21)$$

$$\text{Volume of floor} = m' + n' \qquad (22)$$

$f' = d' + e'/2 =$ half longer span.

$c' = a' + g'/2 =$ half shorter span.

$$m' = 4.b'\left\{c'f' - \frac{2\,(a'f' + c'd')}{3} + \frac{a'd'}{2}\right\} \qquad (23)$$

$$n' = 4\,f'c't' \qquad (24)$$

In these formulas.

m = volume between a plane through the top of the column and a parallel plane tangent to the intrados at the crown.

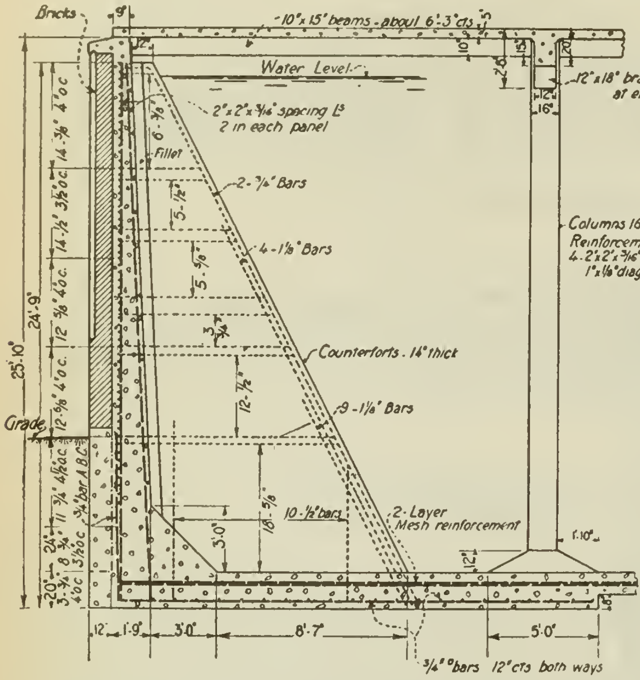


Fig. 15.—Concrete Reservoirs.
City Reservoir, Regina, Sask.

n = volume between a plane tangent to the intrados at the crown and a similar plane tangent to the extrados.

p = volume between the extrados and a plane tangent to the extrados at the crown.

m′ = volume between a plane through the bottom of the columns and a parallel plane tangent to the crown of the intrados of the floor arches.

n′ = volume between a plane tangent to the crown of the intrados of the floor arches and the bottom of the floor.

The significance of the other symbols is given in Figure 10, which is a perspective sketch of one unit of floor and roof, cut out by vertical planes passing through the crowns of the arches. In the case where the column spacing is the same in both directions, the formulas above may be somewhat simplified. If there are no depressions in the roof over the columns, Formulas 23 and 24 may be used for both roof and floor.

(b) Slab and Beam Roofs.

Slab and beam roofs offer no difficulties in the way of design. If the columns are spaced equally in two directions, a slab reinforced both ways may be the best solution. Such slabs may also be used if there is only a slight difference in the column spacings, but their advantages disappear if their length and breadth are not approximately equal. The moment per foot width of slab at the center of a square slab reinforced both ways is generally taken to be

$$M = 7/96\ wL^2 \qquad (25)$$

and if restrained at the edges

$$M = 7/144\ wL^2 \qquad (26)$$

may be used. In Formulas 25 and 26, w = the total unit load on the slab, and L = span of the slab.

Theoretically, the closest spacing of steel should be in the center of the slab, and it should decrease parabolically to the edges. A good practical rule, however, is to use the area of steel per foot width found from the above moment throughout the middle half of the slab, and one-half of this area per foot width throughout the two side quarters. The load on the beams surrounding a square slab reinforced both ways may be considered as parabolic. The moment at the center of a freely supported beam loaded in this manner, and carrying the load from two panels is

$$M = 5/64\ wL^3 \qquad (27)$$

Following the usual practice of considering the center and end moments of a restrained beam as equal

$$M = 1/20\ wL^3 \qquad (28)$$

may be taken as giving the moment in such a beam under a parabolic load. The shear at any point under parabolic loading is given by

$$V = \frac{wL^2}{4} - 3wL^2\left\{\frac{x^2}{2L^2} - \frac{x^3}{3L^3}\right\} \qquad (29)$$

where x is the distance from one end to the point where the shear = V. The diagrams of Figure 11 will help in determining safe points for bending up bars, and for calculating the amount and disposition of the web.

(c) Flat Slabs.

Flat slabs require only simple form work, and straight bars, which are easily and cheaply placed. A complete analytical treatment of their design is very complicated, and hence recourse is had to more or less empirical methods, based partly on theory and partly on the results of tests and experience. The most comprehensive treatise on this subject is probably the ruling of the Chicago Department of Buildings, published in March, 1918.

Design of Columns

Ordinary building practice may be followed in the design of columns, with the exception that no allowance need be made for fireproofing, which is obviously unnecessary in a reservoir.

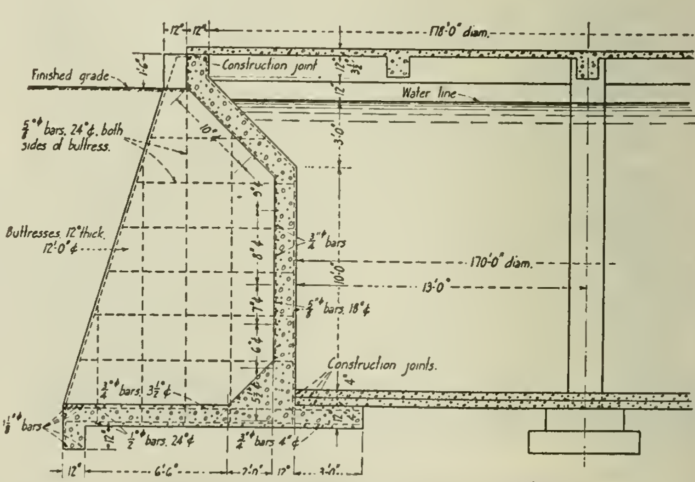


Fig. 16.—Concrete Covered Reservoirs
Fort Dodge, Ia.

Design of Floors and Footings

With groined arch roofs, inverted groined arches are generally used for the floor. In other cases, the floors are ordinarily thin, often not over 6 ins. thick, containing only enough steel to prevent cracking and consequent possible leakage. Sometimes they are laid in two thicknesses and in blocks, the joints in one set breaking with those in the other. This practice is particularly common where little or no reinforcement is used. An expedient sometimes adopted consists in sloping the floor up toward the walls, making this slope as steep as is consistent with safety against sliding, and beginning it, say, at the second line of columns from the wall. While such a procedure lessens the capacity of the reservoir, it also greatly decreases the height of the walls, and thus their cost.

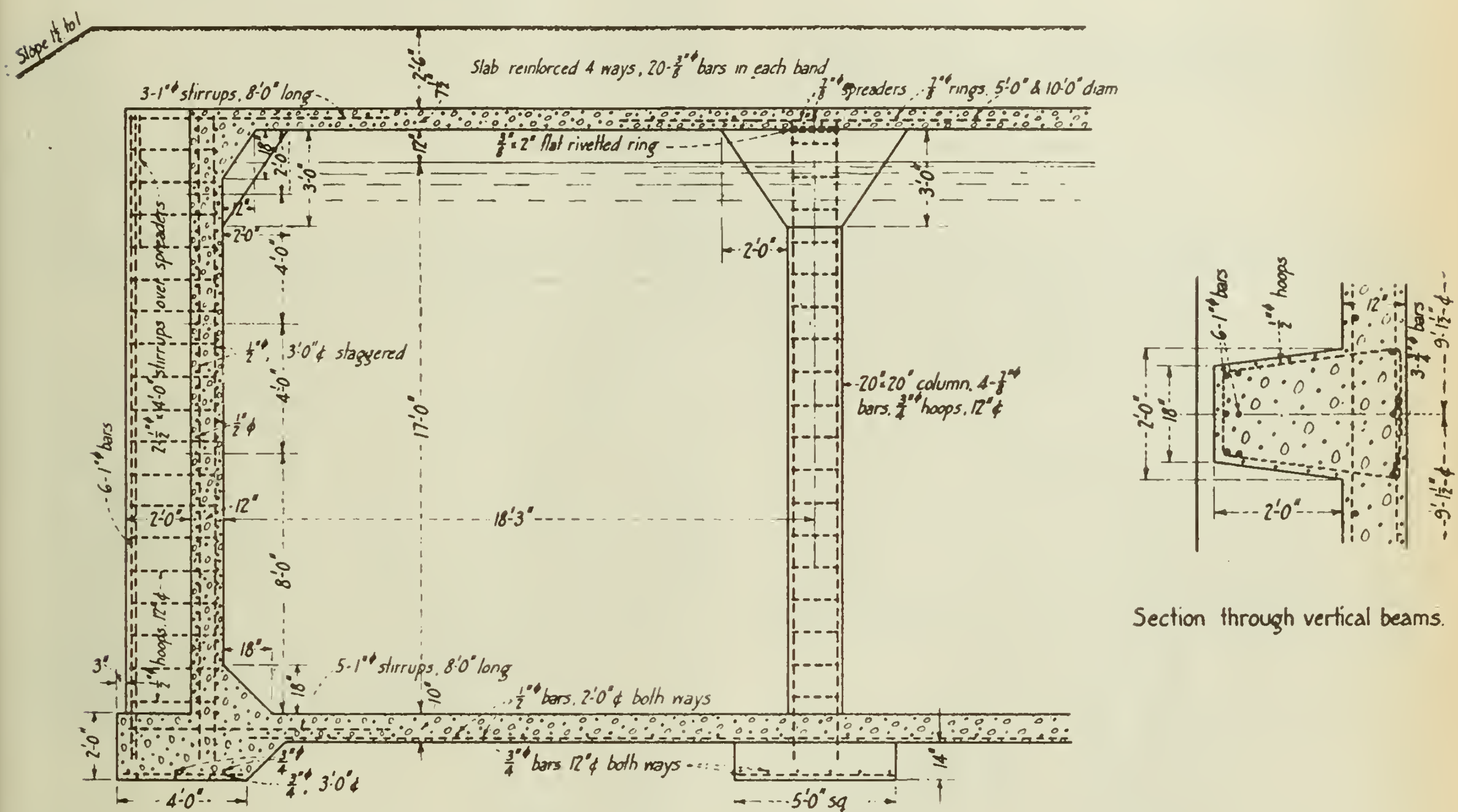


Fig. 17.—Concrete Covered Reservoirs.
Moose Jaw, Sask.—Distribution Reservoir.

Footings follow the usual methods of design. That recommended by Talbot appears to be rational, as well as simple. Let

L = one side of square footing, feet.
a = one side of square column, feet.
c = (L — a)/2
d = thickness of footing from top to center of gravity of steel, ins.
M = moment, in. lbs.
w = safe soil load, lbs. per sq. foot.
b = width of assumed beam carrying moment, ins.
V = shear at face of column, lbs.
v = shear on critical section, lbs. per sq. in.
jd = effective depth, ins.

Then

$$M = (6ac^2 + 7.2\,c^3)w \qquad (30)$$

$$b = 6(a + 2d + L) \qquad (31)$$

$$d = 0.0315\sqrt{\frac{M}{a + 2d + L}} \qquad (32)$$

$$V = (ac + c^2)\,w \qquad (33)$$

$$v = \frac{w}{48} \cdot \frac{L^2 - (a + d/6)^2}{(a + d/6)\,jd} \qquad (34)$$

Formula 32 can be solved only by trial. Use Formula 33 for determining bond stresses and Formula 34 for web reinforcement. Care should be taken that the soil load is reasonably uniform under all the footings since even a slightly unequal settlement will tend to open cracks, which through very small and structurally unimportant, may offer opportunity for leakage.

Expansion Joints and Waterproofing

Reservoirs have been built both with and without special expansion joints. Apparently the results are about the same in either case. With horizontally reinforced walls, there would seem to be little need of them. Theoretically, they should perhaps be used in vertically reinforced walls. As a matter of fact, reservoir walls are usually built in sections of convenient length for continuous concreting, and the construction joints between such sections serve as expansion joints.

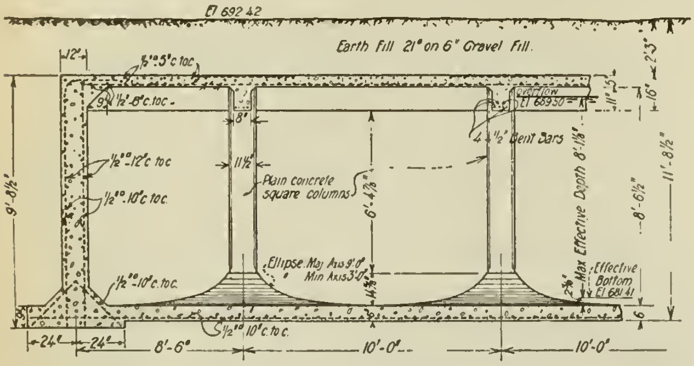


Fig. 18.—Concrete Reservoirs.
Reservoir, Indianapolis, Ind.

Leakage from a reservoir may come through the concrete itself, through cracks and construction joints, or around castings set in the walls or floor, etc. The first sort of leakage may be prevented by making waterproof concrete. Dense concrete can be made by careful proportioning, mixing and placing, and such concrete is as nearly impermeable as that to which some of the proprietary waterproofing compounds have been added. A volumetric analysis of the available aggregates will supply the data on which to base the proportions. Sometimes mixing two or more sands will give a very impervious concrete. In one case, a concrete practically watertight under heads up to 30 ft. was produced by replacing 10% of the regular sand with a very fine moulding sand. Mixing should be thorough, and it is now common to specify the minimum time the batch must remain in the mixer, after all the ingredients have been added. Every precaution should be taken to see that there are no pockets left in the mass during placing.

Cracks of any size are abnormal in concrete reservoirs. They are due to faulty design, materials or workmanship, or to unforseen causes. Construction joints, on the other hand, are necessary. Horizontal joints should be avoided as far as possible. Where they occur, they should be provided with a deep key, and the best possible bond between the old and the new concrete secured. Vertical construction joints should also have a key, and, if practicable, a water stop made of a strip of crimped copper or galvanized iron, one half of which is embedded in the wall on each side of the joint. Castings to be set in the wall or floor should be thoroughly clean when placed. Water-stop flanges can be obtained at slight additional cost on fittings for which the patterns must be specially made, but a watertight joint can be made between smooth cast iron and concrete with ordinary care. The repair of a leaky reservoir at reasonable cost frequently taxes the ingenuity of the engineer to the uttermost. Apparently the only sure method is to cover the leaky portion with a bituminous coat of some sort on the inside, and to protect this coating, perhaps with a course of brick.

Drainage

Some provision for roof drainage should be made. This may be easily done in the case of slab roofs by giving them a pitch. The pockets over the piers in groined arch roofs should be filled with impervious puddle, and these roofs may then be drained in the same manner as slabs.

In damp soils, an open tile drain is often laid at intervals under the floor, and also around the walls. The outlet from such a drain should be so located as to assure a free discharge.

Appurtenances

Manholes.

Every reservoir should be provided with numerous manholes. These may be of any convenient shape, and must be large enough to pass valves, etc., which may need to be removed for repairs. Standard sewer manhole rings and covers are often used, but these are usually heavier and more expensive than is justified. A frame and cover made of plates and angles will generally serve the purpose well enough. An inside cover of 7/8-inch tongue and groove boards, in two layers, with building paper between them will help to prevent freezing. Manhole steps of ¾-inch round galvanized iron, set in the concrete work, are convenient and inexpensive. Sometimes an iron ladder is used instead of the steps, but it has no practical advantages over the former.

Ventilators.

Ventilators are required to provide for the changes in air volume due to the rise and fall in the water level, if for no other purpose. They should extend far enough above the surface of the roof fill so that they will not be sealed by snow in the winter, and should be screened to keep out vermin. They may be of concrete, cast iron pipe — soil pipe does excellently — or of sewer pipe. Both manholes and ventilators should be encased in concrete where they pass through the roof fill. Gravel or broken stone around the outside of these concrete shafts will minimize the danger from heaving due to frost. If the roof is of the beam and slab type, a small pipe, say one inch in diameter, should be placed through each beam just under the slab, to allow the free circulation of air when the water rises above the soffits of the beams.

Overflows.

The overflow may be either a weir, or a vertical pipe inside the reservoir. The latter is usually the simpler and cheaper arrangement. Such an overflow should be provided with a bell mouth, the size of which will depend upon the quantity of water to be discharged, and the allowable variation in head between overflow

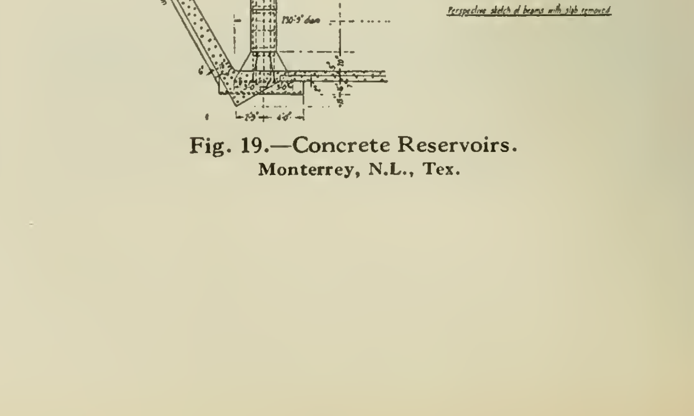


Fig. 19.—Concrete Reservoirs.
Monterrey, N.L., Tex.

level and maximum high water. There appears to be little or no reliable information as to the capacity of an overflow of this type. Provided the capacity of the pipe is great enough to carry away the water faster than it enters, the bell mouth acts as a circular weir, but, as the capacity of the pipe is reached, the flow passes through an intermediate stage, and finally becomes that through a pipe with a specially shaped inlet.

Lawrence and Braunworth conducted a series of experiments on *outward* flow from vertical pipes, and have derived the following formula, when the pipe is acting as a weir:—

$$Q = 5{,}628\,.d^{1.25}.h^{1.35} \qquad (35)$$

in which

Q = discharge, sec. feet.
d = diameter of entrance, ins.
h = head, ins.

This, of course, does not apply exactly to the case in hand, and may be largely in error for such a case, but it seems to be the only available formula.

F. B. Seely has found that the coefficient of discharge for a mouthpiece having a total angle of divergence of between 30° and 60°, and a ratio of end areas of from 1 : 2 to 1 : 4, is about 0.915, provided it is totally submerged. Such a mouth piece can usually be cheaply made by removing one flange from a standard reducer.

Pipe Arrangement.

The arrangement of the piping is determined almost entirely by local conditions. Certain general principles will hold in all cases, however. The inlet should be so placed that a circulation will be maintained. If part of it lies within the reservoir, this part may be made of sewer pipe, as it is called upon to stand a light pressure at most. The outlet is generally taken from a sump, to which the floor is sloped, and from which a drain also leads, but sometimes a swinging pipe is used, so that water may be drawn from any level. If pressure water is available at the site, as is seldom the case, a hose connection inside the reservoir is convenient for

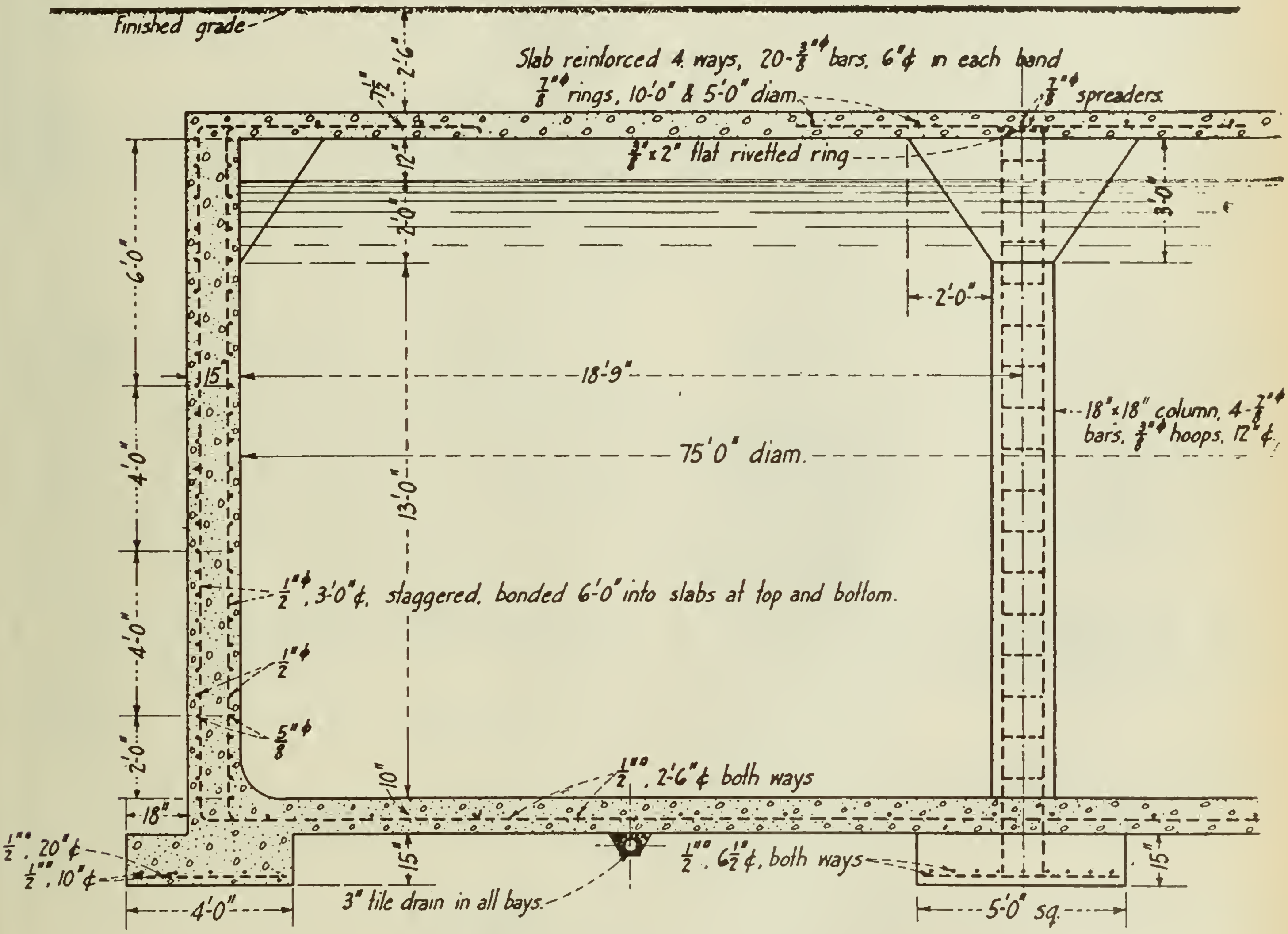


Fig. 20.—Concrete Reservoirs.
Moose Jaw, Sask.—Service Reservoir.

cleaning. All joints which may have to be broken, such as those on each side of valves and fittings, should be flanged.

Costs

There is no common basis upon which the cost of covered reservoirs may be compared, since this is greatly influenced by factors which are rarely the same in any two cases, such as the accessibility of the site, the character of the excavation, etc. Nevertheless, Table II, following, may be of interest. It gives figures for a number of reservoirs, the data regarding which were at hand, and may help somewhat in making the roughest estimates.

Typical Reservoirs

Figures 12 to 20, inclusive, have been selected, not because they are considered to be ideal in all cases, but because they fairly represent reservoirs of various types. Cost figures for most of them are included in Table II. As a matter of interest, Figure 12 is included here, although this reservoir, at Farnborough, England, is principally of brick. It was built in 1877 by William Morris.

Figure 13 shows the construction of the clear water basin of the filter plant of the City of Montreal, P.Q. It has a semi-gravity wall, groined arch roof and floor, and is a good example of this type. The engineers were Hering & Fuller, M.E.I.C.

The Kamloops, B.C., reservoir, shown in Figure 14, also has a semi-gravity wall, with roof supported on beams and girders. The top 4 inches of the floor was placed after all the other concrete work had been completed. This reservoir was designed by DuCane, Dutcher & Co., with R. S. Lea, M.E.I.C., as consulting engineer.

R. O. Wynne-Roberts, M.E.I.C., was engineer for the reservoir of Figure 15, that at the power house, Regina, Sask. The wall here is of the regular counterfort type, and a brick facing was provided for, as there was not room enough for the usual earth fill.

The circular reservoir at Fort Dodge, Iowa, (Figure 16) for which Burns & McDonnell were the engineers, has a buttressed wall in spite of its shape. It was expected that considerable ice would form in the winter, which fact accounts for the outward flare of the wall at the top.

TABLE II.

Details and Costs of Typical Covered Reservoirs

No.	Date	Reservoir	Description	Engineer	Capacity, U.S. gals.	Total cost	Cost per 1,000 U.S. gals.	No.
1.	1902	Waban Hill, Newton, Mass.	Rubble walls, brick piers, concrete floor, steel beams and concrete slab roof.	I. L. Farnham.	2,200,000	$31,225.75	$ 14.20[1]	1.
2.	1904	Fort Meade, S.D.	Vertically reinforced walls, slab and beam roof.	G. K. Hunter.	500,000	17,740.00	35.48	2.
3.	1907	Indianapolis Water Co., Indianapolis, Ind.	Vertically reinforced walls, groined arch floor, roof slab reinforced both ways.	W. C. Maybee.	5,500,000	....	9.33[2]	3.
4.	1908	South, Monterrey, Mex.	Circular, side slopes with concrete paving, precast roof and columns.	G. R. G. Conway, M.E.I.C.	10,000.000	394,000.00[3]	19.70	4.
5.	1908	Obispado, Monterrey, Mex.	Rectangular, same as South.	G. R. G. Conway, M.E.I.C.	10,700,000	375,000.00[3]	17.55	5.
6.	1910	American Paper Goods Co., Kensington, Conn.	Circular, slab and beam roof.	Hall & Bacon.	300,000	5,950.00	19.83[1]	6.
7.	1911	Cabot's Hill, Brookline, Mass.	Circular, gravity wall, flat slab roof.	F. F. Forbes.	4,000,000	80,212.00	20.05[4]	7.
8.	1912	Lowell, Mass.	Groined arch roof, flat floor, semi-gravity wall.	F. A. Barbour, M.E.I.C.	5,000,000	....	Less than 6.00[5]	8.
9.	1912	Kamloops, B.C.	Semi-gravity wall, slab and beam roof.	DuCane, Dutcher & Co.	1,500,000	33,000.00	22.00	9.
10.	1912	Service, Moose Jaw, Sask.	Circular, flat slab roof.	W. J. Francis & Co.	500,000	16,000.00	32.00	10.
11.	1912	Distributing, Moose Jaw, Sask.	Rectangular, walls with vertical beams, flat slab roof.	W. J. Francis & Co.	2,000,000	35,000.00	17.50	11.
12.	1913	La Crosse, Wis.	Vertically reinforced walls, slab and beam roof.	Alvord & Burdick.	5,000,000	74,461.00	14.89[1]	12.
13.	1913	Fort Dodge, Ia.	Circular, buttressed walls, slab and beam roof.	Burns & McDonnell.	2,000,000	25,000.00	12.50	13.
14.	1913	Tor Hill, Regina, Sask.	Circular, steel beams and concrete slab roof.	R. O. Wynne-Roberts, M.E.I.C.	6,000,000	88,000.00	14.67	14.
15.	1914	Power House, Regina, Sask.	Rectangular, counterfort walls, slab and beam roof.	R. O. Wynne-Roberts, M.E.I.C.	6,000,000	94,657.00	15.78[6]	15.
16.	1914	Halifax, N.S.	Circular, slab and beam roof.	F. W. W. Doane, M.E.I.C.	3,900,000	55,000.00	14.10	16.
17.	1915	Hibbing, Minn.	Circular, slab and beam roof.	Burns & McDonnell.	1,100,000	21,784.60	19.80	17.
18.	1916	Lansing, Mich.	Circular, flat slab roof.	D. H. Maury.	3,510,000	36,841.50	10.50[1]	18.
19.	?	?	Horizontally reinforced walls, slab and beam roof.	?	75,000	3,602.52	48.03[7]	19.

1. Based on contract price.
2. Does not include superintendence, equipment, interest and depreciation on equipment or roof drain.
3. Pesos. 4. Includes retaining wall, road and cost of land.
5. Excavation and backfill by day labor, rest by contract.
6. Done by city forces. 7. Includes $1,240 for repairs but no profit.

In Figure 17 is shown the distributing reservoir at Moose Jaw, Sask., designed by Walter J. Francis & Co. The wall is reinforced horizontally, and is supported by vertical beams, which are placed on the center lines of the columns and half way between them. The roof is a flat slab.

The reservoir of the Indianapolis Water Co., Indianapolis, Ind., shown in Figure 18, combines several noteworthy features. It has vertically reinforced walls, a groined arch floor, and a roof of square slabs reinforced both ways. The engineer was W. C. Maybee.

The Moose Jaw, Sask., service reservoir, Figure 19, was also designed by Walter J. Francis & Co. It is circular and has a flat slab roof.

The reservoir at Monterrey, N.L., Mexico, Figure 20, is interesting on account of the fact that the roof beams and columns were precast, that being cheaper than monolithic construction under local conditions. The perspective sketch shows the way in which the beams were bonded to the slab, so as to develop full tee action. The engineer for this work was G. R. G. Conway, M.E.I.C., with J. D. Schuyler as consulting engineer, and the work was done for a concern financed by Canadian capital.

Acknowledgments

The writer desires to acknowledge his indebtedness to Arthur Surveyer, M.E.I.C., for much assistance in the preparation of this paper, and to a number of other engineers who have furnished him with drawings and data, but who are too modest to wish their names to be specifically mentioned.

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THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

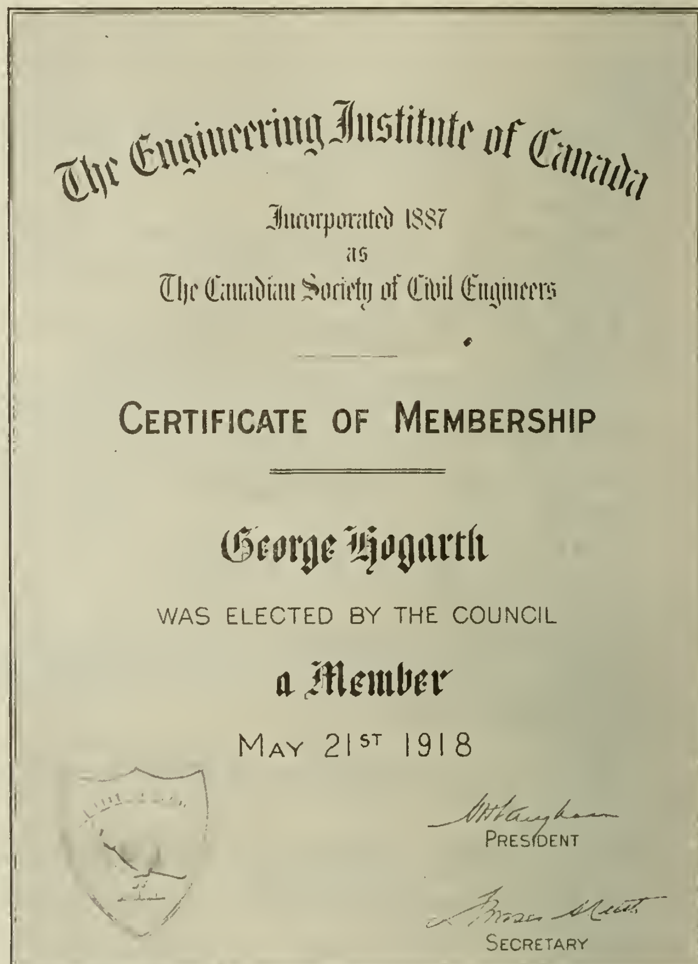
VOL. II. September 1919 No. 9

Ballot on Legislation

Interest in the question of legislation for engineers in Canada has centered in the result of the ballot by which corporate members were given an opportunity of expressing an opinion as to whether they were favourable, or otherwise, to an endeavour to secure legislation along the lines proposed by the Special Committee of *The Institute.* The result of the ballot was presented at the last meeting of Council, and showed seventy-seven percent of the votes cast as being favourable to the proposal. Of a total of six hundred and sixteen, four hundred and seventy-five were in favour, one hundred and thirty-eight were against, and three votes were discarded. No action was taken by Council owing to the importance of the matter and the length of the agenda, but it will come before Council at the next meeting.

New Certificate

Although it has taken some time to secure an approved design and have the necessary certificates engraved, members on looking at the half-tone reproduction of one of the new certificates reproduced herewith, will agree that the result has justified any slight inconvenience experienced on account of the delay. The Council's Committee who not only looked after the designing of the certificate but ordered the engraved plates and certificates have placed *The Institute* under obligation to them, not only for their efforts, but for the result achieved. These are being issued to all corporate members admitted or transferred since the name was changed.



Corporate members possessing the former certificate are entitled to one of the new ones on payment of one dollar and twenty-five cents to cover engrossing and mailing.

New Institute Badge

An illustration of the new badge of *The Institute* is shown herewith. This badge has already received the endorsation of Council and will no doubt receive the approval of every individual member.

Members having copies of the May number of The Journal, which they do not wish to keep the reference, would confer a great favor by mailing them to the Secretary. About twenty copies are required.

The badges may now be had from the Secretary at the following prices: gold, three dollars and seventy-five cents, for Members; silver, two dollars and twenty-five cents, for Associate Members; and bronze, one dollar and fifty cents, for Juniors and Students. Any of these may be had either as a clasp pin with safety attachment, a button or a watch charm. These prices include engraving the owner's name on the back of the shield and the number of the badge. An order has been placed for a quantity of these badges, and will be supplied as orders are received by the Secretary.

Quebec Bridge Transactions

Within a few weeks members of *The Institute* will receive two volumes of Transactions devoted entirely to that monumental engineering achievement, the Quebec Bridge. One of the volumes contains the text and tables together with a number of half-tone illustrations, and the other volume contains over one hundred plates from the original drawings. Three papers are included in the text: The Substructure of the Quebec Bridge by C. N. Monsarrat, M.E.I.C.; Notes on the Work of the St. Lawrence Bridge Company in Preparing the Accepted Design of the Superstructure of the Quebec Bridge by G. H. Duggan, M.E.I.C.; The Design, Manufacture and Erection of the Superstructure of the Quebec Bridge by Phelps Johnson, M.E.I.C., G. H. Duggan, M.E.I.C., and George F. Porter, M.E.I.C.

Thanks to the generosity of the St. Lawrence Bridge Company and the Dominion Bridge Company, these volumes are now available. The finances of *The Institute* would not have permitted their publication this year, but, in order that they might be in the hands of the members as soon as possible, the major portion of the cost has been assumed by the above companies, through Past President G. H. Duggan, for which are due them the hearty thanks of every member of *The Institute*. This fact will be better appreciated when the copies are received by the members.

The volumes themselves are a credit to the engineering profession in Canada and a permanent record, in addition to the bridge itself, of the genius of Canadian engineers.

The Roll of Honour

While it is a trivial tribute to the men, many of whom have made history, and who have demonstrated that Canadian engineers have no superior, the Roll of Honour of *The Institute* with its thousand names with their associated heroism, initiative, and technical ability, and representing for all time the best attributes of the engineering profession in this, or any other country, will be an inspiration and a priceless possession to all future generations of engineers in this country.

Inherent as is the modesty of the engineer, yet when it is combined with that of the soldier and fighting man, it may work to a disadvantage. This has been the case in connection with securing complete details and up to date records to be used in completing the Roll of Honour. For the sake of the profession itself, and for the sake of the men who did so nobly and in order that our records may be complete to the minutest detail, the co-operation of all branches and every member of *The Institute* is earnestly desired. A number of the men with whom the Secretary has been placed in touch have taken it for granted that in their four years' absence, having gone without leaving their addresses, they were dropped from *The Institute*, having taken no steps to be placed on the active list, and there are no doubt others. Every week brings information of men who have returned and are becoming settled in civilian life, yet it is believed that there are a great many now in Canada who have not sent in their addresses. It will require the co-operation of all the membership to see that all the returned men are placed in touch with headquarters in order that they may enjoy the full benefits of *The Institute*.

As a matter of pride in the profession and as a debt of gratitude to the men themselves the members of *The Institute* will no doubt assume a personal responsibility on behalf of returned Canadian engineers who are located in their vicinity.

Dominion Good Roads Plans

The Dominion Government has appointed an Honorary Advisory Board consisting of the Honorable Dr. J. D. Reid, Minister of Public Works, C. A. Magrath, M.E.I.C., J. P. Mullarky, A.M.E.I.C., and R. Holmes Smith. The Advisory Board and A. W. Campbell, M.E.I.C., head of the Highways Branch of the Department of Railways met officials from the Highway Departments of the various provinces on August 22nd, to discuss the method of spending the $20,000,000, which was voted for highway construction last session. The representatives of the Provincial Governments, J. W. Roland, M.E.I.C., Chief Engineer of Highways, Nova Scotia; B. M. Hill, M.E.I.C., Chief Engineer of Highways, New Brunswick; W. A. McLean, M.E.I.C., Deputy Minister of Highways and Geo. Hogarth, M.E.I.C., Chief Engineer of Highways, Ontario; H. Henry, Highway Engineer, Manitoba; Alex M. Macgillivray, A.M.E.I.C., Chief Good Roads Branch, Saskatchewan; H. S. Carpenter, A.M.E.I.C., Deputy Minister of Highways, Saskatchewan; A. E. Foreman, M.E.I.C., Chief Engineer, Department of Public Works, British Columbia, were present and were invited to give their views. Forms prepared by Mr. Campbell to be used in applications for grants were submitted and approved of by the provincial representatives. Various regulations dealing with the amounts of the grants to be allowed were also discussed. L. Charlesworth, M.E.I.C., Deputy Minister of Highways, Alberta, was unable to be present.

Engineering Legislation in Great Britain

It should be of interest to members of *The Institute*, who are now devoting their attention to legislation for engineers, to know that the Council of the Institution of Civil Engineers, one of the old and most conservative of engineering bodies, has recently sent a circular to its corporate members asking for an expression of opinion as to the advisability of the Institution taking steps to secure from Parliament "statutory powers to prescribe the qualifications and to conduct examinations for the admission to the profession of Civil Engineering, to keep a register of Civil Engineers, and to prevent persons who are not duly qualified from holding themselves out as members of that profession."

Should their ballot favour the obtaining of these powers, it will be important to follow the course of events and to note the steps taken by the Institution.

Woodstock, N.B., Appoints Town Manager

R. Fraser Armstrong, B.Sc., A.M.E.I.C., who served overseas as a Lieutenant in the C.E.F., has been appointed Town Manager for the town of Woodstock, N.B., for a period of two years.

The management of the business of the municipality by Town Manager has been tried by many United States municipalities with good results, and Canadian municipalities are now adopting this method of municipal management. The Town of Woodstock is also publishing a monthly statement in municipal transactions and proposed town improvements, for the instruction and guidance of the citizens. The agreement between the Town of Woodstock and Mr. Armstrong is of interest to engineers, in that it shows a decided improvement in the standing and responsibility of municipal engineers, and a growing recognition of the value of engineers to the community.

The agreement is as follows:—

It is Mutually Understood and Agreed between the Town of Woodstock and the Town Manager that the following are the terms and conditions of this contract:—

(a) The Town Manager to be responsible to the Town Council of the Town of Woodstock and to see that all laws and ordinances laid down by the said Town Council are enforced.

(b) The Town Manager to have charged under the said Town Council of all departments and officials of the Town, except the Clerk, Board of School Trustees, Board of Assessors, Police Magistrate and any other officials who may by special ordinance come directly under the said Town Council. The Town Manager to have full authority to appoint and dismiss all employees and officials except those officials directly responsible to the said Town Council.

(c) The Town Manager to exercise control over all departments which may be created by the said Town Council unless by special ordinance the departments so created are to be directly responsible to the said Town Council.

(d) The Town Manager, when possible, to attend all meetings of the said Town Council, with the right to take part in the discussion, but having no vote.

(e) The Town Manager to recommend to the said Town Council for adoption such measures as he may deem necessary or expedient.

(f) The Town Manager to keep the said Town Council fully advised as to the financial condition and needs of the Town.

(g) The Town Manager to submit to the said Town Council each month a report of work carried out during the month with a detail statement of costs and condition of finances in each department.

(h) The Town Manager may, without notice, cause the affairs of any department or employee under his control to be investigated and shall have full access to all town books and records.

(j) The Town Manager shall act as purchasing agent for the town and shall call for quotations on all material and equipment required by the departments under his control. He will submit all quotations to the said Town Council with recommendation for award but shall have the privilege of buying any material or equipment for emergency work submitting report on same at the next meeting of the said Town Council after the purchase aforesaid.

(k) The Town Manager shall organize so as to combine the position of Treasurer and Town Accountant and Collector and Receiver of Town Taxes, Water and Sewer Rates and have this official in his office directly under his control.

(l) The Town Manager for purposes of keeping in touch with general matters will be a supernumerary member of the Board of Assessors of the said Town, shall be notified of the time and place of each meeting, and shall have the privilege of attending same with the right to take part in the discussion but shall have no vote.

(m) The Town Manager shall prepare a yearly report covering all the work and expenditures for the fiscal year with a budget of proposed expenditures for the coming year.

(n) If a dismissal of the Town Manager is contemplated a meeting of the said Town Council must be held, of which meeting the Town Manager must be advised by writing and must have the opportunity of attending. At this meeting an open vote shall be taken as to taking steps for the dismissal of the Town Manager and on a majority vote only of the entire Council, a committee shall be appointed to investigate the cause for proposed dismissal. One member of this committee shall be appointed by the said Town Council, one member by the Town Manager and the third party to be chosen by the other two members of this committee. If this committee finds that the Town Manager has been guilty of dishonesty or mismanagement they can recommend and the said Town Council can confirm his dismissal but he cannot be dismissed until the term of his contract has expired on account of any popular agitation against the Town Manager form of government.

(o) The Town Manager shall have the privilege of resigning upon a month's written notice to the said Town Council providing all the terms of the contract have not been carried out or if his resignation meets with the approval of a majority of the said Town Council; such approval to be signified by an 'open vote at a regularly called meeting' of the said Town Council.

(p) No member of the said Town Council shall interfere in any way with the department of the Town Manager except at a meeting of the said Town Council when the matter can be taken up with the Town Manager.

(q) All applications for employment, privileges from the town of any matters dealing with the departments under the Town Manager, if received by the Town Clerk, will be at once submitted to the Town Manager for action.

(r) The Town Manager shall have the privilege of having called a special meeting of the said Town Council by submitting a written request to the Town Clerk who will take the necessary steps to call the meeting.

(s) All supplies purchased for the departments under the control of the Town Manager must be approved by the Town Manager.

(t) Before the Town Manager assumes responsibility for the accounts and finances an audit of same must be made by an accountant satisfactory to both the Town Manager and the said Town Council.

(u) The said Town Council has the privilege at any time of having an audit made of the departments under the Town Manager's control and will have an audit made at least once a year by a chartered accountant.

IN WITNESS WHEREOF the said Town of Woodstock hath caused these presents to be executed at the Town of Woodstock by its Mayor and its Town Clerk, and its Corporate Seal to be hereunto affixed, and the said R. Fraser Armstrong hath hereunto set his hand and seal, the day and year first above herein written.

(Sgd.) THE TOWN OF WOODSTOCK
(COPY)
per Thomas H. Nodden, MAYOR,
per J. C. Hartley, TOWN CLERK,
(L. S.)

(Sgd.) R. FRASER ARMSTRONG,
(COPY) (L. S.)

Executed in the presence of C. M. AUGHERTON.

Engineers and the American Interstate Commerce Commission.

The following letter, addressed to the President of the United States by the Engineering Council on The Interstate Commerce Commission, shows the efforts being made there to increase the prestige of the engineer, by educating the public to properly appraise the value of his services:—

August 14th, 1919.

The President,
The White House,
Washington, D.C.

Sir:—

The transportation systems of our country are largely the creations of its professional Engineers. This statement can be made without disparagement to the statesmen, the financiers, the manufacturers, the lawyers, the educators, the mechanics, the laborers and many others, who, with the Engineers, have contributed to the development of transportation. Through all stages of preliminary exploration, final survey, construction, upkeep and operation, in financial management, and in adjustment of the relations of transportation to the public, the genius and knowledge of the Engineer are essential. Not only in technical physical matters, but also in determinations of policy, his contributions have supplemented and must ever supplement those of other men. These declarations hold good for all the carriers of commerce, by rail, by highway, by water, by pipe-line, by wire, or by air. Hence, it follows that the body established by Government to regulate the commerce, the carriers and the ways of communication, embracing so many engineering features, should number among its nine members, men of engineering training and experience.

Engineering Council, being aware of a vacancy on the Interstate Commerce Commission, begs leave to request the Chief Executive that in filling this vacancy, he give earnest thought to the selection of a man who, to his other qualifications, adds the training and experience of an engineer familiar with transportation problems.

Engineer members wisely chosen would bring to the investigations and deliberations of the Interstate Commerce Commission not only technical knowledge of great value, but also experience in executive duties, a judicial attitude gained through the direction of work under contracts, minds of analytical habit, familiarity with costs of construction and operation, experience in dealing with employees of many vocations, and integrity of thought cultivated by that inescapable obedience to the laws of Nature involved in the practice of this profession. The Engineer's training fits him for that mode of thinking which is indispensable to impartiality of judgment. One important function of the Commission is valuation of public utilities and another is the determination of relationships and responsibilites of the management of such utilities to the public. No other body of men has given so extensive and so scientific consideration to these matters as have members of the Engineering Profession.

Council's purpose is not to further the interests of any individual or group, but solely to serve the Nation by strengthening one of its most important regulatory bodies. Upon the wisdom, intelligence and courage of this Commission depends in large measure the commercial welfare of the country. It is believed that the Engineering Profession can and should contribute to the country's well-being through the channel of membership in the Interstate Commerce Commission.

Very respectfully,
J. PARK CHANNING,
Chairman.

Resolutions Relating to Andrew Carnegie

American United Engineering Society

Andrew Carnegie's death August 11, 1919, at Lenox, Massachusetts, brought to its close a career which greatly advanced all the engineering arts and sciences. By the introduction into the United States of the Bessemer process for the production of steel and by the establishment and development of steel plants, which became the greatest in the world, he made available for engineers the most useful modern material for engineering construction. In the successful conduct of many industrial enterprises, he amassed great wealth, the possession of which he came to regard with deep seriousness as a public trusteeship. He devoted himself to the distribution of large portions of his fortune to projects for the benefit of Mankind. He distributed his wealth not only in many directions, but also with the exercise of great wisdom based on careful investigation. His munificence provided large funds for the building of a home for the great national engineering societies and many associate societies. He was an honorary member of the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers. He was personally known and loved by many engineers. In view of these facts, be it

Resolved, That the American Societies of Civil, Mining, Metallurgical, Mechanical and Electrical Engineers, the United Engineering Society and the Engineers' Club, herein express to the family of Mr. Carnegie and record their sincere appreciation of the great contributions of Andrew Carnegie to the advancement of engineering, and of his friendly assistance in making possible beautiful homes for the Engineering Societies and the Engineers' Club, thus fostering the spirit of unity in the Profession.

Civil Service Classification

Questions from men in the Civil Service, and the replies of the Civil Service Commissioners which are of interest to the engineering profession.

Question: 1. I have studied the printed classification very carefully but cannot tell in what class I belong, in fact the definition of eight different classes with salaries ranging from $600 to $2280 seems to fit my work. How and when can I learn how my position is classified? 2. If I am dissatisfied with my classification when I learn what it is, what steps should I take? No. 1.

Answer: 1 and 2. In many cases employees cannot tell positively from a study of the classification in which class they belong. The Organization Branch of the Civil Service Commission has tentatively indicated on the classification card sent in last fall the class in which each position falls. At the beginning of next week the deputy heads will begin the preparation of lists of employees now in their departments. These lists will be turned over to the Organization Branch and in the proper column the class in which each employee's position has been tentatively classified will be indicated. The Organization Branch and the deputy heads will then confer with regard to the various classes and, where necessary because of a change in duties or lack of sufficient information, changes in the tentative classes made. At this time too the classes for employees who have come into the service since the cards were prepared will be determined. When the Organization Branch and the deputy head of any department have brought up to date the classification for the department and indicated the class for each employee the deputy head will acquaint the employees of his department with the classification of their positions. Any employee who thinks his classification is incorrect may then take up the matter with the deputy head and the Organization Branch and if still dissatisfied may then present it to the Civil Service Commission for final adjudication. The preparation of the lists for some 50,000 employees and the discussions and conferences between the Organization Branch and some 40 deputy heads will naturally consume several weeks. The employees in some departments, however, will be able to tell in what classes their positions have been placed early in August and it is hoped the process will be complete before the end of August.

Question: How can I get a copy of the printed classification? No. 3.

Answer: Only a small number of copies of the first edition were printed because of the expectation that in the early stages numerous changes would be necessary. There is probably no way in which you can get a copy for your own use though every deputy head and the head of every large branch has a copy to which the employees undoubtedly will be given access. After the classification has been ironed out in the next few weeks a much larger edition will be printed either for free distribution or for sale at a nominal price.

Question: The annual compensation for Deputy Minister is given as $4200 to $8000. What is the basis for making the compensation of all deputy ministers the same when the importance of the various positions measured according to the duties and responsibilities varies greatly? No. 5.

Answer: You have failed to take into consideration the note attached to the compensation scale. It is intended that the salary of no deputy head shall be less than $4200 and not more than $8000, and that each deputy head shall receive a flat rate. The amount of this flat rate as between $4200 and $8000 is to be determined by the Governor in Council, as is implied by the note reading as following:—

> *Note:* The compensation of each Deputy Minister shall be determined by the Governor in Council and shall be based upon an appraisal of the duties and responsibilities of the position in relation to the volume and importance of the work of the department.

Question: What is the last date upon which representations with regard to the classification of a position may be made? No. 6.

Answer: There is no last date. The Commission is very desirous of receiving representations with regard to whole classes as early as possible and preferably before July 20. With regard to the classification of individual positions, however, most employees will not be informed until sometime in August and will therefore be in no position to make representations. The Commission intends, however, as far as such is humanly possible, to hear all who think the classification can be improved, up to the time when the material must go to press in order to be ready for Parliament. Even after the classification is adopted by Parliament, the Commission expects to continue to receive representations and to make changes as they are shown to be desirable; in fact, the Organization Branch has the permanent machinery for such hearings already set up. Any classification to be workable, must be subject to change at any time upon a proper showing of need for change.

Question: When I obtained my present position my qualifications were much higher than those prescribed in the classification. I know of many other positions of which the same thing is true. Please find out for me why the qualifications are made so low? No. 7.

Answer: The qualifications as stated in the classifications are the minimum qualifications which any applicant for the position must possess in order to be considered as a candidate and not the qualifications that the average applicant will possess. The fact that Senior Clerks at a salary of $1320 to $1680 are required to have at least three years of office experience does not mean, for instance, that most of those seeking promotion to the position of Senior Clerk will not have five or six or even a greater number of years of clerical experience. The guiding principle in prescribing the qualifications was to bar out all who would be likely to be failures if accepted, and not to bar out any considerable number who would be at all likely to make good employees if appointed.

Purpose of Examples

Question: Why are examples given for some classes in addition to the definition of class? No. 9.

Answer: As a rule examples of the kinds of duties to be performed are given where the classes are large and where it would be impossible to specify the various kinds of work all those included in the class perform. There are more than 500 separate positions, for instance, included in the class Junior Clerk and of course the work performed by the various incumbents of these positions is quite diverse. If all the different kinds of work were specified the definition would become inordinately long. To prevent this the plan has been followed of giving a definition which is both inclusive and exclusive in that it tells the kind of duties which must be included for the position to fall within the class, and then to make clear the definition, examples of the kinds of work required for different positions within the class are given. The examples, however, are neither inclusive nor exclusive; that is, some persons performing work not mentioned in the examples may be included within the class, and some performing work specifically mentioned in the examples but of greater or lesser responsibility than is indicated in the definition will not be included in the class.

Number of Classes

Question: The classification provided in the Civil Service Act, 1918, contains only about 20 classes. Why is it necessary to have 1,700 classes in the new classification? No. 20.

Answer: The classification in the Civil Service Act, 1918, provides for only the Inside Service and has never been found adequate even for that. There are about 1,700 classes in the new classification for the simple reason that about 1,700 different kinds of work were found in the Dominion service. There have been almost no suggestions from departments or employees for the combining of any of the classes set up, but a good many suggestions that additional classes be provided.

Civil Engineer's Classification

Question: I am a bachelor of applied science, a graduate civil engineer, and an associate member of *The Civil Engineer's Institute of Canada.* I have been surveying for six and a half years as an engineer. In what class may I expect to be placed? No. 26.

Answer: Because of the duties you are performing your position has been classified as junior engineer, with a salary of $1680 to $2040. The determining factor, however, was the duties and not the length of service or the qualifications you state. The qualifications, however, have an important bearing upon the assignment of duties to you.

Too High Classification

Question: It is stated that the Civil Service Commission has provided machinery whereby classifications that are considered too low are to be fixed. It also follows that there must be some cases where the classification is too high. Has machinery been provided for such cases? No. 27.

Answer: Exactly the same machinery serves whether the classification is too high or too low, whenever the facts are called to the attention of the Civil Service Commission. Any employee, deputy head, or group may make representations if they regard the classification as being improper in any respect.

Salary of Employees Below Minimum for Class

Question: I understand that an employee whose present salary is less than the minimum for his class will receive the minimum the same as a new appointee in the class, in spite of his greater experience. The fact that his work is graded above his present salary shows that he has not been receiving proper compensation; yet he is to be still further discriminated against by having to start at the bottom while those who have been compensated are several steps above him. Such a state of affairs would also affect many whose promotions have been held back for several years with a promise of adjustment by the new classification. These employees now find that their years of service count against them in spite of promises to the contrary. Please tell me whether this interpretation is correct and whether any steps are being taken or will be taken to remedy such conditions? No. 38.

Answer: Your letter implies that you expect the classification to remedy injustices of the past and even those of several years' standing. Such can hardly be the case. The classification by preventing the beginning of such conditions in the future and the continuation or aggravation of existing injustices will do all that its most ardent proponents claim for it. The bill introduced at the last session of Parliament provided that employees below the minimum should be raised to the minimum, dating back to April 1, 1919, and that the Commission, with the approval of the Governor in Council, should adopt regulations to provide for the compensation of employees receiving the minimum or more for their class but not more than the maximum. As the legislation was was not adopted, regulations were never drawn up and approved. It is, therefore, impossible to tell what might have been done for those who had been receiving for some time the minimum provided for their class.

District Engineers

Question: What is the basis for distinguishing between grade 1 and grade 2 district engineers? No. 42.

Answer: The distinction between grade 1 and grade 2 district engineers is primarily the importance of the work in the various districts. The Organization Branch secured from the Department of Public Works information with regard to the work being carried on. Those districts where important works are now under way or where the construction, upkeep, and maintenance work is of major importance year after year were placed in grade 2. Other districts were placed in grade 1. It is possible that a particular district may change from one grade to the other from time to time as the importance of the work changes.

Means of Promotion

Question: I gather from answers appearing in the question box that an employee's qualifications, office experience, education, and so forth, will not be considered when classifying him, but that only the actual work he is doing at the time will be considered. If therefore an employee had all the qualifications and met the educational standards which would entitle him, for example, to the position of principal clerk but was doing work which would entitle him to be classified only as senior clerk, what opportunities would he have for promotion and would promotion to principal clerk be by seniority or ability or examination? 2. Will an employee with a high school education be given the opportunity to be promoted to a higher rank calling for a university education? 3. In the distribution of the bonus will an employee who is the sole support of his sister be entitled to the full bonus given to "the supporting head of a household?" No. 43.

Answer: 1. Since the classification is of positions and not of persons, it follows that the education, experience and other qualifications of present incumbents cannot be considered as factors. The present incumbents take the classification of the various positions. The matter of selection of future incumbents, which you mention, properly has nothing to do with classification, but since it is of general interest is answered. In selecting persons for appointment in the future, education, experience, and other qualifications will be given great weight, both in entrance to and in promotion in the service. The method of promotion depends on the legislation adopted.

2. An employee with only a high school education would not normally be given the opportunity to be promoted to a higher class for which one requirement is a university education. The decision as to what constitutes the equivalent of a university education always lies with the Civil Service Commission.

3. Your statement of facts is not sufficient upon which to base a positive answer, but if the sister lives under the same roof, earns less than $200 a year, and is supported solely by a full time employee entitled to receive the bonus under the regulations adopted, the employee would be considered the supporting head of the household.

Assignment to Lighter Duties

Question: Stress is being laid on the fact that the application of the classification is to be made along the lines of the duties now being performed and the responsibilities now exercised without taking into account past experience and service, standards of examination passed, or qualifications possessed by those being classified. Will there not be many cases during the period of application where employees will be discriminated against by those higher up through the assigning of less important duties. What precautions are the experts taking against this? 2. What chance has any present employee in the service in obtaining any new position advertised by the Civil Service Commission when no consideration is given to the applications of those already in the service? No. 45.

Answer: 1. It is possible that some employees might be assigned duties of lesser importance during the period of applying the classification and suffer in their status unless such is called to the attention of the Commission. Any employee so treated, however, will have his case considered if he takes advantage of the machinery the Civil Service Commission has set up to prevent just such injustices by calling the attention of the Commission to the facts. The greater danger, however, is that the general public and the tax payers will suffer through the magnifying of duties by both employees and their superiors. 2. Your question implies a state of affairs which does not exist. If you desire to be considered for one of the positions advertised you should file your application just the same as a person not in the service and you will be considered the same as any other person.

Distinction Between Engineers

Question: The definitions of junior engineer and assistant engineer do not seem to me to be exclusive. What is the definite difference between the two classes? No. 47.

Answer: A junior engineer does routine engineering work, such as supervising minor construction or running an instrument, under the direct supervision of the engineer in charge of the party or work. An assistant engineer on the other hand is himself in charge of a party or work and only occasionally—say once a week—confers with or is visited by his superior. The distinction, therefore, is primarily one of responsibility, the junior engineer being able at all times to get a decision from his superior with regard to any doubtful point while an assistant engineer must exercise considerable independent judgment in making his own decisions.

Method of Applying Classification

Question: There is a rather disquieting rumour to the effect that the Civil Service Commission has asked the deputy ministers to classify their own departments. If it is not true it should be given the quietus at once as those members of the civil service who are more concerned with the establishment of the service on a sound foundation than in the attainment of personal ambitions have enough at present to worry about without being disturbed by rumours of this character? No. 50.

Answer: The rumour is without foundation. The deputy ministers have not been asked by the Civil Service Commission at any time to classify their own departments. It is true of course that deputy ministers will be asked to criticise and comment upon the application of the classification to positions in their respective departments.

Annual Increases

Question: 1. If the classification act is passed this September will I lose my annual increase which is due in October? 2. I passed the examination for a second division clerk in May, 1916. When I obtained my position it was with the understanding that I was to go to a maximum of $1600. Now that the classification is eliminating the yearly increase is there any compensation to be given in such cases? The work I am doing now will likely be classified as senior clerk? No. 59.

Answer: 1 and 2. The classification does not propose to eliminate yearly increases but does substitute a somewhat different system. If your position is classified as senior clerk the maximum will be $1680 instead of $1600. If, however, it is classified as clerk the maximum will be $1260. Whether you would be allowed to go to the old maximum of $1600 will depend upon the legislation adopted. Whether you will get another annual increase in October or whether the new act will apply likewise depends upon the terms of the legislation. You may be sure, however, that you will either get an increase according to the old civil service act or will be entitled to such under the new by meeting the requirements.

Equivalent Education

Question: 1. In the definition of many classes the word "equivalent" occurs. What would be considered as "equivalent" to two years of high school education? 2. In case a deputy head does not classify an employee according to qualifications would it be possible to get a transfer and how would one go about it? No 62.

Answer: 1. Any one of many different circumstances might be considered as the equivalent of two years of high school education; among them may be mentioned a sufficient amount of home study, good correspondence courses, private instruction from a tutor, attendance at various schools not called high schools, and attendance at night schools. 2. Neither the deputy head nor any other person classifies employees, as the classification is of positions. The classification of any position is determined by the organization branch and the deputy head, and the employee takes the classification of his position. The method of securing a transfer is governed by the civil service law and the regulations of the Civil Service Commission; in brief, however, it is necessary to secure the approval of both departments and of the Civil Service Commission.

Education for Citizenship

The Convening Committee of the National Conference on Education, which is to be held in Winnipeg, October 20th to 22nd, "is very pleased to have the opportunity of appealing through the columns of *The Journal* to the influential section of the Canadian public among which it circulates."

The general subject which is to be considered at the approaching Conference is "The Relation of Canadian Education to Canadian Citizenship." The promoters of the Conference have no ready-made formula for the evocation of a high type of Canadian citizenship. A fine collective public-spirit, a great national tradition expressing itself in the private and public conduct of individual citizens,—these are not things than can be achieved by sleight-of-hand or in a trice, and yet the element of conscious effort towards a goal is as natural and desirable in the case of a nation as in that of an individual. The idea of the promoters of the approaching National Conference on Education is, that a number of the most competent and disinterested minds of the nation should come together to consider how best the schools can be made to contribute directly to the evolution of the type of nation that we want to be. In addition to the renewed interest in education which will be the inevitable result of a large meeting and a first class programme, it is proposed to submit to the Conference the idea of attempting to found in Canada a Bureau or Board or Faculty of Educational Research, which, while without executive authority, would assist in providing educational leadership and stimulation for national education throughout the whole Dominion.

The Conference is being directed by a Winnipeg committee of fifty men and women headed by the Lieutenant-Governor of the Province. The original promoter of the idea is W. J. Bulman, Past President of the Canadian Manufacturers' Association. The project has been advocated throughout the country during the last year and a half. Sufficient money for the adequate holding of the Convention has been secured, largely through the good offices of various Rotary Clubs under the leadership of E. Leslie Pidgeon, Past International Président. It is desired that public-spirited organizations of all kinds should be represented at this Conference by delegates. *The Institute* has been invited to send delegates, the nominations for which have been referred to the Executive of the Winnipeg Branch. Inquiries addressed to W. F. Osborne, General Secretary, National Educational Conference, 505 Electric Railway Chambers, Winnipeg, will be promptly replied to.

National Industrial Conference

The Minister of Labour is organizing a National Industrial Conference for the purpose of discussing the labour situation in Canada and taking up the various pertinent questions as included in the agenda below.

The Conference will include one hundred and fifty representatives, of whom sixty will represent capital, sixty labour, and the balance will be representatives of various organizations, whose interests lie between the two. *The Engineering Institute* was asked to name one representative, but later the number was increased to three. The three representatives will be appointed by the Council and will represent the engineering profession at this gathering, which convenes on September 15th, at Ottawa.

Proposed Agenda

1. Consideration of the question of the desirability of unifying and co-ordinating the existing labour laws of the Dominion Parliament and of the Provincial Legislatures (see page 107 of the R. C. Report), and the consideration of any new labour laws which are deemed necessary.

2. Consideration of:

(a) employees right to organize (see paragraph 59, also recommendation on page 19 of R. C. Report);

(b) recognition of labour unions (see paragraph 59, also recommendations on page 19 of R. C. Report);

(c) the right of employees to collective bargaining (see paragraph 65, also recommendation on page 19 of R. C. Report).

3. Consideration of:

(a) the recommendations of the Royal Commission on Industrial Relations in favour of the establishment of a bureau to promote the establishment and development of joint industrial councils (see paragraph 99, also recommendations on page 19 of R. C. Report).

(b) the further recommendations of the Royal Commission on Industrial Relations regarding the establishment of joint plant and industrial councils (see paragraph 85 and 98 and recommendations on page 19 of R. C. Report).

4. Consideration of the recommendation of the Royal Commission on Industrial Relations respecting hours of labour (see paragraph 52 and recommendations on page 19 of R. C. Report).

5. Consideration of minimum wage laws (see paragraph 52 and recommendations on page 19 of R. C. Report).

6. Consideration of the recommendations of the Royal Commission on Industrial Relations that the findings of the Commission be put into effect in all work controlled by the Government where the principles of democratic management can be applied (see recommendations on page 19 of R. C. Report).

7. Consideration of resolutions relating to any other features of the Report of the Royal Commission on Industrial Relations referred to on page 19 of the Report.

8. Consideration of the labour features of the Treaty of Peace.

9. Consideration of any other proposals which may be introduced bearing on the relations of employers and employees.

PROGRAMME OF THE FIFTH GENERAL PROFESSIONAL MEETING ST. JOHN, N.B.

FIRST SESSION.

10 a.m., Wednesday, September 10th, 1919

10.00 A.M. Opening of Meeting.
Address of Welcome—His Honour, the Lieutenant-Governor of New Brunswick.

Address of Welcome—His Worship The Mayor of St. John, N.B.

10.30 A.M. Announcements.

Business.

10.35 A.M. to 12.30 P.M. Forestry in New Brunswick—G. H. Prince, B.Sc.,-F., Chief Forester, N.B.
Discussion.

Usefulness of Vegetation in Maritime Engineering—E. T. P. Shewen, M.E.I.C., Consulting Engineer, Department of Public Works of Canada.
Discussion.

New Brunswick Highways—B. M. Hill, M.E.I.C., Chief Provincial Road Engineer.
Discussion.

1.00 P.M. Lunch at the Manor House—Visiting members will be the guests of the St. John Branch.
Address by Hon. P. Veniot, Minister of Public Works, N.B.

3.00 P.M. to 6.00 P.M. Water Powers of New Brunswick—C. O. Foss, M.E.I.C., Chairman, New Brunswick Water Powers Commission.
Discussion.

Proposed Tide Electric Power Development, Petitcodiac and Memramcook Rivers—W. Rupert Turnbull, F.R.A.S.
Discussion.

Construction of Bear River Bridge—A. T. Macdonald, A.M.E.I.C.
Discussion.

SECOND SESSION.

8.00 P.M., Wednesday, September 10th, 1919

8.00 P.M. Paper and Demonstration of Experiments with High Tension High Frequency Electric Currents—F. P. Vaughan, A.M.E.I.C.
Discussion.

THIRD SESSION.

Thursday, September 11th, 1919

9.30 A.M. to 12.45 P.M. Engineering Problems Connected with Use of Telephone Cables—F. A. Bowman, M.E.I.C., Chairman, Halifax Branch.
Discussion.

Heating Problems Produced by Some of the Modern Methods of Building Construction—W. B. MacKay, A.M.E.I.C.
Discussion.

1.00 P.M. Members will be guests of St. John Board of Trade at Luncheon.

FOURTH SESSION.

Thursday, September 11th, 1919

3.00 P.M. Engineering at the Front—R. Fraser Armstrong, A.M.E.I.C.
Discussion.

4.15 P.M. Automobile trip to Hampton.
Tea at Wayside Inn—Visiting members and ladies will be guests of St. John Branch.

FIFTH SESSION

Friday, September 12th, 1919.

10.00 A.M. Sight seeing trip about Harbour possibly up through Falls and back to Partridge Island and Courtenay Bay.

1.00 P.M. Lunch at Courtenay Bay Works as guests of St. John Dry Dock and Shipbuilding Company.

2.00 P.M. Return to city by street car.
Possibly, if time permits trip, to see Falls at high tide.

SIXTH SESSION

Friday, September 12th, 1919

2.30 P.M. Adjourned Discussion.
Construction of Beacon Bar Wharves—A. R. Crookshank, M.E.I.C.
Discussion.

3.30 P.M. Trips to different manufacturing plants and points of interest.

Headquarters will be located at, and all meetings will be held in the rooms of the St. John Board of Trade, 162 Prince William Street.

Canadian Engineering Standards Association

Specifications Now Available

The Secretary of the Canadian Engineering Standards Association, R. J. Durley, M.E.I.C., announces that a stock of a number of the most important publications of the British Engineering Standards Association has now been received, and can be obtained on application. The following list does not include all publications of the British Engineering Standards Association, but covers those of recent issue which have been published under the new regulations. Copies are for sale at the prices stated.

B. E. S. A. Publications

INTERIM MEMORANDUM ON FRENCH METRIC SCREW THREADS FOR AIRCRAFT PURPOSES.

Report No. C L 3750. 15¢ net.

This Memorandum describes the system of screw threads for aircraft purposes used by the French Military authorities and is accompanied by tables showing limits of size, tolerances, etc., for two grades of fit. The form of thread is that of the Systeme International, in which the crest is cylindrical while the root of the thread is curved in section. The finer tolerances are provided for cases where great accuracy is required. The second grade tolerances are suitable for ordinary bolts and nuts.

BRITISH STANDARD TABLES OF PIPE FLANGES.

Report No. 10—1904. Revised July, 1918. 25¢ net.

This report gives the British Standard dimensions for pipe flanges for steam and water piping for low pressures and high pressures, dimensions of welded-on flanges for pipe lines for working steam pressures of 125, 225 and 325 lbs. per square inch, dimensions for short flanged bends and tees of castmetal for pressures up to 325 lbs. per square inch, and dimensions for long bends of wrought iron and steel.

BRITISH STANDARD SPECIFICATION FOR STRUCTURAL STEEL FOR BRIDGES, ETC., AND GENERAL BUILDING CONSTRUCTION.

Report No. 15—1912. Revised August, 1912. 25¢ net.

This report covers process of manufacture, quality of finished steel, tensile tests, bending tests, tests on rivets, chemical analysis, inspection and other conditions.

REPORT ON BRITISH STANDARD PIPE THREADS FOR IRON OR STEEL PIPES AND TUBES.

Report No. 21—1909. Revised November, 1909. 25¢ net.

This report gives definitions and tables of dimensions for British Standard Pipe Threads. In this system the Whitworth form of thread is employed, but fine pitches are used, and both parallel and conical screw ends are provided for.

BRITISH STANDARD SPECIFICATION FOR ELECTRICITY METERS.

Report No. 37—1919. Revised January, 1919. 25¢ net.

This specification is intended to apply to the purchase of new meters, governing their sale by the manufacturer to the purchaser. Requirements for meters up to the largest sizes in use as well as for three-wire and three-phase meters are included. The electrolytic type of meter is not dealt with. The specification gives standard definitions and provisions regarding external characteristics, insulation, labels, standard method of marking, registering mechanism, minimum running current, permissible limit of error and rate of registration, tests, precautions necessary in erection and other particulars.

BRITISH STANDARD SPECIFICATION FOR CAST IRON SPIGOT AND SOCKET FLUE OR SMOKE PIPES.

Report No. 41—1908. 25¢ net.

This specification gives a schedule of dimensions and weights, with full size sections, for light cast iron spigot and socket pipes suitable for flue or smoke pipes.

BRITISH STANDARD SPECIFICATION FOR CAST IRON PIPES FOR HYDRAULIC POWER.

Report No. 44—1909. 25¢ net.

Provision is made for two classes of this pipe together with bends, tees and special castings.

Class A: Working Pressures from 700 to 900 lbs. per sq. inch.

Class B: Working Pressures from 900 to 1,200 lbs. per sq. inch.

The specification covers quality of material, permissible variation of weight, marking, testing, inspection and tables of dimensions and weights.

REPORT ON BRITISH STANDARD DIMENSIONS FOR SPARKING PLUGS FOR INTERNAL COMBUSTION ENGINES.

Report No. 45—1917. Revised September, 1917. 25¢ net.

This report covers external dimensions only, the form of thread used being a metric thread having a 60° angle, tolerances on full diameter, effective diameter and core diameter for the thread on the plug and in the tapped hole are given, together with external dimensions of the complete plug, and standard nomenclature of sparking plug parts.

BRITISH STANDARD SPECIFICATION FOR KEYS AND KEYWAYS.

Report No. 46—1919. 25¢ net.

The specification covers material, tests, definitions and tables of dimensions for three classes of key: (a) Parallel Sunk Key, (b) Taper Key, (c) Taper Sunk Key.

BRITISH STANDARD SPECIFICATION FOR SIZES OF BROKEN STONE AND CHIPPINGS.

Report No. 63—1913. 25¢ net.

This specification was formulated as a result of conferences between the Quarry owners and road authorities and gives standard nomenclature, definitions and methods of measurement for broken stone and chippings.

BRITISH STANDARD SPECIFICATION FOR SALT GLAZED WARE PIPES.

Report No. 65—1914. 25¢ net.

This report contains tables of dimensions and particulars regarding sockets, grooving, glazing, permissible variation in thickness and diameter, methods of testing for strength and absorption.

REPORT ON BRITISH STANDARD DIMENSIONS OF WHEEL RIMS AND TYRE BANDS FOR SOLID RUBBER TYRES FOR AUTOMOBILES.

Report No. 71—1917. 25¢ net.

This report gives standard sizes of wheel rims and corresponding internal dimensions of solid rubber tyres, for sizes of wheel varying from 670 mm. to 881 mm. Metric dimensions are used throughout.

BRITISH STANDARD RULES FOR ELECTRICAL MACHINERY. (Excluding motors for traction purposes.)

Report No. 72—1917. Revised September, 1917. 25¢ net.

This important report is intended to define the conditions which characterize British standard electrical machinery, including transformers, but excluding traction motors and to provide the purchaser and manufacturer with a general specification indicating the information which should be forwarded with an enquiry or an order for an electrical machine. Methods of defining the rating or rated output are formulated, and in this connection are in substantial agreement with the corresponding rules of the American Institute of Electrical Engineers. Enquiries based on these rules will enable the purchaser to compare tenders received from various manufacturers.

BRITISH STANDARD SPECIFICATION FOR CHARGING PLUG AND SOCKET FOR VEHICLES PROPELLED BY ELECTRIC SECONDARY BATTERIES.

Report No. 74—1917. Revised September, 1917. 25¢ net.

This report contains the provisions necessary to secure interchangeability between any charging plug and any socket of the concentric type. Dimensions of the contact portion of the plug and socket, and dimensions of the gauges needed to check these are given.

BRITISH STANDARD SPECIFICATIONS FOR WROUGHT STEEL FOR AUTOMOBILES.

Report No. 75—1916. 25¢ net.

This important report contains definitions of terms used, methods of testing, and specifications for ten grades of carbon, nickel, and nickel-chrome steel, each specification giving chemical composition, tensile and brinell tests.

BRITISH STANDARD NOMENCLATURE OF TARS, PITCHES, BITUMENS AND ASPHALTS, WHEN USED FOR ROAD PURPOSES AND BRITISH STANDARD SPECIFICATION FOR TAR AND PITCH FOR ROAD PURPOSES.

Report No. 76—1916. 25¢ net.

This valuable report defines tars, pitches, bitumens and asphalts for road purposes, distinguishing between the tar products and bitumens and asphalts. In this respect the practice of the B.E.S.A. is not in accordance with that usual in the United States, where the term bituminous is applied in a wider sense than in Great Britain. The specification gives definitions, properties and methods of testing for two qualities of tar, and for pitch suitable for pitch-grouting.

BRITISH STANDARD SPECIFICATION FOR STARTERS FOR ELECTRIC MOTORS. (Face-Plate Type.)

Report No. 82—1919. 25¢ net.

This report covers definitions, pressures, methods of enclosure, standard sizes and ratings, general construction, marking and tests.

REPORT ON BRITISH STANDARD FINE (B.S.F.) SCREW THREADS AND THEIR TOLERANCES.

Report No. 84—1918. 25¢ net.

This report gives revised tables of dimensions for British standard fine screw threads and covers theoretical dimensions and standard sizes and tolerances of bolts and nuts for two grades of fit. The report also contains an appendix dealing with methods of determining and compensating for errors in pitch, form of thread and diameter. Much information is given regarding methods of gauging screw threads.

BRITISH STANDARD SPECIFICATION FOR ELECTRIC CUT-OUTS FOR LOW PRESSURE, TYPE O.

Report No. 88—1919. 25¢ net.

This specification covers dimensions and standard sizes of cut-outs for low pressure and ordinary duty. A separate specification is contemplated for heavy duty cut-outs.

Requests for copies of any of the above should be addressed to: The Secretary,

Canadian Engineering Standards Assoc.,

Room 112, West Block,

Ottawa,

and should be accompanied by money order payable to the Canadian Engineering Standards Association, Ottawa.

Montreal's Reception to General Currie

Montreal surpassed all previous efforts in the welcome which it extended to General Currie on his visit to the city on August 21st. The route which led from the Place Viger Station to the Khaki Club, via Sherbrooke Street, a distance of about two miles was lined with citizens who gave ample demonstration of their appreciation of the work done by General Currie while in command of the Canadian Corps in France.

In the evening General Currie was entertained at dinner in the Ritz Carlton Hotel by Brigadier General Charles J. Armstrong, C.M.G., C.B., M.E.I.C., Acting G.O.C. of No. 4 Military District, and by the officers of No. 4. Military District. General Armstrong proposed the health of General Currie, and in reply General Currie paid a warm tribute to the work of Canadians overseas, especially to the work of General Armstrong, General Sir Frederick Loomis, General G. E. McCuaig, Colonel F. S. Meighen, Lt.-Col. Alex Ritchie, and Lt.-Col. Clark Kennedy, V.C. Speaking of Colonel Clark-Kennedy, General Currie said:—"Nothing was too dangerous for this gallant officer and I had to restrain him often. Luckily he was not killed but lived to win the Victoria Cross, and I can assure you that no V.C. was ever more worthily won than that awarded to Clark-Kennedy." "Some said that Montreal was too largely represented in the field," said general Currie, "but, when you think of the records achieved by the Montreal battalions, you must agree that it would be well if the whole Canadian Corps had been made up of regiments from Montreal."

General Currie then told of the heroic work done by the Canadians at the 2nd battle of Ypres, and said that after that fight General Smith-Dorrien told him that, had it not been for the marvellous defence by the Canadians, it might have been the greatest disaster that had ever befallen British arms.

While at the Khaki Club, General Currie, in response to the urgent requests of the returned officers and men, addressed them as follows:—

"I am very happy to be here this afternoon. You know me well enough to appreciate that I am not a speaker, nor a politician seeking an opportunity to get a vote. I do not know what you would really like me to say, but the welcome I have received in Montreal and the reception tendered me this afternoon, makes this event one of the happiest in my life.

"Nobody knows better than you, boys, that any success with which my name has been associated has been won for me by you on the field. The Canadian corps was one big machine, and it was the spirit of co-operation that won for us success. If there are any problems to be confronted in Canada, or any difficulties to be overcome, the only way to meet them is by standing together again, and if we stuck by one another in the field, we can do the same in civil life; we are all comrades here, as we were all comrades there.

"The rest of my life, so far as I am able, will be devoted first to helping the widows and orphans of those who are not coming back. (Cheers, and "Hear, Hear"), and next, to helping you boys, who exposed your bodies as a living bulwark against the dangers that threatened the world. You are the men who made for Canada her place as a nation, and you are the men to whom Canada owes the greatest debt. I do not know what your problems are, whether you have been able to get work, whether your employers are prepared to take you back, and if you are getting more money than before, but when I become familiar with all these things, I shall not hesitate to speak, and speak very plainly. I have always called a spade a spade. When a man was good, I promoted him if I could, and if he was not good, I fired him."

CORRESPONDENCE

Canadian Engineering Standards Association

Ottawa, Ont.,
June 12th, 1919.

Editor, *Journal*:—

Referring to your letter of May 21st, regarding *The Engineering Institute of Canada* specifications on Steel Railway Bridges, and Steel Highway Bridges, I am directed to inform you that at the meeting of the Main Committee of this Association held on June 4th, it was decided that a Sub-Committee on Steel Railway Bridges should be appointed, the personnel as far as practicable to be the same as that of the Committee of *The Engineering Institute* on Steel Railway Bridges. It is of course understood that when *The Engineering Institute of Canada* specification is complete, a meeting of this Committee will be held in order to take such steps as may be desirable, in order to obtain as wide acceptance as possible for the specification.

I am also directed to ask you to convey to the Council of *The Institute*, the thanks of the Main Committee of this Association and their appreciation of the helpful manner in which the Council has co-operated with this Association.

I may add that at the meeting above referred to, Mr. G. H. Duggan, M.E.I.C., was appointed Chairman of our Sectional Committee on Bridges and Building Construction, and this Sectional Committee will make recommendations as regards *The Engineering Institute of Canada* specification for Steel Highway Bridges when that specification is ready for consideration by this Association.

Very truly yours,
R. J. DURLEY, M.E.I.C.,
Secretary.

* * *

July 17th, 1919.

Editor, *Journal*:—

A few evenings ago, in the course of your remarks before the Vancouver Branch of *The Engineering Institute*, I understood you to refer to the difficulty of defining the scope of the engineering profession, and the essential and distinctive qualifications of an engineer.

May I venture to offer, as a contribution to the literature related to the subject, the following proposed definition. If the objects of *The Engineering Institute*, embodying incidentally a definition of the profession of the engineer, in which as you will observe, I have paraphrased portions of the charter of the Institute of Civil Engineers.

A Society for the general *advancement* of *mechanical* and *constructive science* by the production of the *acquisition* of *those branches* of *knowledge* which *constitute* the *foundation* of the *profession* of *the engineer* and *invest* to the *power* to *divert* and *subject* "*the active forces of nature*" to *fulfilment* of the *purposes* and *service* of *man*, through *conversion* of *natural resources* into *appropriable wealth* and the *production* of *embodied utilities* such as *roads, bridges*, etc.

If in the above I have been able to present even a partial solution of any of the difficulties which in the framing of a definition of *Engineer* or *Engineering* or effect any clarification or improvement upon former definitions, I shall be glad.

Yours truly,
A. E. HILL, M.E.I.C.

* * *

Houlton, Maine,
August 14th, 1919.

Editor, *Journal*:—

Your circular with pamphlet describing the Canadian Engineers Standard Association has been received. I am sure there is a good field for the work of the Association.

My personal judgement in this matter leads me to prefer the standardizing of parts of machines or structures, rather than of the assembled whole, for instance, nails, spikes, screws and nuts, wire, rails, joints, etc., can be easily and profitably standardized, while it might be difficult or very uneconomical to do so in the case of locomotives, buildings or bridges, at least in a broad measure. I have never been able to understand why in the case of screw threads, with the excellent Whitworth thread in use, the Sellers thread, which is much inferior, should have been standardized in this Country.

It may not be inopportune to take up the question of universal use of the metric system of measurements. I think its adoption by the English speaking people of the world would have a wonderfully good influence in many directions.

Yours truly,
MOSES BURPEE, M.E.I.C.,
Chief Engineer,
Bangor & Aroostook Railroad.

OBITUARY

David Doyle, A.M.E.I.C.

The Institute has learned with deep regret of the death on May 30th, at Woolwich, England, of David Doyle, A.M.E.I.C.

Mr. Doyle was born at Birkenhead, England, on March 8th, 1874, and received his education at the Liverpool School of Technology and the Birkenhead School of Science. After the completion of his education Mr. Doyle served a two years apprenticeship with the firm of Turner, Son & Evanson, Engineers, Chelsea, London, after which, from 1896 to 1904, he was employed on engineering work in England. In 1904 he went to Chile, S.A., for Messrs. Hardie & Co., Construction Engineers, where he spent four years on railway and waterworks construction. Mr. Doyle left South America in 1908 and went to Oakland, California, where he was engaged in improving the municipal water supply, and then came to Canada where, from 1909 till 1914, he was engaged in hydraulic developments for mining purposes in British Columbia. When war came Mr. Doyle returned to England and spent the remainder of his life in the Building Works Department of the Royal Arsenal, Woolwich, England.

Mr. Doyle is survived by his widow and a brother, Frederick Doyle, of Carlisle, England.

Report of Council Meeting

The regular meeting of Council was held at headquarters, Tuesday, August 19th.

The minutes of the previous meeting were approved.

Secretary's Western Trip: The Secretary reported his visit to the conventions of the American Society of Mechanical Engineers, American Society of Civil Engineers, The Winnipeg Branch, Annual Meeting of the Saskatchewan Branch, meetings at Calgary, Vancouver and Victoria, and an informal meeting at Prince Rupert, where the members expressed a desire for a new branch.

Salaries, Civil Service Reclassification: Letters of the Ottawa, Toronto and Border Cities Branches, urging action in connection with the reclassification of the engineers employed in the Civil Service, were read which were in harmony with what Council has already done and is now doing. The Secretary was instructed to go to Ottawa to secure all possible information and data for the benefit of the Committee of Council in order that this information might be used by the Committee when approaching the Government on behalf of the engineers, which it is proposed to do as soon as the data is available. Letters from various members on this subject were noted.

Salaries Schedule: A letter from H. A. Goldman, Secretary of the Salaries Committee of the Toronto Branch, which he had sent to all branches, was noted.

Presidential Address: The Secretary was instructed to forward a copy of the special edition of President Vaughan's address on the "Manufacture of Munitions in Canada," to each member of the House of Commons and of the Senate, as soon as the session opens.

National Industrial Conference: The correspondence of the President and the Secretary with the Department of Labour in response to an invitation to send a single delegate to the proposed National and Industrial Conference, was noted, and after a complete discussion a letter dictated by the President to the Minister of Labour declining to send a representative, was approved.

Standardizing Association: It was noted from the letter from Major L. W. Gill, M.E.I.C., that the proposal to establish an International Association for standardizing methods of testing materials, was shelved for the time being.

Badges: The result of the work of this Committee was presented in a report from the Chairman together with samples of the badges. The Committee recommended the ordering of Five Hundred (500) badges at once, fifty (50) in gold, two hundred (200) in silver, and two hundred and fifty (250) in bronze, and suggesting a price of: gold badges, $3.75; silver badges, $2.25; and the bronze badges, $1.50, all complete and engraved with the member's name and badge number. The report of the Committee was adopted and the Council's appreciation of its work expressed.

Legislation: Report of Scrutineers: The scrutineers appointed by the Council to count the ballot on legislation reported as follows:—

July 24th, 1919

Council of

The Engineering Institute of Canada.

Gentlemen:—

We, the undersigned scrutineers appointed by Council on July 22nd, beg to report that we have opened the ballot submitted to the corporate members of *The Institute* for an expression of opinion regarding proposed legislation and that the result of this ballot is as follows:—

Votes "yes"	475
Votes "no"	138
Discarded votes	3
Total ballots received	616

Respectfully submitted,
Yours very truly,

LESSLIE R. THOMSON,
J. L. BUSFIELD, Scrutineers.

In view of the lengthy agenda it was decided to postpone discussion and action until the meeting of Council, September 8th. A communication from the Sault Ste. Marie Branch was noted, also a circular from the Institution of Civil Engineers showing that the question of legislation was prominent in the Old Country.

Branch By-Laws: The Border Cities Branch By-Laws were referred to the Executive for approval.

Appointment of Treasurer: It was resolved that Brig.-Gen. Sir Alex Bertram be appointed Treasurer of *The Institute*, and the Secretary was instructed to request General Bertram's acceptance of the office.

Perpetuation of Military Titles: Letters from various members were noted as well as one from Lieut.-Col. R. H. Helmer on this subject, and it was decided that the military titles of all the members be preserved in the records and that the titles be given to the members unless otherwise desired. The Secretary was instructed to address a multigraphed letter to each member enclosing copy of a list of the missing members requesting his personal assistance in supplying addresses and in bringing the Honor Roll up to date with the latest rank and honors of the members on active service.

Specifications: It was decided that although they cost more to produce, standard specifications of *The Institute* would be sold at a nominal price of twenty-five (25) cents.

American Societies Development: The report of the Committee on Aims and Organization of the American Society of Mechanical Engineers and the report of the Committee of Development of the American Society of Civil Engineers presented at their recent respective Annual Meetings, were noted with interest.

A.I.E.E. Convention: The report of John Murphy, M.E.I.C., of his activity in the interests of the engineering profession at the recent Convention of the American Institute of Electrical Engineers at Lake Placid, was read with interest and appreciation expressed of his activities in that connection.

Examinations: The suggestion of F. A. Bowman, M.E.I.C., Chairman of the Halifax Branch, that an examination be included in Schedule "C" covering telephone engineering, was considered and referred to the Board of Examiners with a recommendation that the proposal be accepted.

Specifications for Steel Bridges: The action of the Canadian Engineering Standards Association in appointing a Sub-Committee on Steel Railway Bridges to include the personnel as far as practicable of the Committee of *The Engineering Institute,* was approved.

Dues from Men in Military Service: Consideration was given to several letters received from members in connection with rebating dues to men in military service, but not actually overseas. The Secretary was instructed to write confirming the previous policy, that where a man had not been overseas, but in accepting military service had suffered financial hardship, individual requests for remission would be given consideration.

Education of Canadian Children: The report of the Sub-Committee regarding improvement in the education of Canadian children kindly forwarded by Councillor James White, M.E.I.C., was noted.

Quebec Bridge Transactions: The kind offer of the St. Lawrence Bridge Company and the Dominion Bridge Company through G. H. Duggan, M.E.I.C., to assist very materially in the publication of the Transactions devoted to the Quebec Bridge was noted, and the Secretary instructed to write thanking Mr. Duggan and associates, and also to bring this fact to the attention of the members through *The Journal.*

National Conference on Moral Education: The invitation of W. F. Osborne, General Secretary of the National Conference on Moral Education in the Schools in Relation to Canadian Citizenship was presented, and in view of the distance it was decided that the Winnipeg Branch should be asked to nominate representatives and Professor Osborne notified accordingly.

Chapter of A.A.E.: The action of the Executive of the American Association of Engineers in upholding its previous decision that no chapters of the Association be established in Canada and refusing an application from Toronto and one from Quebec, were noted.

James Watt Centenary: The Secretary was instructed to forward circulars received to the various branches to be distributed as they desired.

American Welding Society: The request from the President of the American Welding Society to *The Institute* to appoint a representative, was considered, and it was decided that it was not feasible to have *The Institute* represented. The Secretary was instructed to so advise.

Public Health Act: A letter from the Chairman of the Montreal Branch to Sir Lomer Gouin suggesting that four engineers be appointed to the Board constituted to give effect to the new Act, was noted.

A ballot was canvassed and the following declared elected:—

Members

Thomas Johnson Locke, B.A., (Acadia Univ.) of Shelburne, N.S., district engineer, Dept. Public Works; Fraser Daniel Reid, B.Sc., (Queen's) of Cobalt, Ont., Manager, Coniagas Mines Ltd; Sven Svenningson (M.E., Christiania Univ., Norway) of Montreal, Que., chief engr., Shawinigan Engineering Co.

Associate Members

John Noel Anderson, of Vancouver, B.C., Lieut., 9th Batt., Can. Ry. Troops, pending release. Prior to enlistment, assistant engineer, Vancouver; Charles Lawrence Archibald, of St. John, N.B., draftsman, Royal Can. Engineers, St. John, N.B.; George Wilfred Beresford, of Ottawa, Ont., officer in C.E.F., prior to enlistment, in charge of construction on Erie & Ont. Ry.; Horace Malcolm Bigwood, of Victoria, B.C., Lieut., Canadian Engineers, C.E.F., prior to enlistment, asst. engr., city engineers dept., Victoria; Rex Elmer Buckley, of Niagara Falls, Ont., with Niagara Falls Power Co., engineer and inspection of substation at Echota, N.Y.; Maurice A. Burbank, of Winnipeg, Man., prior to enlistment, engineer, G.T.P.Ry., on location and construction, two years work in France, chief engineer, 4th Bn., Can. Ry. Troops; Walter Roy Campbell, of Campbellton, N.B., first asst. to res. engr., C.N.Rys., Campbellton; William Bradshaw Crombie, of Niagara Falls, Ont., inst'man, Hydro-Elec. Power Development, Chippawa Creek; Francis Murray Dawson, B.Sc., (N.S. Tech. Coll.) of Westmount, Que., Capt., M.C., Canadian Engineers, at present, member of firm, Monks, Manhard & Dawson, engrs., agents and contractors, Montreal; Charles Henry Ellison, of Firdale, Man., asst. engr., in charge of construction, G.T.P.Ry., Firdale, Man.; Charles Clifford Elliott, of Brooks, Alta., in charge of operation and maintenance of canals and structures, C.P.R.; John Levern Franzen, B.Sc., (C.E.) (Washington State Coll.), Div. Engineer, Canada Land & Irrigation Co., Medicine Hat, Alta. Robert Porter Freeman, B.Sc., (C.E.) (N.S. Tech. Coll.) of Halifax, N.S., prior to enlistment in 1916, instructor in charge of short course land surveying, N.S. Tech. Coll., recently demobilized; Stanley Richard Frost, of Niagara Falls, Ont., chief mechanical engineer, American Cyanid Co., in charge of maintenance and construction in large chemical plant; Lionel Leatham Gisborne, B.Sc., (M.E., McGill) draftsman, Niagara Development in Hydro Elec. Power Comm.; William Harland, of Toronto, Ont., asst., hydraulic dept., Hydro Elec. Power Comm.; Thomas Leo Hughson, B.Sc., (Civil, Queen's) of Niagara Falls, 1917-19, overseas, now with Hydro-Elec. Power Comm., Construction Dept.; Walter Janssen, of Montreal, B.Sc., (Univ. of Wisconsin) operating manager, Can. Steel Foundries, Ltd.; George Harold Lowry, of Niagara Falls, Ont., resident engineer, Hydro. Elec. Power Comm.; William James MacKenzie, of Vancouver, B.C., ch. dftsman in ch. engineer's office, C.N.P.Ry.; James Gladstone MacLaurin, B.A.Sc., (Toronto) of Sault Ste. Marie, Ont., manager, water power dept., Algoma Steel Corp.; Edmund Senkler Malloch, B.Sc., (Queen's) of Ottawa, Ont., asst. tech engr., fuels and fuel testing div., Mines Branch, Ottawa; Norman Mallock, B.Sc., (Queen's) of Niagara Falls, Ont., in office of chief field engr., Niagara Power Development; Joseph Benedict McAndrew, B.A.Sc., (Toronto) of St. Catharines, Ont., 16 months with C.E.F. as officer, 7th Can. Ry. Troops, at present designing engr., Welland Ship Canal; Lyle McCoy, of Montreal West, in charge of all new engineering work and maintenance, Can. Car & Foundry Co., and Can. Steel; Thomas Stanley Mills, B.A., B.Sc., (Queen's, D.L.S.) of Ottawa, Ont., acting chief engineer, Dominion Parks Branch, Dept. of Interior, Ottawa; William George Montgomery, of Peterboro, Ont., asst. engr. surveys, designing plans, etc., Trent Canal; Ralph Carleton Morgan, of St. Catharines, Ont., draftsman, Dept. Railways and Canals; John

Bernard Petrie, of Wabana, Nfld., mech. supt. of Dom. Iron & Steel Co., Wabana; Gerald Mungo Ponton, of Ottawa, Ont., Lieut., Can. Engrs., Tunnelling Co., C.E.F., at present officer with I.M.B., prior to enlistment, in 1916, metallurgist, Phelps Dodge Co., New Mexico, Arizona and Mexico; Othmar Wallace Ross, B.A.Sc., (Toronto) Capt., of St. Catharines, Ont., 3 years on active service, at present asst. engr., section 1, Welland Ship Canal; Harry Roy Silcox, B.Sc., (McMaster Univ.) of Toronto, Ont., field engr., railway dept., Hydro-Elec. Power Comm.; Stewart Troop, of Moncton, N.B., (Lieut., Can. Engrs.) purchasing engr., Kipawa Co. Ltd.; Russell S. Trowsdale, of Calgary, Alta., dist. engr. in Alta., for Can. Gen. Elec. Co. and Can Allis-Chalmers; Ernest Owen Way, of Ottawa, Ont., ch. inspector in full charge of Dominion Standards Branch of weights and measures, and Dominion Inspection Service.

Juniors

Claude Bradley, of Calgary, Alta., asst. surveyor, Dept. Nat. Resources, C.P.R.; Arthur Wesley Crawford, of Hamilton, Ont., dist. vocational officer, Dept. of Soldiers' Civil Re-Establishment; Douglas Bankier Gardner, B.A.Sc., of Toronto, Ont., 1916-19, Lieut., Can. Engrs., at present with Hydro-Elec. Power Comm. as draftsman; Norman Geddes McDonald, B.A.Sc., (Toronto) of Niagara Falls, Ont., at present draftsman, Hydro-Elec. Power Comm., on the Ont. Power Co's extension; Charles Salmon MacLean, B.A., B.Sc., (Univ. of N.B.) of Halifax, N.S., instructor at N.S. Tech. Coll., in re-educ. classes, dept. soldiers' civil re-establishment; William Britton Pennock, B.Sc., (McGill) of Ottawa, Ont., Lieut., Canadian Engineers, C.E.F., France, prior to enlistment, in chg. of sounding party, Sask. river survey, at present vocational officer, Dept. of Soldiers' Re-Establishment of Canada; Joseph Henry Ryan, B.Sc., (C.E., N.S.T.C.) of Halifax, N.S., with Halifax Shipyards, Ltd.; Frank Bennett Young, of St. John, N.B., Major 26th Batt., B.E.F., prior to enlistment, in private practice, Crown Land surveyor for N.B.'

Associates

Jesse Franklin Block, B.S.A., (Univ. of Alta.) of Calgary, Alta., served as non-com. officer in No. 10, Engrs. & Ry. Constrn. Corps, at present asst. to ch. agric. engr., Dept. of Interior, Calgary.

Transferred from Associate Member to Member.

James Roy Cockburn, B.A.Sc., (Toronto of Toronto, Ont., 1916-19, on active service with 58th Bn. in France, Royal Engrs. in France and Palestine, prior to enlistment, asst. professor of descriptive geometry, Univ. of Toronto; George Hendry Ferguson, B.A.Sc., (C.E., Univ. Toronto) of Ottawa, Ont., 1915-18, officer with C.E.F., Can. Engrs., at present, asst. engr., Comm. of Conservation; John Francis Greene, B.Sc., (Boston) of Winnipeg, Man., member of firm C. D. Howe & Co., conslt. engrs., Port Arthur and Winnipeg; Archibald Rettie Holmes, B. Eng., (Kings) of Toronto, Ont., president, Archibald & Holmes, Ltd., engrs. and bldrs.; Irving Heward Nevitt, B.A.Sc., (Toronto) of Toronto, Ont., supt. and asst. engr. in chg. of operation of main sewage disposal works, etc.; Harold Roy Miles, of Lethbridge, Alta., div. engr., C.P.R., Lethbridge div.; George Kinghorn McDougall, B.Sc., (McGill) of Montreal, Consulting engineer, McDougall & Pease; David Bird McLay, B.Sc., (Glasgow Univ.) Captain, R.E., prior to enlistment in 1915, asst. engr., construction and maintenance of roads, city engr's office, Vancouver; Aloys Reginald Sprenger, Major, Canadian Engrs., C.E.F., 1915-19, prior to enlistment, engr., T.C.Ry., St. John, N.B., at present, dist. supt'g engr. for Eastern Canada, Dept. Soldiers' Civil Re-establishment, Ottawa.

Transferred from Junior to Associate Member

Walter Edward Blue, of Ottawa, Ont., Major Canadian Field Artillery, 1914-19, prior to enlistment, res. engr., Chaudiere Dam, Lake Nipissing, at present, asst. Engr., Dept. Public Works, Ottawa; John William Ford, B.A.Sc., (Toronto) of Niagara Falls, Ont., with Niagara Power Development, H.E.P. Comm.; Merritt Henry French, of Calgary, Alta., hydrometric and irrigation engr., Cypress Hills irrigation dist.; Flavius Ivo Cobbett Goodman, B.Sc., (McGill) of Halifax, N.S., res. engr., Halifax, O.T.; Alexander Watson Gregory, of St. Stephen, N.B., Capt., M.C., 26th Infantry Batt., France, 1915-19, asst. engr. in chg., (ch. engr's branch) Dept. Public Works, Ottawa; Robert Bruce Harkness, of Toronto, Ont., active service, commanded 19th Batt., at present, in chg. Niagara dist., Soldiers' Civil Re-establishment; William Wren Hay, B.Sc., (Univ. of Vermont) of Rogers, Mich., U.S.A., served in France with U.S. Army, 1917-19; Bruce Bowers Hogarth, B.A.Sc., (Toronto) of Ottawa, Ont., 1916-19, with C.E.F., Overseas, at present, insp. engr., power development on Winnipeg River, for Dominion Water Power Br.; Russel G. Lye, B.A.Sc., (Toronto) of Toronto, Ont., at present, active pilot for Surveys Dept., Speight & Van Nostrand; John Alexander McGillivray, of Winnipeg, Man., on valuation staff of Man. Public Utilities; Robert Cavan MacLachlan, B.Sc., (McGill), 18 months in France with Canadian Forestry corps, at present, asst. res. engr., Welland Ship Canal, St. Catharines, Ont.; Hugh Mervyn Morrow, B.Sc., (McGill) of Montreal, Que., Lieut., Can. Ry. Troops, France, at present, tech. salesman, Dom. Iron & Steel Co.; Frank O'Brian Nehin, B.Sc., (McGill) of Montreal, Que., asst. engr., Mt. Royal Tunnel & Terminal Co.; James Hillyard Norris, B.Sc., (McGill) of Montreal, Que., partner in firm of Douglas Bremner & Co. Ltd.; Jock Brown Shaw, of Victoria, B.C., asst. engr., Dept. Public Works, Vancouver Island Dist.; James Crossley Stewart, of Ottawa, Ont., Lt.-Col., D.S.O., Canadian Field Artillery, 1914-19, at present time asst. engr. to S. J. Chapleau, Dept. Public Works, Ottawa; Norman Wilson, B.Sc., (Univ. of N.B.) of Ottawa, Ont., Lieut., Canadian Engineers, Overseas, 1916-19, at present, asst. hydrographic survey, Dept. of Naval Service, Ottawa.

Transferred from Student to Associate Member

Jean Edouard Barcelo, B.Sc., and C.E., (Laval) of Montreal, Que., with Quebec Streams Comm'n; E. Raymond Marien, B.A.Sc. (Laval), of Quebec City, at present comm'r of Industries, Quebec.

Transferred from Student to Junior Member

Theodore Dery, of Rimouski, Que., asst. engr., Dept. Public Works; Roy Cecil Ward, B.Sc., (Toronto) of Toronto, Ont., estimating and designing, Toronto Iron Works.

BRANCH NEWS

Halifax Branch

Frederick R. Faulkner, M.E.I.C., Sec'y.-Treas.

Brigadier-General C. H. Mitchell, was in Halifax on July 25th. The notice of his coming and the time of his stay was so short that it was not possible to call a meeting of the Halifax Branch to meet him, but the members of the Executive Committee who were in the city at the time, C. E. W. Dodwell, M.E.I.C., and Professor Sexton entertained the General at an informal supper at the *Green Lantern*, after which a visit was paid to the Nova Scotia Technical College.

Toronto Branch

W. S. Harvey, A.M.E.I.C., Sec'y.-Treas.

At a meeting of the Executive of the Toronto Branch held recently, it was decided to send the following memorandum to the Council of *The Institute:*—

"Inasmuch as the Report on the Proposed Reclassification of the Civil Service of Canada, as issued by the Civil Service Commission in June last, does not, in our opinion, provide for adequate or reasonable rates of remuneration for the higher positions of the Engineering Branches of the Civil Service of Canada, and as, we understand, it is the intention of the Government to present a bill during the coming session, dealing with the Reclassification of the Civil Service, we urgently recommend that the Council of *The E.I.C.* take as energetic action as possible before the next session of Parliament, to induce the Government to make such changes in this proposed Reclassification as are necessary to provide a fair and proper remuneration to all the Engineers now adversely affected.

The Members of the Executive of this Branch very fully appreciate the excellent work that has already been done and the splendid efforts that have been exerted by the parent Society through the Council and Committees in Montreal and Ottawa. They are, however, strongly of the opinion that *The E.I.C.*, through the Council, can continue to exercise great weight and influence with the Government in regard to this question, and that any substantial results obtained will be a very great benefit to the engineering profession in Canada."

Border Cities Branch

G. C. Williams, A.M.E.I.C., Sec'y.-Treas.

A night letter, signed by the Chairman and Secretary of the Branch, was forwarded, on August 20th, to Council, as follows:—

"At a meeting of Executive of Border Cities Branch June nineteenth, for discussion of Government engineers' salaries, a resolution was passed asking that Council of Parent Society strongly urge Government at Ottawa to pass reclassification of engineers in Civil Service as per Arthur D. Young report and memorandum, dated June twenty-fourth, handed to Chief Engineer of Public Works by engineers on his staff."

Vancouver Branch

A. G. Dalzell, M.E.I.C., Sec'y.-Treas.

The following members of the Branch have now returned from overseas:—J. W. B. Blackman, M.E.I.C.; J. R. Grant, M.E.I.C.; R. F. Leslie, M.E.I.C.; C. S. Manchester, M.E.I.C.; H. St. J. Montizambert, M.E.I.C.; C. F. Alston, A.M.E.I.C.; C. R. Crysdale, M.E.I.C.; H. B. Earle, A.M.E.I.C.; R. G. E. Leckie, A.M.E.I.C.; F. O. Mills, A.M.E.I.C.; W. H. Moodie, A.M.E.I.C.; T. E. Price, A.M.E.I.C.; R. Snodgrass, A.M.E.I.C.; W. J. Smart, A.M.E.I.C.; W. G. Swan, A.M.E.I.C.; G. A. Walkem, A.M.E.I.C.; A. E. Humphrey, S.E.I.C.; R. S. Perry, S.E.I.C.

MEMBERS EXCHANGE

Members wishing to acquire or dispose of engineering or scientific books or instruments may insert, under this heading, concise advertisements; free of charge.

For Sale

Transactions of the Institute of Engineers (Scotland), Volume 1, 1st Session, 1857 to 1858. Printed in 1858.

Mechanical Engineers' Proceedings 1872 to 1887—16 volumes.

Engineering (England), 1866 to 1903—75 volumes.

Engineering News (American), 1885 to 1887—6 volumes.

Engineering Record (American), 1889 to 1890—2 volumes.

Scientific American, 1882, 1883, 1884 — 6 Volumes. Full years.
1885—Jan. to June. 1 Volume.
1886—Jan. to June. 1 Volume.
1887— 2 Volumes. Full year.

Leather backs and corners, all but four or five numbers of Engineering in first class order, those damaged have the backs off, a couple of dollars will put them in good order. Anyone wanting to add to their library can have a bargain. Address M.E. No. 1, *The Engineering Institute.*

*

Bound Volumes of Engineering News

A member of *The Institute* has for sale 27 volumes of Engineering News, bound, being 12 volumes 1890 to 1895 and 15 volumes 1903 to 1911. The price asked for these 27 volumes is $40.00, F.O.B., Moncton, or will consider an offer. If any member or Branch desires these kindly address M.E. No. 2, *The Engineering Institute.*

Personals

Lieut.-Col. H. R. Lordly, C.E., M.E.I.C., who has recently returned from overseas, has been elected a Fellow of the Society of Engineers, London. This singular distinction has been granted to Colonel Lordly because of the engineering work which he has accomplished overseas while employed with the Imperial Forces. The Society of Engineers has a restricted membership and amongst its members are many of the most eminent engineers in the Old Country.

Lieut.-Col. H. R. Lordly, C.E., M.E.I.C.

Colonel Lordly is a graduate of Cornell University and is the holder of the Fuertes Gold Medal given by the College of Civil Engineers in memory of its former head Dean Fuertes. *The Institute* has always had the active support of Colonel Lordly, who has served as Honorary Librarian for one year, has twice been a member of the Nominating Committee, and has contributed several papers, the last one being on Subaqueous Concrete, in which class of work he has had extensive experience. Colonel Lordly has been granted two patents in connection with concrete construction, both of which have been successful. One of the patents is for a concrete pile with a jetting and sucking device, and the other is for a concrete block cast around sand cores. Before going overseas Colonel Lordly was for many years in charge of the rebuilding of the Lachine Canal, and will in future engage in consulting engineering practice in Montreal.

Colonel Lordly has had extensive military experience. He is the possessor of both the Long Service Auxiliary Medal and the Officers Long Service Decoration, the latter being awarded while on service overseas. He has been a member of the Executive Council of the Province of Quebec Rifle Association and has won the Governor-General's Medal and the Lieutenant-Governor's Medal for the Special Aggregates Competition. Before the war Colonel Lordly was in command of the Corps of Guides at Montreal, and when war came he organized and took overseas the 5th Pioneer Battalion from Montreal.

*

D. deC. Ross-Ross, B.Sc., Jr. E.I.C., has been appointed instructor in Power Plant Engineering at the Central Technical School, Toronto, in connection with the work of the Soldier's Civil Re-establishment.

*

Capt. K. MacKinnon, M.C., J.E.I.C., of the 2nd Signal Co., Divisional Engineers, returned to his home in New Glasgow on July 17th. Previous to the war Capt. MacKinnon was with the Halifax Power Company.

*

R. E. Weeks, S.E.I.C., has been appointed municipal engineer for the Municipality of Glenwood, with headquarters at Souris, Man. A contract has been let by the Municipality for 28 miles of good roads, the construction of which has been commenced.

*

Gaylen R. Duncan, M.Sc., A.M.E.I.C., of the firm of G.R. Duncan & Co., Fort William, Ont., and President of the Fort William Board of Trade has recently been elected Vice-President of the International Real Estate Association of Atlantic City.

*

Captain L. W. Wynne-Roberts, R.E., son of R. O. Wynne-Roberts, M.E.I.C., of Toronto, who has had some remarkable experiences, in various parts, with the Royal Engineers, is now on his way home from India. It is expected that he will arrive in Toronto next October.

*

Major Roy A. Spencer, M.C., and Bar, J E.I.C., arrived in Halifax early in August on the new White Star liner *Regina* after rendering gallant service for several years at the Front, with the Canadian Engineers. Major Spencer expects to reside in Halifax.

*

Lieut. H. E. Bates, B.Sc., A.M.E.I.C., of Montreal, returned from Overseas on the *Megantic* in August, having served since March, 1916, with the 66th Battery, 14th Brigade, C.F.A., Montreal. Previous to the war Mr. Bates was engaged on the Quebec Bridge under Lt.-Col. Monsarrat, M.E.I.C.

*

Capt. J. A. Knight, S.E.I.C., Canadian Engineers, has recently returned to his home in Toronto after three and a half years at the front. During the early part of Capt. Knight's military career he was an officer in the 2nd Tunnelling Company and later was in the 11th Battalion, Canadian Engineers.

H.R.H. The Prince of Wales, at the request of the Mayor of Cobalt, will visit the Coniagas Mines on September 2nd, where he will be entertained by the Company at luncheon. The President, Lt.-Col. R. W. Leonard, M.E.I.C. will preside. All members of *The Institute*, in the vicinity, are receiving special invitations to be present at this function.

*

A. St. Laurent, M.E.I.C., Assistant Deputy Minister of Public Works, has been appointed Technical Departmental Representative on the Board of Hearing and Recommendations which has been established by the Civil Service Commission to assist in the work of fitting the personnel of the Civil Service to the Classification recently published by the Commission.

*

H. Wyatt Johnston, S.E.I.C., has just returned to Montreal after nearly two years absence on military service, having served with the Canadian Forestry Corps and later with the 8th Battalion Canadian Engineers during the offensive of 1918, and was present at the taking of Mons. He is enthusiastic regarding the magnificent achievements of the Canadian Engineers during the last days of the war.

*

Lieut. G. F. Layne, M.C., S.E.I.C., has recently returned from overseas. While overseas Mr. Layne held the rank of Captain in the Royal Horse and Royal Field Artillery (T), but served in France and Palestine with the Seige Artillery. In June 1917 Mr. Layne was mentioned in despatches and in September 1917 was awarded the Military Cross for gallantry and devotion to duty in action.

*

D. A. R. McCannel, B.Sc., A.M.E.I.C., has recently been appointed City Engineer of Regina, Sask. Mr. McCannel has been a resident of Regina since 1893, and received his early education in the public and high schools of Regina. In 1914, he graduated from Queen's University, Kingston, with the degree of B.Sc. in Civil Engineering. Mr. McCannel has been on the engineering staff of the city of Regina since 1914.

*

Major G. R. Taylor, J.E.I.C., joined the Canadian Expeditionary Forces in February, 1915, at which time he was engaged with the Hydro-Electric Commission. He went to France as Captain of the 10th Batt., C.R.T., and was advanced to the rank of Major in October, 1917. Major Taylor was engaged on light railway work at Nieuport and Ypres for a considerable length of time and after the Armistice on standard gauge reparation work. He returned to Canada in August 1919.

*

Lieut. Walter S. Ford, B.Sc., A.M.E.I.C., who previous to the war was engaged with the Western Canada Power Company, Limited, on power house construction, returned to Canada on July 14th and has gone on to Redlands, California, where he will spend some months. Lieut. Ford enlisted in January, 1915, as Sapper with the Canadian Overseas Railway Construction Corps and spent two years in England, Belgium and France on narrow and standard gauge railway construction. Later he transferred to the Royal Guards Artillery with a commission. He was wounded on February 6th, 1918.

*

Lieut.-Col. Daniel Hillman, D.S.O., M.E.I.C., has returned to Canada after distinguished service in France. Colonel Hillman joined the Canadian Overseas Railway Construction Corps as a Lieutenant in 1915 and served with that unit in France from July 1915, till January 1918, when he was seconded to the Royal Engineers as Assistant Railway Construction Engineer. In March, 1918, he was promoted to Railway Construction Engineer and held this appointment till May 1919, when he was returned to his own unit. Before going Overseas, Colonel Hillman held the position of Divisional Engineer in charge of the double tracking of the C. P. R. line from Sudbury to Port Arthur.

*

The Asphalt Association has appointed Bruce Aldrich as district engineer of the Canadian district, with headquarters at the office of the H. K. McCann Company, Limited, Toronto. Mr. Aldrich was born in England and received his higher education there, but spent his early life and received his primary education in Canada. His experience in connection with testing of asphalts and cement and as organizer of the municipal laboratory of Baltimore eminently fits him for this position in which he will devote his attention to co-operation with officials and engineers in the several provinces with a view to bringing about constructive results in asphaltic highway work.

*

Major Shirley T. Layton, M.C., B.Sc., A.M.E.I.C., returned to Canada on July 12th on the *Carmania* after serving thirty-eight months active field service in France. Major Layton enlisted on November 10th, 1914, and sailed from Canada, June 15th, 1915, with the 2nd Heavy Battery as Lieutenant, going to France three months later. There he was promoted to Captain and transferred to the 2nd Siege Battery. In February 1918, he was promoted to Major in command of the 5th Siege Battery. He was twice mentioned in despatches and was awarded the M.C. in the spring of 1918. He participated in the engagements of Hooge, Vimy, Hill 70, Passchendale, and other Canadian engagements, seeing continuous service through all these without mishap.

*

Lieut.-Col. W. P. Anderson, C.M.G., M.E.I.C., Past President of *The Institute* met the S.S. *Melita* at Montreal, on August 23rd, to welcome back his two sons; Colonel T.V. Anderson, D.S.O., A.M.E.I.C., who has been in command of the Engineering Construction Corps at Seaford since he lost his right hand at Vimy, while in command of the 3rd Divisional Engineers; and Lieut.-Col. W. B. Anderson, C.M.G., D.S.O., who before the war was Assistant Quartermaster-General of the Canadian Corps at Montreal. Past President Anderson's youngest son, Major Alex Anderson, D.S.O., J.E.I.C., who was in command of the 2nd Division Signallers, returned to Canada two months ago and has resumed work with the Public Works Department.

Employment Bureau

Situations Vacant

Contractor's Assistant

Opening for young college graduate who has had some experience on construction work to start with an Engineering Contracting firm in Montreal. Box No. 46.

Building Superintendent

An experienced Building Superintendent, college graduate required for Construction Company. One experienced in taking off quantities and constructing work preferred. Box No. 47.

Supervising Engineer

Position open for a Resident Civil Engineer to supervise the construction, in Eastern Canada, of a Hydro-Electric Power Development, including Dam, Power Station and Transmission Line. Previous experience on similar work absolutely necessary. Box No. 45.

Professor of Mechanical Engineering

Professor of Mechanical Engineering wanted at Nova Scotia Technical College. Must be a graduate of a recognized engineering college with at least six to eight years of practical experience. Salary $200 per month. Box No. 48.

Instructor of Civil Engineering.

Instructor of Civil Engineering wanted at Nova Scotia Technical College. Must be a graduate of a recognized engineering college with at least three years of practical experience. Salary $150.00 per month. Box No. 49.

Draftsmen required

Draftsmen required for position in a New York office having experience in industrial engineering. Apply Box 50.

CIVIL SERVICE COMMISSION

The Civil Service Commission of Canada hereby give public notice that application will be received from persons qualified to fill the following positions on the Superior Staff of the Royal Military College, Kingston, Ont.

A Professor of Engineering. Initial Salary $3,480 per Annum

1. A Professor of Engineering at an initial salary of $3,480 per annum, to have charge under direction, of the Engineering Department of the Royal Military College, to instruct in the several branches of engineering and to direct the work of assistant professors and instructors in engineering and surveying. Candidates should be graduates of a school of applied science of recognized standing, with at least five years of experience in teaching the principles of engineering in some academic institution of higher learning, preferably with some engineering practice in the recent war. They should have a thorough theoretical knowledge of engineering in all its branches.

An Instructor in Chemistry. Initial Salary $1,800 per Annum

2. An Instructor in Chemistry at an initial salary of $1,800 per annum, to assist in the Royal Military College in teaching and instructing in chemistry. Candidates should be not more than 25 years of age, and be graduates in chemical engineering of a school of applied science of recognized standing, or be honour graduates in chemistry with physics as a minor subject, from a university of recognized standing.

An Instructor in Physics. Initial Salary of $1,800 per Annum

3. An Instructor in Physics at an initial salary of $1,800 per annum, to assist in the Royal Military College in teaching and instructing in physics. Candidates should be not more than 25 years of age, and should be graduates in civil, mechanical or electrical engineering, or in honour physics with mathematics as a minor subject from a university of recognized standing.

An Instructor in Civil Engineering. Initial Salary $1,800 per Annum

4. An Instructor in Civil Engineering at an initial salary of $1,800 per annum, to assist in the Engineering Department of the Royal Military College. Candidates should be not more than 25 years of age, and be graduates of a school of applied science of recognized standing, with preferably one or two years of experience in engineering design or construction work. They should have a good theoretical knowledge of civil engineering in all its branches.

Two Instructors in Mathematics. Initial Salaries $1,800 per Annum

5. Two instructors in Mathematics at initial salaries of $1,800 per annum, to assist in the Royal Military College in teaching and instructing in mathematics. Candidates should not be more than 25 years of age, and should be graduates from a university of recognized standing with honours in mathematics.

An Instructor in French. Initial Salary $1,800 per Annum

6. An Instructor in French at an initial salary of $1,800 per annum, to assist in the Royal Military College in teaching and instructing in French. Candidates should be not more than 25 years of age, and should be graduates from a university of recognized standing, with French as an honour subject. They should have a thorough knowledge of French literature.

An Instructor in English. Initial Salary $1,800 per Annum

7. An Instructor in English at an initial salary of $1,800 per annum, to assist in the Royal Military College in teaching and instructing in English. Candidates should be not more than 25 years of age, and should be graduates from a university of recognized standing, with English as an honour subject. They should have a thorough knowledge of English literature.

Applicants should apply in writing on their own paper, to the secretary of the Civil Service Commission, Ottawa, not later than the 6th day of September. Applicants must specify the position for which the apply and must give full particulars as to name, address, age, qualifications, experience and previous employment. Applications should be accompanied by letters of reference from three reputable citizens.

Second List

The Civil Service Commission of Canada hereby give public notice that applications will be received from persons qualified to fill the following positions in the Civil Service of Canada.

A Chief, Organization Branch, Civil Service Commission. Salary $2,800 per Annum

1. A Chief, Organization Branch, Civil Service Commission, at an initial salary of $2,800 per annum. The duties of this officer are to be responsible, under the Secretary, Civil Service Commission, for the conducting of investigations and surveys and the preparation of plans of organization for the various departments and subordinate units thereof in the Dominion Government; to have charge of the making of investigations in connection with the efficiency of processes or operations or of individuals or groups of individuals within departments; to administer and keep up to date the classification of the Civil Service; to direct the staff of the Organization Branch; and to perform other related investigational and administrative work as required.

Candidates shall be *not less than twenty-five and not more than forty years of age and must be of good address tactful, able to meet the public and departmental officials and to judge people.* They must possess education equivalent to graduation from a university of recognized standing in accounting, economics, engineering or science *and at least five years of experience in accounting, engineering, shop or business management, or similar work, of which at least two years shall have been in an administrative capacity.* Applicants must be familiar with Civil Service administration *or the organization and methods of large business concerns.* Experience in investigation or organization work is very desirable.

The examination will consist of three parts, rated as follows:—(1) Education and experience, 40; (2) a thesis on a problem in office management, accounting, industrial operation, or organization, to be chosen from a list established by the Commission, 30; (3) Oral interview, 30. Applicants will not be assembled for the statements of education and experience and for the thesis, but may do this work at their own homes. These will be received only from those candidates who show that they possess the minimum qualifications in education and experience. Those successful in the first two parts of the examination will be assembled later at one or more points for oral interview.

Application forms properly filled in, must be filed in the office of the Civil Service Commission not later than August 29th.

A Junior Engineer, Dept. of Public Works, Prince Rupert, B.C. Salary, $1,680 per Annum.

2. A Junior Engineer for the Department of Public Works at Prince Rupert, B.C., at an initial salary of $1,680 per annum. Applicants should be graduates in engineering from a School of Applied Science of recognized standing with two years of engineering experience, or four years of engineering experience in design, estimate, construction and maintenance work.

Application forms properly filled in, must be filed in the office of the Civil Service Commission not later than August 29th.

Secretary of the Board of Pension Commissioners. Salary $4,000 per annum

3. A Secretary of the Board of Pension Commissioners at an initial salary of $4,000 per annum. Candidates should have a good education, and several years of experience in a secretarial capacity, or in business administration. They should have, in particular, ability to manage, direct and co-ordinate the work of a large staff. Good address, tact, and agreeable personality are desirable qualifications.

Two Resident Architects for Sask. and Alta., Dept. of Public Works. Salaries $2,220 per annum.

4. Two Resident Architects, one for Alberta with headquarters at Calgary, and one at Saskatchewan with headquarters at Regina, Department of Public Works, at initial salaries of $2,220 per annum. Candidates must have education equivalent to high school graduation, and either graduation in architecture from a school of applied science of recognized standing, with three years of experience in architectural design, estimate, and construction work, two years of which shall have been in a position of professional responsibility, or five years of experience in architectural design, estimate, and construction work, two years of which shall have been in a position of professional responsibility. Candidates should have tact, good judgment, and ability to manage men.

A Junior Engineer, Welland Ship Canal. Salary $1,680 per annum

5. A Junior Engineer for the office of the Welland Ship Canal Construction Staff, Department of Railways and Canals, at an initial salary of $1,680 per annum. Candidates must have education equivalent to high school graduation, and either graduation in engineering from a school of applied science of recognized standing, with two years of engineering experience, or four years of engineering experience in design, estimate, construction, and maintenance work. The appointee will be required, under direction, to make surveys, supervise engineering construction and repairs, to make computations in connection with engineering work, and to perform other related work as required. This position was advertised April 16th, and is now re-advertised.

An Irrigation Specialist, Dept. of the Interior, Calgary. Salary $1,680 per annum

6. An Irrigation Specialist for the Reclamation Service of the Department of the Interior at Calgary at an initial salary of $1,680 per annum. Candidates must have education equivalent to graduation in agriculture from a school of recognized standing. They should have

a knowledge of irrigation problems, and at least one year of experience as Irrigation Assistant or in work of equivalent character and standard. They should have ability to plan and lay out works for water distribution over fields. They should have also supervisory ability.

A Junior Seismologist, Dept. of the Interior. Salary $1,500 per annum

7. A Junior Seismologist, Department of the Interior, at an initial salary of $1,500 per annum. Candidates must have education equivalent to graduation from a university of recognized standing, with specialization in mathematics and physics. They should have at least two years of experience with physical apparatus.

A Junior Magnetician, Dept. of the Interior. Salary $1,500 per annum

8. A Junior Magnetician for the Dominion Observatory, Department of the Interior, at an initial salary of $1,500 per annum. Candidates must have education equivalent to graduation from a university of recognized standing, with specialization in mathematics and physics. They must be familiar with problems in terrestrial magnetism. Exactitude is a desirable qualification.

An Assistant Inspector of Electricity and Gas for Hamilton, Dept. of Trade and Commerce. Salary $1,260 per annum

9. An Assistant Inspector of Electricity and Gas for Hamilton, Ontario, Department of Trade and Commerce, at an initial salary of $1,260 per annum. Applicants should have education equivalent to graduation from a technical high school, and preferably university training in science. They should have at least two years of experience in the manufacture or testing of electric and gas meters and equipment, or experience of equivalent character and standard. A qualifying examination in electricity will be held in connection with the filling of this position, and applicants will be informed later of the conditions of the examination. Candidates must be residents of the Province of Ontario.

A Male Junior Examiner, Civil Service Commission. Salary $1,600 per annum.

10. A Male Junior Examiner, Examination Branch, Civil Service Commission, at an initial salary of $1,600 per annum. The appointee will be required to assist in the preparation advertising, conduct and rating of written, oral and practical examinations, both personally and in co-operation with experts in various fields to perform clerical work incident to recording the results of examinations; to maintain Civil Service records; and to perform other related work as required. Candidates must have the equivalent of a high school education and must show such experience as will give reasonable assurance that they can undertake such duties as are listed above; they must be of good address, tactful, possessed of good judgment and able to meet and deal with the public and departmental officials. Initiative and executive and constructive capacity must be shown and integrity and trustworthiness are essential qualifications. Preference will be given to candidates with university training.

The examination will consist of three parts rated as follows:—(1) Education and experience, 40; (2) Questions on problems relating to the duties of the position, 30; (3) Oral interview, 30. The second part of the examination will be given only to those who have shown that they possess the minimum qualifications in education and experience. Those successful in the first two parts of the examination will be assembled later at one or more points for oral interview.

This position was advertised July 16th, and is now re-advertised. Applications received to date are still under consideration, and candidates who have already entered this competition need not duplicate their applications.

In the case of positions numbers, 4, 5 and 6, attention is drawn to the fact that appointments to these positions shall be made, so far as practicable, from bona fide residents of the province in which the position is situated.

Application forms for positions 3 to 10 properly filled in, must be filed in the office of the Civil Service Commission not later than September 15th.

General Directions.

The salaries for the above positions may be supplemented by such bonus as may be provided by Parliament.

Selections for eligible lists of applicants qualified to fill similar vacancies which may occur in future may be made from the applications for these positions.

According to law, preference is given to returned soldier applicants, possessing the minimum qualifications. Returned soldiers must furnish a certified copy of their discharge certificates, or in the case of commissioned officers, a certified statement of their military services.

Attention is drawn to the fact that appointments to these positions shall be made, so far as practicable, from bona fide residents of the province in which the position is situated.

Application forms may be obtained from the offices of the Employment Service of Canada or the Secretary of the Civil Service Commission, Ottawa.

By order of the Commission,

W. Foran,
Secretary.

Situations Wanted

Electrical Engineer

Electrical Engineer having extensive mechanical and electrical experience, as well as a thorough knowledge of business methods, organization, contracts, purchase of materials, etc., is open for immediate engagement. Has been in responsible charge of design and supervision of various engineering works for well known Architects and Consulting Engineer. Until recently, engaged on the purchase of steel and other commodities for an Allied Government. Both languages. Reply Box No. 11-P.

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† For 1919-20
‡For 1919-20-21

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Preliminary Notice

of Application for Admission and for Transfer

26th August, 1919.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in September, 1919.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

AMES—FREDERICK THOMAS, of Bentley, Alta. Born at Folkestone, England. Sept. 28th, 1887. Educ. Boarding School, Sandwich, England, London College of Preceptors Certificate. 1903-06, Articled pupil with Chris. Jones, borough engr. Hythe, Eng.; 1906-07, asst. in architectural drafting and Bldg. Constrn. with T. Tunbridge, Folkestone, Eng.; 1907-13, inst'man and res. engr. on constrn. G.T.P.; 1913-16, Ry. constrn. and location with R. W. Jones, Edmonton, Alta.; 1917-19, Supt. in chg. of constrn. and operation, Lacombe and N. W. Ry., extending line from Bentley to Rimbrey, Alta.

References: R. W. Jones, R. H. Douglas, C. Ewart, M. Murphy, W. S. Fetherstonhaugh, W. R. Smith, A. J. Gayfer.

ANDERSON—JOHN MARSHALL, of Vancouver, B.C. Born at Aberdeen, Scotland, May 14th, 1890. Educ. Robt. Gordon Coll. and Royal Tech. Coll., Glasgow, 1907-11, rodman, draftsman, reconnaissance, location, constrn. and maintenance, C.P.R.; 1912-15, transitman under dist. engr. C.P.R., responsible for surveying, estimates, constrn. of ry. grade revisions, etc., 1917-19, with Canadian Overseas Ry. Constrn. Corps, reconnaissance, location and constrn. of military standard gauge rys. in France, records and plans.

References: H. Rindal, C. E. Cartwright, F. P. Wilson, D. Hillman, M. K. McQuarrie, H. B. Walkem, J. P. Forde, T. E. Price.

CAMBER—CLYDE F., of Minto, N.B. Born at Woodstock, N.B., Feb. 6th, 1890. Educ., 2 yrs. Mt. Allison Univ., 1 yr. with C.P.R., Woodstock; 6 mos., timekeeper, N.B. Telephone Co.; 6 mos., rodman on International Waterways Comm. survey; rodman and inst'man C.P.R.; foreman, with A. E. Babkirk, contractor, bldg. fence and pole line, etc.; 1917-18, St. J. & Que. Ry., inst'man, responsible for grades and alignment. etc.; Sept. 1918 to date, mgr. and engr., Grand Lake Coal Co. Ltd., Minto, in full chg. of mining operation and eng. work.

References: J. S. Armstrong, F. G. Goodspeed, H. Phillips, A. D. Taylor, R. S. Weston.

COOKSON—LESLIE HARDING, of Bathurst, N.B. Born at Parish of Kars, N.B., May 29th, 1890. Educ., 2 yrs. course at Acadia Univ. and I.C.S., 1 yr. railroad survey and constrn; 3 yrs. Dominion Public Works, harbour survey, etc.; 1 yr. contracting work, bldg. dams and street pavement, supt. of work; 3 yrs. pulp mill work; Nov. 1916 to date, with Bathurst Pulp & Paper Division, first as mech. and structural draftsman and since Apr. 1918, res. engr. in chge. of all constrn. work, doing all drafting, engr. work, etc.

References: J. K. Scammell, H. R. Logie, G. S. MacDonald, G. Stead, H. L. Theriault, H. Melanson.

DRYDEN—JOHN GRANVILLE, of Halifax, N.S. Born at Westville, N.S. Jan. 26th, 1885. Educ., high school. 2 yrs. stationary engr. and 1 yr. firing stationary boilers, Intercolonial Coal Mining Co; 2 yrs. in machine shop, N.S. Steel & Coal Co.; 1906-08, force account timekeeper; 1908-09, plotting and figuring cross sections, residency No. 1, T.C.Ry.; 1909 (7 mos.) on Salmon River viaduct, T.C.Ry.; 1910 (5 mos.) running transit and level on location, I.C.Ry.; 1911, leveller, I.C.Ry., Moncton; 1911-12, transitman on constrn., P.E.I.Ry.; 1912-13, asst. engr. on location, Halifax Ocean Terminals; 1913-17, inst'man on constrn. Apr. 1917 to date, asst. engr., Halifax Ocean Terminals.

References: J. E. Belliveau, O. S. Cox, R. H. Cushing, W. A. Duff, P. A. Freeman, R. H. Smith, L. H. Wheaton.

DYER—FREDERICK CHARLES, of Toronto, Ont. Born at Manchester Eng., Feb. 14th, 1872. Educ., B.A.Sc., Toronto Univ., 1909. 1902, master mechanic Log Cabin Mine; summers 1903-07, foreman on Diamond Drill with E.K. Roche Haileybury; research work on ore dressing problems with H.E.T. Haultain; design of process and mill for mfrs., Corundum Co., and others; 4 yrs., demonstrator, and past 5 yrs., lecturer in mining eng., Univ. of Toronto; 1910, reporting on mining, leases; 1912-14, member of firm Bantry & Dyer, engineers and surveyors; 1915-17, with Robertson & Dyer; 1918 (5 mos.) ch. inspector of vocational classes, Dept. Soldiers Civil Re-Establishment in Ontario; 1917 to date, with Dyrob Steel Tools Ltd., as designer of plant and process and conslt. engr.; private practice as mining engr.

References: L. M. Arkley, W. J. Francis, P. Gillespie, H. E. T. Haultain, E. G. Hewson, C. R. Young.

GRAHAM—WILLIAM FIELD, of Dundas, Ont. Born at Dundas, Nov. 8th, 1881. Educ., high school; 2 yrs. McGill. 1902-03, rod and transitman, resident on bridges, A.C.Ry.; 1903-12, topog'r, level, transit, resident, G.T.P.; 1912-15, asst. engr. location, P.G.E.Ry.; 1915-18, with C.E.F.; at present, field engr., reclamation service, Dept. of the Interior.

References: R. J. Burley, Sir A. Bertram, J. Callaghan, B. B. Kelliher, R. S. McCormick, J. S. Tempest.

GRAHAM—ANDREW GEORGE, of Vancouver, B.C. Born at Ladysmith, S. Africa, Dec. 25th, 1887. Educ., C. E. course, Royal Tech. Coll., Glasgow, Scot. 1903-08, pupilage with Kyle & Frew, Glasgow, on surveys, waterworks, drainage schemes, etc.; 1908-11, under late ch. engr. to Clyde Navigation Trust, as asst. engr. engaged on Yorkill basins and quays. also on prelim. work for Meadowside Granary and gen. river work; 1911 (3 mos). under A. O. Powell, on stadia survey of Fraser river for harbor purposes; 1911-12, on constrn. work near Kamloops, B.C., C.N.P.Ry.; 1912-13, asst. engr. under J. W. B. Blackman, in sewerage dept., res. engr. on main storm sewer section, New Westminster; 1913-16, on constrn. work on mountain section, P.G.E.Ry., in responsible chg. of constrn. of round house and turntable; 1916-19, on active service with 5th Can. Div. Artillery; June 1919 to date, with Vancouver Harbour Comm'rs. on prelim. work for harbor schemes.

References: C. Brakenridge, C. R. Crysdale, E. H. Longley, F. M. Preston, H. Stewardson, T. H. White.

HARRISON—THOMAS FRANCIS, of Kingston, Ont. Born at Kingston, Aug. 21st, 1885. Educ., high school. 1906-07, rodman, C.P.R.; 1907-08, rodman, transit, location, C.O.Ry.; 1911, in city engr's dept., on paving, Kingston; draftsman on location, C.P.R.; 1908-11, asst. engr. on constrn. chg. of revision of line, C.O.Ry.; 1911-14, res. engr., on constrn., C.N.O.Ry.; 1914, chg. of concrete and asphalt paving, Kingston; 1915-16, contracting; 1917, asst. drainage engr.; 1917-18, in chg. of topographical survey; 1918, testing engr., Munition Board; 1918-19, lieut. Can. Engrs., at present, engr. on bridge surveys, C.N.Ry.

References: C. S. Cameron, H. B. R. Craig, J. D. Evans, G. L. Hosbal, R. J. McClelland, A. F. Stewart.

HICKS—HENRY BUELL (Major) of Cranbrook, B.C. Born at St. Paul, Minn., Nov. 4th, 1868. Educ., public school and 1 yr. Univ. of Wash. 1890-96, rodman, etc., U.P.Ry., and in city eng. dept., Seattle, Wash., state harbor line survey and hydrographic survey, State of Washington; 1896-97, level and transit, irrigation work; 1897, exploring party to Mt. St. Elias, Alaska; 1898-1902, mining in Yukon and Alaska; 1902-05, inspector on paving, sewers, etc., and 1905-07, level and transit, city eng. dept., Seattle; 1907-10, asst. to H. E. W. Canavan, Victoria, B.C., on irrigation work, surveys and constrn.; 1910-12, in chg. of hydrographic and topographic survey party, Cranbrook dist.; 1912-15, dist. engr., Water Rights Branch; 1915-19, overseas with 54th Can. Engrs., 1915, lieut., 1917, major; June 1919 to date, dist. engr., Water Rights Branch, Dept. of Lands, Cranbrook.

References: W. J. E. Biker, J. Callaghan, E. Davis, E. A. Jamieson, W. Young.

MASSON—AUGUSTE D., of Quebec, Que. Born at Montreal, Que., May 13th, 1878. Educ. classical course B. L. Laval Univ., 1903, R.R. eng. course I.C.S. 1903-04 making reports on progress of work, changing grades, bldg new improved lines, C. P. R.; 1904-1906, asst. supt. of erection, Dom. Bridge Co., Montreal, in chg. of fabrication of simpler material at Ste. Anne de Bellevue; 1906-07, draftsman and supt. of structural steel work, Lake Superior Corp., Sault Ste. Marie, Ont.; 1907-08, draftsman and dsgner, Dom. Bridge Co., Wpg.; 1908-09, ch. draftsman and designer, dsgning and detailing of structural steel and cast iron work, Western Iron Work, Ltd. Wpg.; 1909-11, in chg. at bridge site for cutting, blasting and removal of debris of old bridge, Quebec Board of Engrs. 1912, selling agent and contracting engr. Structural Steel Mfgs.; 1914-16, organized and operated structural steel shop, (Masson, Ltd.), Quebec, 1917, connected with various munitions plants; Sept. 1917 to date, res. engr. in full chg. of all constrn. work supt'g. estimating, detailing, all steel work, etc., Davis Shipbuilding & Repairing Co. Lauzon, Que.

References: H. C. Vautelet, P. Leclaire, A. R. Decary, C. A. Buchanan, R. Thompson.

McAVITY—GEORGE CLIFFORD, of St. John, N.B. Born at St. John, N.B., June 15th, 1890. Educ. 2½ yrs. McGill Univ. Mech. Eng. Gen. Manager of all Manufacturing, T. McAvity & Sons, Ltd. ,St. John, N.B.

References: A. Gray, C. C. Kirby, J. A. Grant, E.G. Horne, A.R. Crookshank.

MITCHELL—JESSE HUNTER, of Banff, Alta. Born at London, Eng., Nov. 2nd, 1887. Educ., private tuition and course in math., Queen's Univ. 1910, rodman, etc. on constrn., C.N.R.; 1911-15, rodman, leveller, inst'man on Dom. land subdiv., transit stadia and plane table on Dom. land topog. survey, Jasper Park, Alta; 1916, asst. on topog. and geological surveys in Cobalt dist.; 1917 (3 mos.) asst. mine engr., Nipissing Mining Co.; 3 mos., asst. on miscellaneous surveys; 2 mos., asst. to A. E. Read, A. L. S., transit stadia, levelling, etc.; 1918-19, location engr., on Dom. Parks Highways, 6 mos., in chg. of revision and location, 6 mos. completing notes, drafting and designing wooden truss bridges; at present, asst. to res. engr., Banff

References: E. E. Brydone-Jack, D. J. Carter, J. T. Child, R. Cunningham, J. M. Wardle.

OLDHAM—WALTER FREDERICK, of Winnipeg, Man. Born at Manchester, Eng., Aug. 29th, 1885. Educ., B.Sc., (honors eng.) Manchester Univ., 1906. 1907-08, rodman on constrn., main line, G.T.P.; 1909 (6 mos.) transitman on prelim. topog. survey, irrigation dept., C.P.R.; 1909-11, draftsman and leveller, location survey, G.T.P.; 1911 (7 mos.) res. engr., Biggar Calgary branch, G.T.P.; 1912-13, res. engr., Kildonan Bridge, Transcona yards, C.P.R.; 1914-15, estimate and cost clerk, Westinghouse, Church, Kerr, Co'; 1915-18, field engr., Jas. McDiarmid Co., Winnipeg; June 1918, overseas with O.M.F.C., discharged from military forces July 1919.

References: P. Burke-Gaffney, L. C. Jacobs, J. M. Leamy, F. Lee, C. N. Mitchell, W. D. Pender, F. W. B. Scholefield, G. L. Shanks.

PEASE—EDSON RAYMOND, (Major), of Montreal. Born at Montreal, May 13th, 1884. Educ., B.A., 1907, B.Sc., 1908, McGill Univ. 1906 (4 mos.) in Gen. Elec. shops, Schenectady, N.Y.; 1907 (4 mos.) in Westinghouse shops, Pittsburgh; 1908 (5 mos.) operating, line work, etc., West Kootenay Power Co.; 1909 (6 mos.) chg. of elec. installation in G.T.R. shops at Battle Creek, Mich.; 1909-14, with Western Canada Power Co., surveying and prelim. work, constrn. and operation of plant, drafting and dsgn. of main power house, etc.; chg. of underground cable system, chg. of substations, etc.; 1915-19, overseas, returned as major, 2nd in command, 42nd, R.H.C.; at present, partner in firm McDougall & Pease, conslt. elec. engrs.

References: R. F. Hayward, L. A. Herdt, F. S. Keith, J. C. Kemp, G. K. McDougall, R. H. Mulock, K. M. Perry.

PERKINS—GEORGE CHARLES, of Lachine, P.Q. Born at Amritsar, India, May 19th, 1886. Educ., 1st class certificate in civil and mech. eng., City & Guilds Central Tech. Coll. London, Eng., 1906-09, student with G. P. Knowles, M.I.C.E., 1910-11, cons. engr., London County Council; 1911-12, draftsman, Railway Signal Co. of Canada, Lachine, shop drawings for elec., mech. interlocking and signalling, etc.; 1912, asst. in installation of crossing gates, etc.; 1912-13, inst'man, C.P.R., maintenance of way, surveys, plans, etc.; 1913-16, inst'man, asst. res. engr's office, C. G. Rys., Levis, P.Q., maintenance, surveys, inspection, report of all bridges, etc.; 1917, gauge inspector, Imperial Munitions Board, Ottawa; May 1917-May 1919, sargeant in France with Can. Overseas Troops, in chg. of laying out of light and heavy steel for forestry operations; at present, on contract work.

References: C. B. Brown, L. C. Dupuis, R. J. Durley, R. H. Emmerson, H. T. Ruhl, V. I. Smart, F. Taylor.

POOLE—JOHN MAURICE, of Halifax, N.S. Born at Windsor, N.S. Dec. 23rd, 1889. Educ. 3 yrs. Kings Coll. and 2 yrs., N.S. Tech. Coll. 1909 (3 mos.) on town eng. of Windsor, N.S.; 1912-15, rodman and inst'man, C.N.O.Ry.; 1915, (4 mos.) P.W.D., Halifax; 1915-17, with Foley Bros. on Halifax Ocean Terminals (6 mos.) as rock checker on drill scow; (9 mos.) as concrete inspector; 1917-18, with N.S. Tramways & Power Co., Halifax in chg. of surveying party; May 1918 to date, with Pickings & Roland, in chg. of surveying party, making new and complete plan of Halifax, etc.

References: J. W. Roland, P. A. Freeman, W. P. Morrison, A. C. Brown, O. S. Cox.

POPE—STANLEY DOUGLAS HAROLD, of Victoria, B.C. Born at Victoria, B.C., June 13th, 1887. Educ. High Sch. matric. to McGill Univ.; part of C. E. Course I.C.S. 1909, inst-man, land surveying; 1910, levelling, C.P.R. Vancouver Island; 1911 asst. to city surveyor, Victoria; 1912, asst. surveyor; 1913-14, asst. engr. constrn. of pavements and final plans for northwest sewer scheme; 1914-19 on active service with C.E.F., in chg. of various works allotted to regiment, such as roads, light railways, saps & dugouts; latterly with Royal Garrision Artillery; at present, asst. engr., Victoria.

References: R. A. Bainbridge, A. E. Foreman, F. M. Preston, A. O'Meara, E. P. McKie.

RAYNER—GILBERT (Major, M.C.), of Bowmanville, Ont. Born at Liverpool, Eng., May 27th, 1889. Educ., 3 yrs. eng. course, Liverpool Coll. 1910. 1911-13, inst'man, topog'r., etc., on location and constrn.; 1913-14, res. engr., double tracking at Streetsville and completing new track at Trenton, Ont., C.P.Ry.; Nov. 1914 to July 1919 with Royal Engrs., awarded M.C. Oct. 1917.

References: R. A. Girouard, C. P. Howrigan, C. Luscombe, R. A. Ross, H. L. Sherwood, K. Weatherbe.

SANDE—ARTHUR, of Toronto, Ont. Born at Zurich, Switzerland, Nov. 6th, 1881. Educ., civ. engr., Tech. High School, Zurich, 1899. 1900-05, dftsman, asst. engr. and asst. supt. for constrn., with Wayss & Freyberg; 1905-09, with Nassau Fireproofing & Concrete Co., N.Y.C.; 1910-12, on eng. staff of Armour & Co., Chicago, as concrete engr., etc.; 1913-16, constrn., engr., with Central Constrn. Co., San. Francisco; 1917, structural engr. in office of Bernard H. Prack, industrial engrs.; 1917-18, Dom. Canners Ltd., plant, Simcoe, Ont.; 1918-1919, Kipawa Fibre Co., Temiskaming, asst. ch. engr. of design and constrn.; 1919, in chg. of eng. on plant for Porritts & Spencer, Hamilton, Ont.; since Aug. 1919, structural engr., with W. J. Westaway Co., Hamilton.

References: C. B. Thorne, G. D. MacKinnon, F. O. White.

TAGGART—CHARLES HENRY, of Kamloops, B.C. Born at Brockville, Ont., Sept. 3rd, 1883. Educ. D.L.S. 1911. 1905-08, draftsman under surveyor general, Ottawa; 1908 (7 mos.) articled pupil with Jas. Warren as asst.; 1908-10, first asst. full chg. of base line survey with Arthur Saint Cyr; May 1911 to date, full chg. of parties on surveys on investigation work, Dept. of Interior, laying out and constructing irrigation systems and obtaining data relative to water power, both of a minor nature; at present in chg. of party making resurvey and investigations to soils, etc. in Manitoba under the direction of surveyor general.

References: F. W. Anderson, P. Phillips, C. G. Cline, A. M. Phillips, F. J. Dawson, H. L. Seymour.

TAWSE—HARRY STORY, of Aberdeen, Scotland. Born at Kemnay Village, Aberdeen, Scot., April 18th, 1887. Educ., Assoc. Royal Tech. Coll., 1909. 2½ yrs. with Public Works contractor as asst. engr.; 1910-14, with C.N.Ry., as follows: 1910-11, draftsman, leveller and inst'man on location; 1911-12, draftsman to div. engr. on constrn.; 1912-14, res. engr. on constrn.; Nov. 1914, on active service, demobilized Feb. 1919; Feb. 1919 to date, head of firm, Tawse & Allan, civil engrs. and architects, Aberdeen, Scotland.

References: G. R. G. Conway, J. Ferguson, G. P. MacLaren, J. R. McKenzie, J. L. Morris, A. F. Stewart, H. K. Wicksteed.

TIMBRELL—EDMUND GENTRY, of Ottawa, Ont. Born at London, Eng., Dec. 13th, 1890. Educ., B.Sc., (honors eng.) London Univ. 1913. 4 yrs. apprentice, Government Arsenal, Woolwich, Eng.; 1913-16 and Feb. 1918 to date, surveys examiner, topographical surveys, Dept. of Interior; 1916-17, asst. inspector of ammunition Montreal central district; 1917-18, district instructor in chg. School of Instruction for Ontario at Toronto, Imperial Ministry of Munitions.

References: R. J. Burley, G. B. Dodge, H. M. Jaquays, J. A. S. King,A.L. Morgan, B. E. Norrish, C. Rinfret, H. W. B. Swabey.

WADDELL—NEIL MACMILLAN, of Winnipeg, Man. Born at Glasgow, Scotland, July 19th, 1887. Educ., Glasgow & W. of Scotland Tech. Coll. (evenings) 1904-1909. 1904-11, with R. C. Farrell, A.M.I.C.E., first 5 yrs. as apprentice, assting in dsgning, staking, roads, sewers, water supply works, etc., then asst. engr., in chg. of field party, later ch. asst. on calculation and dsgn. of structure, etc.; Apr. 1911 to date with C.N.R., as follows: 1911-12, draftsman in maintenance of way engr.'s office; 1912-17, res. engr., Port Arthur, responsible for about 500 miles of track, including bridges, etc.; at present, res. engr., Brandon.

References: E. N. Johnson, L. M. Jones, M. H. Macleod, W. T. Moodie, A. V. Redmond, A. J. Taunton, T. H. White.

WHITE—AMBROSE HARDING, of Brooklyn, N.Y. Born at Bucksport, Me., Sept. 6th, 1868. Educ., C. E. 1897, B.C.E. 1899, Univ. of Maine. 1884-90, (during vacations) rear flagman, R.R. prelim. surveys inst'man on location and constrn.; 1890-03, engr. and draftsman with Trenton Iron Co. and others; 1893-97, transitman with Metropolitan Survey Comm. of Mass., and asst. city engr., Everett, Mass.; 1897 to date, with International Paper Co., constrn. engr. in chg. of erection of pulp and paper mills, foundry, etc., ch. draftsman, div. engr., mgr. of constrn. and maintenance; at present, ch. engr., Internat. Paper Co., N.Y., and St. Maurice Lumber Co. of Canada.

References: H. S. Ferguson, G. F. Hardy, A. Hazen, H. O. Keay, E. S. Mattice, J. C. Smith, C. A. Waterous.

WRIGHT—ARCHIBALD EDWARD, of Copper Mountain, B.C. Born at Liverpool, Eng., Apr. 23rd, 1873. Educ., eng. lectures, Liverpool Univ. and tech. schools. 1887, engaged in dsgn. of mills and machinery, with Jas. Donaldson, consl. and mech. engr.; 1889-1911, with C. H. Beloe, as juuior asst.; 1896, became ch. asst., engaged on dsgn. and execution of sewerage works, waterworks, roads, bridges, etc., 1899-1901, served with Imperial Yeomanry in S. Africa; 1913, with Garden & Taylor on surveys and drafting; 1913-18, with Cartwright & Matheson Co., on dsgn. of dams, bridge, sewers, tracks, roads, etc.; Apr. 1918 to date, with Can. Copper Corp., dsgn. and chg. of eng. works; at present at their mine at Copper Mountain, in chg. of dsgn. of eng. work in connection with development work of mine.

References: C. E. Cartwright, C. E. Cooper, A. J. Matheson, C. W. Williams, F. P. Wilson.

WYNN—EARLE MURRAY, of Niagara Falls, Ont. Born at Niagara Falls, Dec. 20th, 1889. Educ., high school. 1906-10, on municipal and survey work as rodman, inst'man, etc., Niagara Falls; 1911-12, with C.P.R. location party, as asst. draftsman, topographer and draftsman; 1912 (3 mos.) inspecting concrete bridges and piling for York county under Frank Barber; 1913 to date with Hydro Elec. Power Comm., as follows: 1913 (8 mos.) transitman on high tension transmission line location, St. Thomas to Windsor; 1913-14, asst. to res. engr. Woodell's Falls power development, as inspector, inst'man, etc.; 1914-15, asst. to res. engr., Eugenia Falls power development in chg. of half the work comprising gatehouse, wooden flume, steel surge tank, etc.; 1915-16, res. engr., Eugenia, completing installation of machinery etc.; 1916 (7 mos.) estimates and general drafting, head office; Sept. 1916 to date, topographical and designing draftsman, Niagara power development.

References: H. G. Acres, F. Barber, F. A. Gaby, J. B. Goodwin, T. H. Hogg, G. C. Hoshal.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT TO MEMBER

HOLDEN—JOHN CHIENE, of Winnipeg, Man. Born at St. John, N.B., Feb. 18th, 1876. Educ., grad. R.M.C., 1896. Summer 1896, military reconnaisance work, Can. Govt.; autumn, rodman on harbor improvements, St. John, N.B.; 1897, leveller, prelim. survey, I.C.Ry.; inst'man, harbor survey, St. John, N.B.; 1898, B.C. Southern Ry., for C.P.R.; Apr. 1898 to date, with C.P.R. as follows: 1898-1901, leveller, transitman, draftsman on prelim. and location and inst'man on constrn; 1901-03, res. engr. of constrn., transitman on grade revision and reconnaisance engr.; 1903-07, res. engr., maintenance, central div.; 1907, asst. div. engr.; Apr. 1912 to date, engr., Manitoba dist., C.P.R.

References: J. M. R. Fairbairn, F. Lee, J. G. Sullivan.

HUGHES—GARNET BURK, (Major-Gen., C.B., C.M.G., D.S.O., F.R.G.S.), of Derby, England. Born at Toronto, Ont., Apr. 22nd, 1880. Educ. R.M.C., 1901. 1901-04, asst. to ch. engr. C.N.R. in N.S., Que. & Ont.; 1904-07 in chg. of location of parts of C.N.R. in Ont., Que.; 1907-09, gen. supt. in chg. constrn. of the Cia de Augua y Drenaji de Monteerey, Mexico, on water supply and drainage; 1909, asst. to ch. engr. C.N.R., Sask., Alta., Man. and B.C., in connection with exploration and location in Rocky Mountains; 1910-11 dist. engr.; C.N.R. ry. in chg. of all work on Vancouver Island; 1911-13, res. engr. B.C. Elec. Ry. Vancouver Island line, including Victoria; 1914, dist. engr. P.W.D., Vancouver Island; 1914-18 on war service; 1919, Managing Director of British Cellulose & Chemical Mfg. Co. Ltd., Spondon, near Derby.

References: H. K. Wicksteed, G. R. G. Conway, T. H. White, C. Hoard, C. H. Rust.

LITTLE—HAROLD ROBERT, of Westmount, P.Q. Born at London, Ont., Oct. 8th, 1887. Educ., B.Sc., McGill Univ., 1911. 1911-12, engr. and roadmaster, London St. Ry. Co., London, Ont.; 1912-14, engr. on constrn., Fyshe-Martin Co. Ltd., and Fyshe, McNeill, Martin, Trainer Ltd., Calgary; 1914-16, supt. of constrn., Merchants Bank of Canada at Calgary and Vancouver; Sept. 1916 to date, inspector of Bank premises, in chg. of all constrn., bldgs. and real properties, Merchants Bank, Montreal.

References: E. Brown, A. F. Byers, M. D. Barclay, T. M. Fysche, H. M. MacKay.

RODGER—WILLIAM, of Dartmouth, N.S. Born at Pollockshaws, Scotland, April 29th, 1875. Educ. Glasgow and West of Scotland Tech. Coll. 1888-98, with Dubs & Co. Glasgow Locomotive Works as mech. draftsman; 1898-1908 leading locomotive draftsman, Neilson, Reid & Co., Glasgow; 1908-11 Singer Sewing Mach. Mfg. Co., Glasgow; 1911-15 steam expert, C.P.R.; 1915-17 elevation draftsman, Jenckes Machine Co.; 1917-18 ,ch. engr. Fraser Brace Co.; 1918, ch. engr. Starr Mfg. Co.; Mech. supt. Halifax Shipyards; and at present plant and maintenance engr.

References: H. H. Vaughan, W. J. Francis, W. P. Morrison, J. Lorn Allan, P. A. Freeman.

SAUNDERS—REGINALD GEORGE, (Capt.) of Toronto, Ont. Born at London, Eng., Jan. 25th, 1887. Educ., Stableton Hall Univ., grammar school, Salford Tech. School, C.E. course, I.C.S. 1900-01, with L. Russell, elec. and sanitary engr., Bexhill, Eng., apprentice on constrn., house wiring, etc.; 1901-02, telegraph and telephone dept., Gen. Elec. Co., Manchester, Eng., on shop machines and bench work; 1902-03, gen. office drafting and tracing; summer 1903, contractors building spur. for C.P.R.; 1903-04, designing, drafting and surveying with E. Von der Osten & Co.; 1904-05, bridge dept., city engr's office, Toronto, designing, surveying and supervision; 1905-09, water works dept., Toronto; 1909-10, city engr's office, Moose Jaw, Sask., res. engr., dsgning, laying out and supervising constrn. of special public work; 1910-11, asst. city engr.; 1911-13, partner in firm Wilson, Townsend & Saunders; 1914-15, Toronto Harbor Comm'rs., as asst. supt. of constrn., duties pertaining to office; Oct. 1915, May 1919, on active service in France, latter 12 mos., as staff captain. A. & O. 2nd Bde., Can. Engrs.; May 1919 to date, partner of firm Weddell & Saunders, Trenton and Toronto.

References: G. T. Clarke, E. L. Cousins, R. E. W. Hagarty, R. W. Leonard, C. H. Rust, C. J. Townsend, J. G. R. Wainwright, J. M. Wilson.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

AMOSS—FRANCIS X., (Capt.) of Corinth, Ont. Born at Corinth, Apr. 22nd, 1887. Educ., sr. leaving, parts 1 and 2, Aylmer Coll. Inst. 1903.1911-12, inst'man, N.T.C. Ry.; 1913-14, res. engr. N.T.C.; 1914-15, res. engr., O'Brien div. yard; July 1915, Apr. 1919, on active service in France; at present, track engr., in chg. of rechainage Fort William to Sioux lookout branch, C.G.Ry.

References: T. S. Armstrong, A. M. Macgillivray, A. McLellan, A. V. Redmond, W. P. Wilgar.

DESROSIERS—ARTHUR, of Detroit, Mich. Born at Ottawa, Ont., July 7th, 1890. Educ., B.Sc. McGill Univ., 1912 (Honors) Summers, 1908-10, Militia Topog'l. surveys; 1911, asst. res. engr. of constrn. Elevator 2, Montreal Harbour; 1912 (7 mos.) asst. engr. N. Sask. hydrographic surveys; 1913, with Board of Highways comm. Sask. as bridge designer; 1914, reinforced concrete engr. and structural steel checker on grain elevators, Board of grain Comm. of Canada; 1915-19 structural engr. Gabriel Reinforcement Co., Detroit, Mich.; at present private practice as conslt. engr. Detroit.

References: C. R. Coutlee, E. D. Lafleur, A. St. Laurent, A. J. MacPherson, C. P. Richards, C. D. Howe, L. A. DesRosiers.

FISKEN—ARTHUR DOUGLAS, (Major M.C.), of Kerrisdale, B.C. Born at Toronto, Ont., Sept. 3rd, 1889. Educ., Grad. R.M.C. (distinguished in eng). 1910. 1907 with party of A.O. Wheller, geodetic survey of Rockies; 1910-14 on office staff of (eng. branch) of Chas. W. Leavitt, civil and landscape engr. New York, as inst'man on constrn., surveys and development of private estate draftsman, reports, estimates, etc.; Jan. 1915, Feb. 1919 with C.E.F., wounded twice, awarded M.C., Nov. 1917; 2 yrs. res. engr. constrn. of estate of Sir John Eaton; res. engr. New York Capital Park; 1914, in chg. of collection of all data for city plans of Kitchener, Ont.; 1914 (8 mos.) instructor in Military eng. at Can. Military school, England; 6 mos. instructor at R.M.C. Kingston, Ont.; 1919 with Taylor Management Corp. making layout of Shaughnessy Heights Suburb, Vancouver; Since Feb. 1919, owner of The Marine Garage & Repair Shop, Marpole, B.C.

References: C. S. Gzowski, E. G. Matheson, A. D. Swan, W. H. Breithaupt, C. Brakenridge, R. G. E. Leckie.

LAMOTHE—GEORGES EDMOND, of Quebec, Que. Born at Quebec, Que., July 6th, 1893, Educ., B.A.Sc., Ecole Poly., 1913. Summers 1907-12, rodman and inst'man on T.C. survey and constrn. and P.W.D.; 1913 (6 mos.) res. engr. for La Cie Neigette, on rly. constrn. and hydro-elec. development; 1913-15, engr. in chg. of party on ry. location, river surveying and gauging for Quebec Development Co. of New York on Saguenay River; Jan. 1916 to June 1919, Scout and Intelligence Officer in 22nd (French Can.) Bn. rank of Capt.; at present, Constrn. engr. Price Bros & Co. Ltd., Quebec.

References: J. J. Fortin, W. S. Lee, T. J. Trembaly, A. E. Dubuc, J.M.McCarthy, J. M. H. Cimon.

McCOLL—SAMUEL EBENEZER, (Lieut.) of Winnipeg, Man. Born at Winnipeg, July 17th, 1886. Educ., B.A., Univ. of Man., 1907, (medallist, math. and physics), M.L.S., D.L.S. 1907-10, asst., special survey, Winnipeg; 1909, right of way power transmission line; 1910-11, full chg., subdiv. of 4000 acres into city lots; 1912 to date, member of firm McColl Bros., engrs. and surveyors, surveys, laying out and gen. municipal work; 1918, leiut., Can. Engrs., 2nd C.E.R.B., Seaford, Eng.

References: E. E. Brydone-Jack, C. H. Fox, G. B. McColl, J. A. H. O'Reilly W. B. Young.

MURRAY—WILLIAM PAUL, (Lieut. M.C.) of Lachine, P.Q. Born at Stratford, Ont., Oct. 19th, 1886. Educ., B.A.Sc., Toronto Univ., 1909. 1909 (4 mos.) draftsman, Cadillac Motor Co., Detroit; 1910-11, draftsman and checker, Dom. Bridge Co.; 1912-15, engr. in chg. of erection of heavy steel ry. bridges, Dom. Bridge Co.; June 1915-1919, on active service, 1915-17, in chg. of surveys for Can. Overseas Ry. Constrn. Corps; 1918-19, reconnaissance office No. 5, ry. survey section, Royal Engrs., at present, bridge dsgning, Dom. Bridge Co.

References: G. H. Duggan, C. L. Hervey, D. Hillman, C. W. P. Ramsay, F. P. Shearwood, D. C. Tennant, J. G. Reid.

NARES—BASIL LLEWELYN, of Montreal, Que. Born at Winnipeg, Man. March 18th, 1888. Educ. B.Sc., (C.E.) McGill 1911. 1911-12, purchasing engr. 1912-13, concrete foreman, G. H. Archibald & Co., engrs. and contractors, Winnipeg; 1913-14, demonstrator, McGill, descrip. & Surveying; 1914-15, with Universal Portland Cement Co., Chicago, inspection and reports on constrn. of concrete roads in Illinois, Wisconsin, Michigan & Missouri, etc.; 1915-17, asst. to works manager, shell dept., Canada Cement Co., in chge. of all routine work in shell shops; 1917-18, asst. inspector of shells, Imperial Ministry of Munitions, responsible for quantity of shells turned out from 15 different plants in Montreal; 1918 (4 mos.) ch. inspector P. Lyall & Sons, Longue Pointe shell plant, designed gauges and responsible for quantity of shells turned out; Jan. 1919 to date, bldg. supt., responsible chg. of all constrn. work in Montreal, A. F. Byers & Co. Ltd.

References: A. F. Byers, N. P. Dalziel, D. L. Derrom, H. M. MacKay, H. R. Little.

SAINT-LAURENT—JEAN BAPTISTE OCTAVE, of Ottawa, Ont. Born at Ottawa, Sept. 16th, 1891. Educ., B.A., Laval Univ., 1911, grad. R.M.C. 1914. 1907-14, summer student, P.W.D.; 1914-16, inst'man and asst. engr. on hydrographic survey; 1916-18, asst. to res. engr., on constrn. work, Campbellford track elevation, new bridge over over Trent Canal, etc.; Nov. 1918 to date, engr. on constrn., The Foundation Co. Ltd., hydro-elec. development at St. Jerome, power house, dam, etc.

References: R. E. Chadwick, S. J. Chapleau, C. R. Coutlee, A.S. Going, A. Gray, W. G. Swartz.

SPENCER—ROY AUBREY, (Major) of Montreal. Born at Port Morien, N.S., April 20th, 1889. Educ., B.Sc., (C.E.) 1904, M.Sc., (C.E.) McGill Univ., 6 mos. in machine shop and 4 yrs. rodman, inst'man, etc., Dom. Coal Co.; 5 mos., draftsman, constrn. C.P.R.; 14 mos., res. engr., 4 mos., locating engr., St. J. & Que. Ry.; 1 yr. research work, Forest Laboratory; 5 mos., lieut., 23 mos., capt., 14 mos., major, Can. Engrs., recently demobilized.

References: J. S. Bates, E. Brown, H. Donkin, G. H. Duggan, H. M. MacKay, C. M. Odell, R. Thompson.

WILSON—CLIFFORD, ST. JOHN of Halifax, N.S. Born at St. John, N.B. Jan. 27th, 1888. Educ. B.Sc., McGill Univ., 1911. Summer 1910 rodman with G.G. Murdoch on C.P.R. right of way; 1911-15, structural engr. Dom. Bridge Co., Wpg.; 1915-18, asst. engr. Halifax Ocean Terminals; 1918 to date, office engr. Pickings & Roland in chg. of design, steel and concrete structures, timber wharfs, coal pockets, sewers, streets, etc.

References: J. W. Roland, J. McGregor, A. C. Brown, H. M. MacKay, G. E. Bell.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

ALBERGA—GEORGE FREDERICK, of Montreal, Que. Born at Black River, Jamaica, B.W.I., April 29th, 1892. Educ. B.Sc., McGill Univ.; 1916 in Munitions dept. Canada Cement Co., 3 mos. in stores and purchasing dept.; 5 mos. as ch. inspector; Oct. 1916, Feb. 1919, on active service as sargeant 2nd Can. Constrn.Coy.

References: H. M. MacKay, E. Brown, D. L. Derrom, R de L. French, A. J. Gayfer, C. M. McKergow.

ANGLIN—DOUGLAS GOULD, of Kingston, Ont. Born at Kingston, May 31st, 1890. Educ., B.Sc., (mining eng. and metallurgy) 1911, B.Sc., (C.E.) 1912, Queen's Univ., 1908, N.T.C.Ry.; 1909, prospecting; 1910, municipal eng.; 1911, observer, Detroit R. Boundary survey; 1912, supt'g. erection of Can. Locomotive shops, Kingston; 1913, first asst., 1914, in chg., Rainy River survey; 1915, in chg. dock contrn., P.W.D., Big Rideau Lake; 1915, June 1919, on active service; at present, asst. engr., P.W.D.

References: E. E. Brydone-Jack, S. J. Chapleau, A. Macphail, W. J. Stewart, G. C. Wright.

GAGE—EDWARD VICTOR, of Montreal. Born at Pearceton, Que., Nov. 21st, 1893. Educ., B.Sc., (C.E.) McGill, 1915. Summer 1913, in Dept. of Interior; 1915, asst. on peat survey, mines branch; 8 mos., inst'man, St. Maurice Constrn. Co.; May 1916 to date, with A. F. Byers Co., past 2 yrs. as gen. asst. to Mr. Byers.

References: E. Brown, A. F. Byers, C. E. Fraser, H. M. MacKay, G. M. Wynn.

GARDNER—WILLIAM McGREGOR, (Lieut. McGill C.O.T.C.), of Montreal. Born at Montreal, Apr. 15th, 1896. Educ., B.Sc., McGill Univ., 1917. 1916, gen. dsgner. and draftsman, Shaw. Water & Power Co.; since graduation on active service with Artillery as observer; at present with Montreal Tramways Co., as track engr., taking chg. of survey party and calculating and laying out steel intersections and gen. right of way.

References: R. Bickerdike, E. Brown, J. Hunter, H. M. MacKay, A. Roberts, J. C. Smith.

GAUTHIER—HENRI, of Ottawa, Ont. Born at Montreal, Que., April 10th, 1890. Educ., B.A.Sc., (C.E.) Ecole Poly. 1915. Summers 1912-14 land surveying, winter 1912 inst'man, etc. on transmission line constrn. Shaw. Water & Power Co.; May 1915 to date with Dept. of Mines, Ottawa as follows: 1915, field asst. with Dr. L. Reinecke, geological survey, on road materials survey in Ont. & Quebec; 1916, in chg. of field party making survey for proposed Hull-Montreal highway; 1917, chg. of investigation of available supplies of road material occuring in Montreal dist.; 1918, investigated gravel supplies in Manitoba and made special study of soil conditions in connection with problems of building sand-clay roads; during winters 1917-18 & 1918-19, did the testing by standard methods in laboratory of the division of samples collected by field parties, etc.; at present asst. engr. on investigation of road materials Div. Mines Branch.

References: C. Leluau, P. E. Mercier, B. F. Haanel, A. Larivière, A. Pepin, R. Blais.

GODIN—CHARLES, of Three Rivers, P.Q. Born at St. John's, P.Q., Aug. 19th, 1892. Educ., C.E., Polytech., 1915. Summer 1912, surveying with P.E. Mercier; 1913, gen. office and field work, with D. Laperiere; 1915 (3 mos.) draftsman on municipal plan of Longue Pointe, with W.E. Boucher; 1916-17, draftsman and engr. on mech. and constrn. work, L'Air Liquide Society; Apr. 1918 to date, with Wayagamack Pulp & Paper Co., as dsgner in mech. and bldg. constrn.

References: B. Grandmont, A. L. Harkness, J. Laurin, G. M. Wynn.

JOHNSTON—GEORGE WILLIAM FREDERICK, of Ottawa, Ont. Born at Lethbridge, Alta., Oct. 27th, 1893. Educ., B.A.Sc., Toronto Univ., 1915. Vacations, 1912, rodman and timekeeper, Lethbridge; 1913, computer in roadway dept., Toronto; 1914, inst'man in chg. of party; 1915-17, computer of latitude and longitude, Dom. Observatory; 2 yrs. on active service; at present, astronomical computer.

References: P. Gillespie, C.A. Magrath, F. S. Rutherford, W. M. Tobey, B. Ripley.

MUNTZ—ERIC PERCIVAL, of St. Catharines, Ont. Born at Toronto, July 21st, 1892. Educ., B.A.Sc., Toronto Univ., 1914. 1911-12, rodman, etc., constrn., C.N.R.; 1913, inst'man in chg. of party on constrn., C.N.R.; 1914-16, asst. engr., Welland Ship Canal; July 1916,—Mar. 1919, on active service, 1916-17, in chg. of operation 30 mile narrow gauge ry.; 1917-18, capt. and quarter master; 1918-19, broad gauge ry. bridge renewals, with C.R.T. in Palestine; Jan.-Feb. 1919, erection of 110 ft. deck span over Orantes river, Syria; at present, asst. engr., Sec. No. 2, Welland Ship Canal.

References: H. G. Acres, E. G. Cameron, A. P. Linton, T. R. Loudon, W. H. Sullivan, J. L. Weller.

Monthly Engineering Index

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AERONAUTICS

AIRCRAFT (LIGHTER THAN AIR)

Airship Requirements. Lighter-than-Air Craft, T. R. Cave-Brown-Cave. Aviation, vol. 6, no. 11, July 1, 1919, pp. 585 & 588-591, 3 figs. Fabrics, engine requirements, useful carrying capacity, water recovery and use of hydrogen as fuel, mooring, towing and anchors. (Concluded.) Paper read before Roy. Aeronautical Soc.

R-9. The Evolution of the Airship—I. Aeronautics, vol. 16, no. 297, June 26, 1919, pp. 664-665, 3 figs. Construction of R-9.

R-34. British Airship R-34 Described. Aviation, vol. 6, no. 12, July 15, 1919, pp. 629-632, 6 figs.

Rigid Airship. The Tension in the Radial Wires of a Rigid Airship, E. H. Leavitt. Aeronautics, vol. 16, no. 295 and 297, June 12 and 26, 1919, pp. 617-618 and 675, 2 figs. June 12: Derivation of formulæ. June 26: Formula. Reference made to article in Aeronautics of June 12.

Vickers. The Evolution of the Airship—II, Aeronautics, vol. 17, no. 298, July 3, 1919, pp. 15-18, 8 figs. Vickers, Ltd. and their war productions.

APPLICATIONS

Commercial Applications. American Commercial, Tourist and Pleasure Aeroplanes. Aerial Age, vol. 9, no. 20, July 28, 1919, pp. 930-931, and p. 943, 10 figs. Aerial mapping and photography, express and mail delivery, passenger-carrying, fire and police patrol, advertising, exploring, reconnaissance, news distribution, and exhibitions. Details of ten types are briefly reported.

Mail Service. Aerial Mail Service (L'Aviation et la Poste), M. Delfieu. Annales des Postes, Télégraphes et Téléphones, vol. 8, no. 2, June 1919, pp. 216-227. Sees it handicapped at present by three essential deficiencies of aviation—irregularity, insecurity and excessive expense.

AUXILIARY SERVICES

Landing Fields. Municipal Landing Fields for Air Service. Am. City, City Ed., vol. 21, no. 1, July 1919, pp. 20-23, 2 figs. War Department's Specifications.

Parachutes. The Sperry Parachute, H. E. Goodman. Aerial Age, vol. 9, no. 17, July 7, 1919, p. 812, 2 figs. Advantage said to be that aeronaut is able to get out of machine when it is in abnormal position.
The "Guardian Angel" Parachute. Indian Eng., vol. 65, no. 20, May 17, 1919, pp. 276-277, 2 figs. on supp. plate. Automatic and instantaneous opening said to be effected by enclosure in parachute body as it emerges from its case, cylindrical column of air, which under compression of fall is immediately converted into a cushion of air, extending into every direction to periphery. It can be used from height of 200 ft.

Wireless. Wireless Telegraphy Applied to Aviation, W. Knight. Aviation, vol. 6, no. 11, July 1, 1919, pp. 572-575, 7 figs. Principles of transmission and application of invention to air navigation, particularly with reference to its use for communication between airplanes and radio stations on the ground.
Development of Radio Equipment for Naval Aircraft, Edgar H. Felix. Flying, vol. 8, no. 6, July 1919, pp. 536-540, 11 figs. Installation on NC-3.
Wireless Telephone Transmitter for Seaplanes. Rudder, vol. 35, no. 7, July 1919, pp. 332-334, 4 figs. As designed for flying boats of H-16 class of U. S. navy.

DESIGN

Altitudes, Flight at. Theory of Airplane Flight at Various Altitudes. Predetermination of the Ceiling (Théorie du vol. des aéroplanes aux diverses altitudes. Pédétermination de la hauteur du plafond), A. Rateau. Comptes Rendus des séances de l'Academie des Sciences, vol. 168, no. 23, June 10, 1919, pp. 1142-1147. Equations expressing angle of wings, speed of airplane, revolution per second of propeller, and slip of propeller with reference to "effective pitch."

Flying Boats. The Design and Construction of Flying Boats, David Nicolson. Aeronautics, vol. 16, no. 293 (New Series), May 29, 1919, pp. 562-565, 11 figs. For types known officially as F.2A, F.3, F.5, P.5, and N.4. Paper presented before Instn. Engrs. and Shipbuilders in Scotland. (To be continued.)

Load and Stresses. The Loads and Stresses on Aeroplanes, John Case. Aeronautics, vol. 16, no. 293, 294, 295, 296 and 297, May 29, June 5, 12, 19 and 26, 1919, pp. 556-559, 589-592, 619-622, 644-647 and 671-673, 32 figs. May 29: Equations of equilibrium when flying and when alighting with engine shut off; approximate method of calculating loads when turning in horizontal position and when flattening out from vertical dive and looping. June 5: How flattening out of flight path is brought about. June 12: Loads caused by gusts, spiral glides and spinning. June 19: Distribution of load over the planes. June 26: Pressure distribution in spiral glide.

Metal Construction. Metal Construction of Aircraft, A. P. Thurston. Aeronautics, vol. 16, no. 293 (New Series), May 29, 1919, pp. 570-571. Methods of design and calculation of guide spars. Paper read before Royal Aeronautical Soc. (Concluded.)

Rigging. The Rigging of Aeroplanes, R. J. Goodman Crouch. Aeronautical Jl., vol. 23, no. 100, April 1919, pp. 143-178, 21 figs. Based on diagrams published by Roy. Air Force. Application of methods illustrated by various examples.

Struts. Strength of Two Combined Struts, K. Aichi. (In Japanese.) Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 56, Feb. 1919.
Formula Giving the Ultimate Load for a Long Strut of Varying Cross-Section, K. Aichi. (In Japanese.) Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 56, Feb. 1919.
Struts of Conical Taper, H. A. Webb and E. D. Lang. Aeronautical Journal, vol. 23, no. 100, April 1919, pp. 179-186, 3 figs. Strength of wooden struts consisting of parallel center portion with ends of conical taper is considered mathematically. Best results are obtained when parallel portion is half total length of strut, and when taper of ends is such that end of diameter is half of center diameter. Formula for design is offered.

War Developments. Some developments in Aircraft Design and Application During the War, Lord Weir. Engineering, vol. 108, no. 2793, July 11, 1919, pp. 59-61 7 figs. Aerodynamical aspect of design and progress. Applicational aspect taken up in second part of paper. (To be continued.) Read before North-East Coast Instn. of Engrs. and Shipbuilders.

ENGINES

Altitudes, High. Operation of Airplane Motors at High Altitudes (Hohenregelung fur Flugmotoren), R. Krüger. Motor-wagen, vol. 22, no. 6, Feb. 28, 1919, pp. 103-104, 5 figs. Discusses French, American, Swiss and German inventions for insuring proper working conditions for motor even in thin air of high altitudes.

Cosmos. Cosmos "Jupiter" Aero Engine. Aeronautics, vol. 16, no. 297, June 26, 1919, pp. 666-668, 4 figs. Specifications and performance at demonstration at Filton.
The Cosmos Aero Engines. Flight, vol. 11, no. 27, July 3, 1919, pp. 869-871, 7 figs. Radial types constructed by Cosmos Engineering Co., Ltd.

Curtiss. The Curtiss Model K-6 Aero Engine. Aeronautics, vol. 16, no. 295, June 12, 1919, pp. 608-609, 1 fig. Six cylinders en bloc, 4-stroke cycle, rated horsepower 150 at 1,700 r.p.m.

Design. The Design of Aeroplane Engines, pts. 22, 23 and 24, John Wallace. Aeronautics, vol. 16, no. 296 and 297, June 19 and 26, 1919, pp. 638-641 and 660-662 and vol. 17, no. 298, July 3, 1919, pp. 22-24, 9 figs. June 19: Stresses in crankshaft and crankpins; crankshaft bearings; ventilators; oil, water and air pumps. June 26: Requirements of satisfactory carburetor; venturi tube; principle of Zenith carburetor. July 3: Sources of poor efficiency; starting installations.

Hispano-Suiza. The Hispano-Suiza Airplane Engine—II, H. O. C. Isenberg. Am. Mach., vol. 51, no. 2, July 10, 1919, pp. 55-58, 13 figs. Foundry methods used for aluminum and bronze castings at works of Wright-Martin Aircraft Corporation.

Liberty. The Liberty 12A Aircraft Engine. Automobile Engr., vol. 9, no. 128 July 1919, pp. 213-221, 12 figs. Analysis of internal stresses, forces, and pressures on main members.

R-34 Motor Plant. A Technical Study of the R-34 Motor Plant. Automotive Indus., vol. 41, no. 2, July 10, 1919, pp. 81-83, 2 figs. With reference to operation of engines.

Salmson. France's Liberty Engine. The Amazing Salmson, W. F. Bradley. Automotive Indus., vol. 41, no. 2, July 10, 1919, pp. 59-66, 16 figs., partly on supp. plate. Engine is intermediate between rotary air-colled aviation engine and fixed cylinder water-cooled star type. Outstanding features are nine steel cylinders mounted around circular crankcase, crankcase and cylinders being fixed and single-throw crankshaft revolving.

Supercharging. The Value of Supercharging. Aviation, vol. 6, no. 11, July 1, 1919, pp. 577-579, 5 figs. and Aerial Age, vol. 9, no. 19, July 21, 1919, pp. 892-893, 4 figs. Tests conducted at altitude laboratory of Bureau of Standards, said to indicate that net gain in hp. will result even if considerable power is needed to drive blower.

MATERIALS OF CONSTRUCTION

Balloon Fabrics. Notes on Balloon Fabrics, Junius David Edwards. Aviation, vol. 6, no. 12, July 15, 1919, pp. 626-627, 2 figs. Characteristics of fabrics in use and discussion of means along which future development may be expected to take place.

Duralumin. Duralumin in Aviation (Le duralumin en aviation). Aérophile, vol. 27, nos. 9-10, May 1 and 15, 1919, pp. 129-130, 1 fig. Advantages claimed over wood by reason of less sensitiveness to atmospheric changes.

Plywood. The General Properties and Uses of Plywood—III, B. C. Boulton. Aerial Age, vol. 9, no. 19, July 21, 1919, pp. 895-897, 4 figs. Monocoque type of fuselage. (Concluded.)

METEOROLOGY

Aerial Currents, Errors in Determination. Errors Arising from Insufficiency of Knowledge of Meteorological Variations of Aerial Navigation (Sur les erreurs d'estime que peut entraîner la connaissance incomplète du régime aérologique), L. Dunoyer. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 22, June 2, 1919, pp. 1102-1105. Probable errors in estimating effect of crossing on aerial current.

Anticyclones and Depressions. The Origin of Anticyclones and Depressions, John Logie. Proc. Roy. Soc. of Edinburgh, vol. 39, part 1, Session 1918-19, pp. 56-77, 8 figs. Theory based on two postulates—(1) when two portions of air differing slightly in density are adjacent and in the same level, they tend to mingle and so destroy the difference of density; (2) when changes of pressure occur at any level in an extensive layer of air, the surrounding air does not "immediately rush in," but only slowly intrudes into the region of diminished pressure.

Storms. Storm Types and Peculiarities, George S. Bliss. Jl. Engrs. Club of Philadelphia, vol. 36, no. 176, July 1919, pp. 272-274, 8 figs. Bowie and Weightman map studies and summary on their conclusions. Paper read before Am. Soc. Heating & Ventilating Engrs.
See also Anticyclones.

Wind Velocities. Influence of the Vertical Distribution of the Temperature on the Wind Velocity Measured in the Vicinity of the Ground (Influence de la distribution verticale des températures sur les vitesses du vent mesurées au voisinage du sol), C. E. Brazier. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 23, June 10, 1919, pp. 1160-1161. Observations extending over period of ten years alleged to establish that considerable influence is exerted by temperature distribution on ratio of wind velocity to gradient at altitudes at which anemometers are usually placed.

The Pilot Balloon Method of Determining the Direction and Speed of the Upper Winds, Ivan R. Tannehill. Jl. U. S. Artillery, vol. 51, no. 1, July 1919, pp. 1-16, 4 figs. One-theodolite method for sighting baloon compared with two-theodolite and other methods. Rapidity of calculations in one-theodolite method admitted to lead to small errors, but it is observed that atmospheric changes taking place during longer observations required by other methods lead also to errors.

Influence of Seasons and the Periodic Changes in Atmosphere on the Corresponding Variations in Atmospheric Pressure and Wind Intensity (Influence des saisons et des régimes aérologiques sur les variations corrélatives de la pression atmosphérique et de l'intensité du vent), G. Reboul and L. Dunoyer. Comptes rendus des séances de l'Academie des Sciences, vol. 168, no. 19, May 12, 1919, pp. 947-950. As factor for determining coefficient of certitude of rules for forecasting weather conditions.

Various Cases of Diminution of Wind Velocity with Altitude (Sur certains cas de diminution de la vitesse du vent avec l'altitude), Albert Baldit. Comptes rendus des séances de l'Academie des Sciences, vol. 168, no. 24, June 16, 1919, pp. 1211-1214. Instances are quoted to prove that established rule of increasing wind velocity with altitude represents merely average of a great number of cases, but not absolutely constant law.

PRODUCTION

Fittings. Making Aircraft Fittings with Temporary Tools, S. A. Hand. Am. Mach., vol. 51, no. 5, July 31, 1919, pp. 221-225, 22 figs. Tools developed to facilitate production in large quantities.

NC Boats. How the NC Boats were Built Under Pressure of War Need—II, J. C. Hunsaker. Automotive Indus., vol. 41, no. 3, July 17, 1919, pp. 120-123, 2 figs. Guarding against corrosion; glue for laminated construction; building of testing hangar.

MILITARY AIRCRAFT

Blackburd. *See Torpedo-Carrying Aeroplanes.*

British Airships. The Evolution of the British Naval Airship. Eng., vol. 107, no. 2789 and 2790, June 13 and 20, 1919, pp. 757-759 and 797-799, 46 figs., partly on supp. plates. Account of airship work of Vickers concern. Particulars of construction of R-80. (Concluded.)

Torpedo-Carrying Aeroplane. The "Blackburd" Torpedo-Carrying Aeroplane. Engineering, vol. 108, no. 2793, July 11, 1919, pp. 46-48, 5 figs. Weight with torpedo and full tanks, 5,800-lb.; engine, 350-hp. Rolls-Royce Eagle.

Naval Aircraft. Progress in Naval Aircraft, J. C. Hunsaker. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 31-44, 10 figs. Notes on development of NC boats, notably manner of guarding against corrosion, protecting wooden and fabric parts and special equipment for transatlantic flight.

MODELS

Electrically Driven Models. Elementary Aeronautics and Model Notes, John F. McMahon. Aerial Age, vol. 9, no. 20, July 28, 1919, p. 941. On models driven by electricity.

Spar Forms. Model Aeroplanes—XXVII (New Series), F. J. Camm. Aeronautics, vol. 16, no. 295, June 12, 1919, pp. 623-624, 27 figs. Spar forms.

PLANES

Ansaldo. The Ansaldo 1 Biplane. Aerial Age, vol. 9, no. 19, July 21, 1919, pp. 890-891, 4 figs. General specifications are: Span, upper plane 25 ft., lower plane 21 ft. 8 in.; overall height 10 ft. 6 in.; engine, S. P. A. Ansaldo 220 hp.

Avro. The Avro "Baby" Sporting Biplane. Flight, vol. 11, no. 26, June 26, 1919, pp. 831-836, 12 figs. Fuselage is of rectangular section and conventional girder type. Machine is a single seater. Span 25 ft.; length overall 18 ft. 6 in.; height 7 ft. 6 in.; weight, loaded, 857 lb.

B. A. T.—340 H.P. A. B. C. (Type F. K. 25—"Basilisk"). Aeronautics, vol. 16, no. 296 (New Series), June 19, 1919, p. 637, 1 fig. Fuselage follows system adopted in Bantam, but machine is somewhat larger.
See also Wasp.

Bristol. The Bristol Passenger Triplane. Aerial Age, vol. 9, no. 20, July 28, 1919, p. 932, 2 figs. Graph of performances of Bristol triplane cargo machine.

The Bristol Triplane Braemar. Aviation, vol. 6, no. 12, July 15, 1919, p. 639, 1 fig. Intended to be used for bombing of Berlin and other interior German towns. Driving power supplied by 400-hp. Liberty engines, fitted tandem, in pairs, on either side of fuselage.

Curtiss. The Curtiss Model 18-B Biplane. Flight, vol. 11, no. 28, July 10, 1919, pp. 902-904, 5 figs. Machine is built around same fuselage and power plant as the triplane, but has lesser over-all height.

Flying Boats. Design and Construction of Flying Boats, David Nicolson. Flight, vol. 11, no. 28, July 10, 1919, pp. 915-919, 7 figs. Hull construction of P. and N. types. (Concluded.)

Lawson. Lawson Aerial Transport. Aerial Age, vol. 9, no. 17, July 7, 1919, pp. 810-811, 3 figs. Fuselage built to accommodate 26 passengers. Designed from commercial point of view for transcontinental service between New York and San Francisco.

Navy Specifications. The New Navy General Specifications for Airplanes, Archibald Black. Aviation, vol. 6, no. 11, July 1, 1919, pp. 592-594, 1 fig. Comments on subject matter which has been added to or changed from that in previous issue. Addition referred to as new is no. 100-A.

Wasp. B. A. T.—170 H.P. Wasp (Type F.K. 23—"Bantam"). Aeronautics, vol. 16, no. 296 (New Series), June 19, 1919, p. 636, 1 fig. Fuselage consists entirely of large sheets of three-ply birch, fixed on oval section formers which are supported on four ash longitudinals.
See also B. A. T.

PROPELLERS

Moisture Proofing. Moisture Proofing Airplane Propellers with Aluminum Leaf, M. E. Dunlap. Aviation, vol. 6, no. 12, July 15, 1919, pp. 636-638, 9 figs. Method of applying aluminum leaf. A diagram is presented showing comparative effectiveness of different coatings in moisture proofing wood as determined by tests.

Wood Propellers. Wood Propeller Construction, Porter E. Stone. Aerial Age, vol. 9, no. 20, July 28, 1919, pp. 934-938, 12 figs. Suggestions in regard to their manufacture in quantity.

TRANSATLANTIC FLIGHT

NC Flight. Precautions That Spelled Success, James L. Breese, Jr. Sci. Am., vol. 121, no. 3, July 19, 1919, p. 55, 2 figs. Engineering features of flight of NC planes across ocean, notably arrangement for maintaining water in radiators and method of hooking up batteries.

R-34 Flight. Transatlantic Voyage of R-34. Aeronautics, vol. 17, no. 298, July 3, 1919, pp. 7-9, 1 fig. Plans considered by Admirality and details of equipment.

VARIA

Altitude Errors. Altitude Errors in Aerial Navigation, J. G. Coffin. Aviation, vol. 6, no. 12, July 15, 1919, pp. 624-626, 5 figs. Form of pressure indicating device suggested for avoiding errors consists in placing instrument inside container, for instance, a sphere, with an opening to outside air and rotating or oscillating container so as to periodically cover the entire 360 deg.

British Regulations for Air Navigation. The British Regulations for Aerial Navigation, Henry Woodhouse. Flying, vol. 8, no. 6, July 1919, pp. 525-533. Governing civilian aeronautics.

Log Books. The New Air Navigation Directions. Aeronautics, vol. 16, no. 293 (New Series), May 29, 1919, pp. 567-569. Instructions for use of log books. (Continued.)

Physiology of High-Altitude Flight. Physiological Aspects of Travel at High Altitudes (Transports à haute altitude des voyageurs en cabine aérienne, Communication faite par le docteur Guglielminetti à la Commission scientifique de l'Aero-Club de France, Séance du 30 avril 1919. Aérophile, vol. 27, nos. 9-10, May 1 and 15, 1919, pp. 132-135, 2 figs. Based on experiments and writer's experience during sojourn on top of Mont Blanc.

Wilbur Wright Lecture, 1919. The Wilbur Wright Lecture, 1919, Leonard Bairstow. Aeronautics, vol. 17, no. 298, July 2, 1919, pp. 12-14. Progress of aviation during period of war. (Concluded.) Paper read before Roy. Aeronautical Soc.

CIVIL ENGINEERING

BRIDGES

Chicago. Problems Encountered in the Design of 12th Street Bridge, Hugh E. Young, Eng. World, vol. 15, no. 1, July 1, 1919, pp. 17-26, 15 figs. Plans for bridge improvement, both involving straightening of Chicago river. Completion will give west side of city a 118-ft. thoroughfare to Lake Michigan.

Concrete Bridge. Calculation of Arched Reinforced-Concrete Bridge of 30 Meters Span (Berekening van een viakke gewelforug van gewapend beton van 30 M. spanning), W. J. Wisselink. Ingenieur, vol. 34, no. 27, July 5, 1919, pp. 496-503, 6 figs. Vertical section of bridge; determination of total constant load per meter; distribution of load.

Foundations. Test of Sandy Foundations at Arch Bridge Pier, Arthur Richards. Eng. News-Rec., vol. 83, no. 5, July 31, 1919, pp. 208-209, 2 figs. Settlement measured by gage at top of timber mast passing through completed concrete base. Stone blocks for load.

Inspection. Points Requiring Special Observation and Investigation in Bridge Inspection, Herbert C. Keith. Can. Engr., vol. 37, no. 3, July 17, 1919, pp. 145-147. Concerning reduction of vibration, investigation of compressing members, preventing decay of timber stringers and similar points. From paper presented before Brooklyn Engrs. Club.

Kansas City. Central Avenue Bridge and Viaduct to Kansas City. Elec. Traction, vol. 15, no. 7, July 1919, pp. 411-416, 14 figs. Design to accommodate both street railway and roadway traffic between Kansas City, Missouri and Kansas City, Kansas.

Pontoon Bridges. The Coblenz Pontoon Bridge, J. W. Skelly. Prof. Memoirs, Corps Engrs. U. S. Army & Engr. Dept., vol. 11, no. 56, March-April 1919, pp. 217-228, 13 figs. Bridge is about 1,050 ft. long and is composed of 14 sections—two draw sections, 98 ft. and 81 ft. in length, eight fixed sections 81 ft. long and at each end two short ramp sections about 50 ft. long. Other sections are held in reserve for use as required.

Railway Bridge Specifications. Comparison of Five Railway Bridge Specifications. Eng. News-Rec., vol. 83, no. 1, July 3, 1919, pp. 33-36. Proposed revised A.R.E.A. specifications compared with Southern Pacific, Pennsylvania, and New York Central accepted practice.

Reinforcement. Historic Shropshire Bridges Strengthened with Ferro-Concrete A. T. Davis. Ferro-Concrete, vol. 10, no. 9, March 1919, pp. 249-262, 21 figs. Bridges in question were constructed with cast-iron arches on masonry abutments about a century ago.

How an Old Masonry Arch Bridge Was Rebuilt. Ry. Maintenance Engr., vol. 15, no. 7, July 1919, pp. 228-230, 5 figs. Bridge consisted of five semi-circular arches of 40 ft. span having a total length of 260 ft. and total height above bottom of footings of 60 ft.

Sectional Bridges. Types of Truss Bridges (Neue Bauarten zerlegbarer Brucken). Rudolf Bernhard. Zentralblatt der Bauverwaitung, vol. 39, no. 15, Feb. 15, 1919, pp. 80-83, 24 figs. Reconstruction of bridges destroyed during war and types developed.

Substructure. Substructure of Michigan Avenue Bascule Bridge, Chicago, Hugh E. Young and William A. Mulcahey. Eng. News-Rec., vol. 83, no. 5, July 31, 1919, pp. 210-213, 4 figs. Cylinder piers sunk to rock and hardpan carry concrete tailpits for double-deck bridge. Steel columns embedded in wall support girders for trunnions and uplift anchorage.

Suspension Bridge. Special Design Features and Erection Methods for 540-Foot Suspension Bridge, William G. Grove. Eng. News-Rec., vol. 83, no. 1, July 3, 1919, pp. 4-8, 8 figs. Designed with varying cable inclinations at towers.

Suspension Bridge and Suspension Ferry in Rio de Janeiro (Hangebrucke und Schwebefahre in Rio de Janeiro). Zentralblatt der Bauverwaitung, vol. 39, no. 28, April 2, 1919, pp. 145-146, 4 figs. Bridge spans branch of the sea 150 meters wide.

Suspension Bridge of Gotteron, Fribourg (Le pont suspendu du Gotteron, à Fribourg). Bulletin Technique de la Suisse Romande, vol. 45, no. 12, June 14, 1919, pp. 112-114, 5 figs. Placing additional cable units so as to reduce maximum working stress to 18 kg. per sq. mm.

Widening. Widening Existing Bridges. Ferro-Concrete, vol. 10, no. 9, March 1919, pp. 268-271, 7 figs. By means of reinforced concrete. Reference is made to actual work.

BUILDING AND CONSTRUCTION

Apartment Houses. Million Dollar Apartment House in Montreal. Contract Rec., vol. 33, no. 27, July 2, 1919, pp. 650-653, 6 figs. Eight-story building on site 253 ft. x 75 ft.; to contain eighty apartments.

Army Supply Base. Building the New Orleans Army Supply Base. Eng. News-Rec., vol. 83, no. 3, July 17, 1919, pp. 122-125, 4 figs. Concentration of equipment, use of 7 miles of temporary railway track, and rapid construction of project. mentioned as notable features.

Concrete-Block Construction. Houses for Halifax Reconstruction Built of Granite-Face Concrete Blocks. Contract Rec., vol. 33, no. 26, June 25, 1919, pp. 603-606, 6 figs. Building hollow walls with hydro-stone units presenting natural stone appearance.

Concrete Floor Surfaces. Concrete Floor Surfaces, W. P. Anderson. Ferro-Concrete, vol. 10, no. 11, May 1919, pp. 322-324. It is stated that in putting down concrete floors satisfactory results can be obtained either by using a top dressing or by finishing the structural concrete itself.

Concrete Substructure. The Construction of a Pumping Station for the Schenectady Works, General Electric Company, Keith O. Guthrie. Gen. Elec. Rev., vol. 22, no. 7, July 1919, pp. 538-544, 10 figs. Indicating method of pouring concrete substructure and lowering it into position.

Constructional Elements. Planning the Industrial Plant—III, Hugh M. Wharton. Indus. Management, vol. 58, no. 2, Aug. 1919, pp. 113-117, 12 figs. Practice in roofs, floors, stairways, windows. (To be continued.)

Cribbing. Sectional Concrete Cribbing Displaces Retaining Walls at Embankments. Coal Age, vol. 16, no. 4, July 24, 1919, pp. 141-143, 4 figs. Details of pillow blocks and fillers used in sectional concrete retaining wall.

Concrete Buildings. Concrete Building Addition Made at Reasonable Cost. Eng. News-Rec., vol. 83, no. 2, July 10, 1919, pp. 75-76, 3 figs. Cost per cu. ft., 15.4 cents. Work done in Boston district during war.

Designs. Cutting Down the Cost of Engineering in Building Design and Construction. E. H. Darling. Contract Rec., vol. 33, no. 26, June 25, 1919, pp. 597-599. Fallacy of free engineering and free designs.

Flagpole Erection. Seventy-Foot Concrete Flagpole Poured Erect in Place, R. C. Hardman. Eng. News-Rec., vol. 83, no. 4, July 24, 1919, p. 173. Construction effected by means of a light tower, similar to a hoisting tower.

Framing. Steel and Concrete Framing Combined for Economy. Eng. News-Rec., vol. 83, no. 4, July 24, 1919, pp. 178-182, 5 figs. Cost and space both saved in Chicago 12-story office building carried over theater auditorium. Design includes special heavy trusses, girders and cantilevers.

Garages. Curved Drive for Automobiles in Six-Story Garage. Eng. News-Rec., vol. 83, no. 4, July 24, 1919, pp. 188-189, 2 figs. Incline between floors claimed to give better facilities than elevators.

Hotels. Palmers' New Hotel and Canteen. Eng. & Indus. Management, vol. 1 (New Series), no. 20, June 26, 1919, pp. 619-620, 2 figs. Hotel composed of three large, three-story buildings. Canteen consists of large dining hall, kitchen, stores, offices and staff quarters.

Housing. A Solution of the Housing Problem in the United States, Robert Anderson Pope. Jl. Am. Inst. Architects, vol. 7, no. 7, July 1919, pp. 305-314, 2 figs. Proposal is made that each head of family and individual worker be provided with enough garden space immediately contiguous to his dwelling to enable him to produce with intelligent direction and co-operation of an agricultural corps of community workers, the larger part of vegetables and small fruits which he and his family consume within the course of a year.

The Plumbing Standards for the Housing Projects of the Emergency Fleet Corporation, William G. Tucker. Architectural Rec., vol. 46, no. 1, July 1919, pp. 47-56, 6 figs. As adopted for various types of housing projects, which are divided into three general classes — (1) bungalows, (2) two-story dwellings, detached, semi-detached or in groups, apartments, and (3) dormitories, hotels, mess halls, kitchens and cafeterias.

The Engineering Aspect of the Housing Problem. Eng. Rev., vol. 32, no. 12, June 16, 1919, pp. 342-344, 2 figs. Alternative method of utilizing bricks with economy of materials in walls to the brick on edge construction. (Second article.)

A Model Housing Plan for Reclaiming a St. Louis District. Am. Architect, vol. 116, no. 2271, July 2, 1919, pp. 8-13, 6 figs. Removing existing buildings in slum sections to make way for more attractive and equitable government housing project.

Inspection. Testing and Inspection as a Means of Safe-guarding Construction, R. Robertson Deans. Contract Rec., vol. 33, no. 26, June 25, 1919, pp. 624-626. Duty of testing engineer in detecting faulty materials. Concrete and steel.

Purifiers. The Application of Reinforced Concrete to Purifier Construction, A. E. Broadberry. Gas World, vol. 70, no. 1819, May 31, 1919, pp. 459-462, and (discussion), pp. 462-463, 14 figs., and Gas Jl., vol. 146, no. 2925, June 3, 1919, pp. 601-603, and (discussion), pp. 604-605, 14 figs. Plan and details of construction. Maximum pressure was assumed to be 48 in.

Reservoirs. Storage and Service Reservoirs in British Waterworks Engineering. Ferro-Concrete, vol. 10, no. 10, April 1919, pp. 297-301, 5 figs. Illustrating construction of reinforced-concrete reservoirs.

Retaining Walls. The Stability of Reinforced Concrete Retaining Walls, F. Zimmerman. Eng. & Contracting, vol. 52, no. 4, July 23, 1919, pp. 94-96, 4 figs. Diagram for solving design equations graphically.
See also Cribbing.

Silos. Grain Silos of Reinforced Concrete (Getreidesilos in Eisenbeton), G. Escher. Beton & Eisen, vol. 18, nos. 2-3, Feb. 5, 1919, pp. 17-20, 10 figs. Type built on Rank system, which aims at cooling grain by propelling air currents through silo walls into it. (To be concluded.)

Stacks. Solving a Stack-Raising Problem, Martin Fishback. Eng. & Min. Jl., vol. 108, no. 3, July 19, 1919, pp. 95-96, 5 figs. Work done in replacing stack 6 ft. in diameter and 75 ft. long.

Steel Mill Buildings. An Investigation of the Stresses in the Transverse Bent for Steel Mill Buildings, C. S. Sperry. Proc. Colorado Sci. Soc., vol. 11, June 1919, pp. 253-268, 5 figs., partly on supp. plates. Accuracy of stresses obtained by various approximate solutions.

Tanks. Tank Construction—XXIX, Ernest G. Beck. Mech. World, vol. 65, no. 1695, June 27, 1919, pp. 306-307, 7 figs. Side walls of rectangular tanks. (Continuation of serial.)

Theatres. Engineering Features of the Modern Theatre—I & II. Am. Architect, vol. 116, no. 2273 and 2274, July 16 and 23, 1919, pp. 91-98 and 123-129, 26 figs. partly on supp. plate. Study of Sam Shubert Theater at Philadelphia, notable feature of which is entire absence of obstructing columns, and of State-Lake Theater in Chicago.
See also Framing.

CEMENT AND CONCRETE

Calcium Chloride in Concrete Mixtures. Construction Work in New York Last Year. Good Roads, vol. 18 (new series), no. 2, July 9, 1919, pp. 14-15 and 22, 1 fig. From report of First Deputy Commissioner on work of Construction Department of State Commission of Highways during 1918. A graphical description of results of tests with calcium chloride in concrete mixtures is presented

Cement Gun. Lining a Reservoir with Concrete by the Cement Gun. E. Court Eaton. Eng. News-Rec., vol. 83, no. 4, July 24, 1919, pp. 167-168, 2 figs. Costs and progress made, given for operations in irrigation district during current high-price period.

Compressing Concrete. Compressing Concrete Increases Its Strength, Frank P. McKibben. Cement & Eng. News, vol. 31, no. 7, July 1919, pp. 22-23, 2 figs. Plain columns of successive layers pressed down, said to average half again as strong as those poured for full length.

Concrete. Concrete in Roads, Bridges and Culverts, H. Eltinge Breed. Mun. & County Eng., vol. 56, no. 6, June 1919, pp. 222-225, 1 fig. Concluded from tests that crushed-stone concrete resists impact better than gravel concrete, and that large-sized material is more durable than the small sizes.

Concrete Blocks. Making Concrete Blocks for Toronto Breakwater, Frederick Phillips. Can. Engr., vol. 37, no. 2, July 10, 1919, pp. 119-120, 3 figs. Collapsible wooden forms for making concrete blocks weighing 10 and 18 tons.
Plant Lay-Out for Making Concrete Blocks. Contract Rec., vol. 33, no. 28, July 9, 1919, pp. 665-666, 2 figs. Large units for breakwater construction cast at plant arranged to facilitate handling of raw materials and product.

Concrete Pipe Manufacture. Speeding up the Manufacture of Concrete Pipe with Compressed Air, F. A. McLean. Contract Rec., vol. 33, no. 29, July 16, 1919, pp. 694-695, 3 figs. Results obtained by installation of compressors and pneumatic rammers.

Cracking in Reinforced Concrete. Crack and Rust Formation in Reinforced-Concrete Constructions (Riss- und Rostbildungen an Tragwerken aus Eisenbeton). Zeitschrift des osterr. Ingenieur-und Architekten-Vereins, vol. 71, no. 1, Jan. 3, 1919, pp. 8-9, 1 fig. Caused by faulty design and construction. (To be concluded.)

Curing Concrete. Curing Concrete. Mun. Jl. & Public Works, vol. 47, no. 3, July 19, 1919, pp. 34-35, 2 figs. Results of tests made to determine effect of curing conditions on strength of concrete and wear from abrasion.

Gravel, Grading of. Proportioning of Pit-Run Gravel for Concrete, R. W. Crum. Can. Engr., vol. 37, no. 4, July 24, 1919, pp. 165-170, 8 figs. Also Concrete, vol. 15, no. 1, July 1919, pp. 3-8, 8 figs. Conclusion resulting from investigation is that grading of pit-run gravel may be measured by percentage of fine aggregate to total aggregate and by weight per cu. ft. measured loose.

Gunite. *See Cement Gun.*
New Concrete Terminals at Norfolk, Cement & Eng. News, vol. 31, no. 7, July 1919, pp. 22-23, 5 figs. With reference to method of attaching wire and method of forming gunite wall.
See also Cement Gun.

India. Ferro-Concrete in India. Ry. Engr., vol. 40, no. 474, July 1919, pp. 154-156. Practice follows British Standard Specification. From technical paper no. 191 of Public Works Dept., Government of India.

Mixing Methods. Bettering Concrete by a New Mixing Method, Nathan C. Johnson. Eng. News-Rec., vol. 82, no. 26, June 26, 1919, pp. 1266-1270, 7 figs. Using as basis motion-picture studies of concrete in mixing. Mixer has been developed in which, it is claimed, cement gets necessary thorough contact with aggregate.
See also Mix Water Removal.
Concrete Mixtures for Ferro-Concrete Work, With Special Reference to the Influence of Voids in the Aggregate, T. J. Gueritte. Ferro-Concrete, vol. 10, no. 2, August 1919, pp. 42-52, 6 figs. Comparison of specifications issued by Joint Committee on Reinforced Concrete of Roy. Inst. of British Architects, the regulations drawn up by London County Council, and the Mouchel-Hennebique standards.
Studies in Surface Area Proportionate Method, R. B. Young. Can. Engr., vol. 36, no. 26, June 26, 1919, pp. 563-566, 6 figs. Surface-area method of proportioning materials of mortars and concretes tested and approved by Ont. Hydroelectric Power Commission.
Tests Do Not Bear Out Surface Area Method, Duff A. Abrams. Can. Engr., vol. 36, no. 26, June 26, 1919, pp. 566-569. Comparison of surface area and fineness-modulus methods. Writer prefers latter method.
The "Sand" Method of Proportioning Pit Run Gravel for Concrete. Eng. & Contracting, vol. 52, no. 1, July 2, 1919, pp. 18-20, 5 figs. Investigation to establish engineering methods for proper use of such material, conducted by Engineering Experiment Station of Iowa State College. Paper read before Am. Soc. for Testing Materials.

Mix-Water Removal. Pressing Out Mix Water Adds to Cement Mortar Strength, C. T. Wiskocil. Eng. News-Rec., vol. 83, no. 3, July 17, 1919, pp. 130-132, 3 figs. Tests at University of California with apparatus which permitted pressures up to 30,000-lb. per sq. in. reported as giving very high compressive values.

Quick-Hardening Concrete. Cements Producing Quick-Hardening Concrete, P. H. Bates. Can. Engr., vol. 37, no. 1, July 3, 1919, pp. 113-115, and 117. Data obtained with "Sorel cement" in course of investigations conducted by Pittsburgh Branch of Bureau of Standards and dealing with various problems relating to Portland cement.

Proportioning Concrete. *See Mixing Methods.*

Reinforced-Concrete Tests. Some Tests on the Properties of Reinforced Concrete, W. A. Slater. Eng. News-Rec., vol. 83, no. 5, July 31, 1919, pp. 217-220, 6 figs. Effect of protecting metal, lapping reinforcing bars and of reversing stress in beams as well as action of diagonally placed rods in slab spans studied for concrete ship. Research of Emergency Fleet Corporation.

Reinforcing Elements. High Tensile v. Mild Steel for Reinforcing Concrete, Arthur W. C. Shelf. Surveyor, vol. 55, no. 1432, June 27, 1919, pp. 495-496, 5 figs. Tests interpreted as proving that ordinary plain mild-steel bars of 28 to 32 tons breaking strain are best to employ for reinforced concrete.

EARTHWORK, ROCK, EXCAVATION, ETC.

Canals. Enlargement of the Yakima-Tieton Main Canal, G. C. Finley. Eng. News-Rec., vol. 82, no. 26, June 26, 1919, pp. 1255-1258, 7 figs. Half circular section of reinforced concrete increased in height. Bonus system said to have proved successful in overcoming great scarcity of labor at favorable cost.
Chippewa Power Development in All Phases is a Higher Efficiency Enterprise. Contract Rec., vol. 33, no. 26, June 25, 1919, pp. 590-596, 18 figs. Building 12¾-mile canal.

Dam. Dam Foundation Placed by Suspended Pneumatic Caissons. Eng. News-Rec., vol. 83, no. 3, July 17, 1919, pp. 108-110, 8 figs. Difficulties encountered in getting footing in deep and swift water in narrow gorge of Spanish River at High Falls in northern Ontario.
Dam Supported by Bascule Bridge Closes Canal Lock. Eng. News-Rec., vol. 83, no. 3, July 17, 1919, pp. 116-118, 4 figs. Steel beams and panels placed from bridge form temporary dam permitting repair work in Trolhattan Canal.
Forms and Dimensions of Large Masonry Dams (Formes et dimensions des grands barrages en maçonnerie), M. Résal. Annales des Ponts et Chaussées, vol. 2, Mar. Apr. 1919, pp. 165-221, 34 figs. Mechanical discussion of stresses and illustration of method of computing them in various practical cases.
The Tata Hydro-Electric Power Plant, Bombay. Indian & Eastern Engr., vol. 44, no. 5, May 1919, pp. 151-154, 6 figs. Dams are 1200, 1500 and 2700 yards long. They were built with lime mortar. (To be continued.)

Drydocks. Carron Dry Docks at Grangemouth. Eng., vol. 107, no. 2789, June 13, 1919, pp. 762-763 & 774, 15 figs. Utilization of disused junction lock for wet dock.

Excavation Methods. Excavation Methods on the Miami Conservancy Project, G. L. Teeple. Eng. & Contracting, vol. 52, no. 3, July 15, 1919, pp. 61-63, 4 figs. Flood-prevention project which involves construction of five large earth dams.

Grading. How to Get Clean-Cut Grading Jobs, F. F. Mengel. Good Roads, vol. 18, no. 5, July 30, 1919, pp. 68-69. Suggestions in regard to methods in light and heavy work.

Percussion Drilling. Percussion Plant for Oil-Well Drilling. Engineering, vol. 107, no. 2791, June 27, 1919, pp. 830-833, 15 figs. Points out differences of rigs in three systems: American, Standard or Californian and Canadian.

Sewers. Sewer-Construction Records Used at Scarsdale, New York, Perry Thompson. Eng. News-Rec., vol. 83, no. 3, July 17, 1919, pp. 111-112, 3 figs. Daily record blank, rock book and sample headings from final estimate book used on 22-miles of sewers.

Shaft Sinking. Sinking and Concreting Mine Shaft 936 Feet Deep. Richard L. Russell. Eng. News-Rec., vol. 82, no. 26, June 26, 1919, pp. 1259-1262, 5 figs. Simultaneous concreting and excavating operations.

Tunnels. Backfilling Tunnel Through Holes Bored from Surface, J. Armstrong. Eng. News-Rec., vol. 93, no. 4, July 24, 1919, pp. 174-175, 2 figs. Concrete poured around 60-in. cast-iron pipe in 10 by 10 ft. rock bore by dropping it 70 ft. from trestle across river.
Pittsburgh South Hills Tunnel and Earlier Projects, Eng. News-Rec. vol. 83, no. 4, July 24, 1919, pp. 166-167, 1 fig. Project for 5500-ft. tunnel.
Conduit Construction Work in Tunnels. Bell Telephone News, vol. 8, no. 12, July 1919, pp. 18-19, 7 figs. Formation of conduit under Chicago River consisting of single-duct tile laid three wide and 8 to 10 ft. high with complete encasement of concrete.
Construction Details on the Marin Water and Power Project, H. M. Bowers. Jl. Electricity, vol. 43, no. 1, July 1, 1919, pp. 22-23. Cost and construction data and description of 8700-ft. tunnel.
Tunnel Construction under Water (Tunnelbau unter Wasser), A. Haag. Zentralblatt der Bauverwaltung, vol. 39, no. 11, Feb. 1, 1919, pp. 57-59, 10 figs. With special reference to tunnels under the rivers Spree and Elbe and under the Kiel canal.
The Catskill Tunnels—IV. Ry. Engr., vol. 40, no. 474, July 1919, pp. 143-147, 4 figs. Alteration of heading during construction of Hunter's Brook Tunnel. (Continuation of serial.)

HARBORS

Docks. Reinforced-Concrete Dock (Travaux-Publics), A. Goupil. Génie Civil, vol. 75, no. 1, July 5, 1919, pp. 7-10, 8 figs. Work done at Dutch Indies, notably extension of ports of Soerabaja and Semarang. From De Ingenieur, Feb. 22, 1919.

Houston, Tex. Harbor Facilities and Development at Houston, Texas. Eng. News-Rec., vol. 83, no. 4, July 24, 1919, pp. 156-159, 7 figs. Wharves, freight sheds, warehouses, railway connections and freight-handling machinery.

Singapore. Singapore Harbour Works. Ferro-Concrete, vol. 10, no. 8, Feb. 1919, pp. 220-28, 11 figs. Refers especially to reinforced-concrete construction.

Suez. Extensions of the Port at Suez (Les travaux d'extension du port de Suez). Génie Civil, vol. 74, no. 26, June 28, 1919, pp. 525-529, 2 figs. Involving extension of docks.

MATERIALS OF CONSTRUCTION

Asphalt. Melting Point of Asphalts, Leland M. Proctor. Chem. & Metallurgical Engr., vol. 21, no. 2, July 15, 1919, pp. 81-83, 1 fig. Comparison of data obtained by various processes for determining melting point.

Road Materials. Proposed Tests and Specifications for Road Building Materials. Good Roads, vol. 18, no. 1 & 2, July 2 & 9, 1919, pp. 3-4 and 13 & 18-19, 3 figs. Recommendations of Committee D-4 on road materials of Am. Soc. for Testing Materials.

Instructions for Field Inspection of Road Materials. Eng. & Contracting, vol. 52, no. 1, July 2, 1919, pp. 16-18. Issued by New Jersey State Highway Dept. for guidance of inspectors.

STONE, CRUSHED. Commercial Sizes of Crushed Stone. Eng. & Contracting, vol. 52, no. 3, July 16, 1919, pp. 72-73. Results of survey of Ohio, Kentucky, Tennessee, North Carolina and Georgia, undertaken by Bureau of Public Roads, for securing data to be used in developing of system of standard sizes and uniform nomenclature for crushed-stone products. From Public Roads.

ROADS AND PAVEMENTS

AMERICAN SOCIETY OF CIVIL ENGINEERS. Highways and Their Construction (Carreteras y su construcion). Ingenieria Internacional, vol. 1, no. 3, June, 1919, pp. 131-140, 8 figs. Final report of special committee on materials for road construction and standards for their test and use, of Am. Soc. Civil Engrs.

ASPHALT PAVEMENT. Asphalt-Covered Napped-Block Pavement. Mun. Jl. & Public Works, vol. 47, no. 3, July 19, 1919, pp. 32-34. Pavement is constructed of old granite block napped and reclipped and laid with a filler of sand and asphalt mixed, novel feature consisting in addition of covering of same sand-asphalt mixture over entire pavement to depth of about ⅜ in.

ASSOCIATION OF DOMINION LAND SURVEYORS. Roads, A. H. Hawkins. Annual Report of Assn. of Dominion Land Surveyors, Jan. 29, 30 and 31, 1919, pp. 91-97. Building of permanent roads is advocated.

BITUMINOUS MATS. Bituminous Mat Protects Texas Roads, James P. Nash. Am. City, Town & County Ed., vol. 21, no. 1, July 1919, pp. 1-5, 2 figs. Process claimed to work satisfactorily in dry climate.

BITUMINOUS ROADS. Bituminous Roads in Great Britain and the United States (Les chaussées bitumineuses en Grande-Brétagne et aux Etats-Unis), R. Feret. Annales des Ponts de Chaussées, vol. 2, Mar.-Ap. 1919, pp. 222-244. Gives particulars regarding work done and practices adopted in these countries.

The Design and Construction of Bituminous Macadam Roads and Pavements, A. W. Dean. Mun. & County Eng., vol. 56, no. 6, June 1919, pp. 206-208. Best and most lasting results believed to be obtained with sizes of stone in second course varying from ¾ in. to 2½ in., with larger sizes predominating.

BRICK PAVEMENTS. A Review of Recent Progress in Brick Pavement Design and Construction, Clark R. Mandigo. Mun. & Country Eng., vol. 57, no. 1, July 1919, pp. 9-11, 2 figs. Includes notes on advantages claimed for asphalt filler.

CONCRETE-ROAD SPECIFICATIONS. Chartered Summary of State Concrete Road Specifications, A. N. Johnson, Eng. News-Rec., vol. 83, no. 4, July 24, 1919, pp. 160-162, 1 fig. Arrangement in chart form.

Constructing Concrete Pavements. Mun. Jl. & Public Works, vol. 47, no. 2, July 12, 1919, pp. 22-23. Standard practice as recommended by Mississippi Valley Assn. of State Highway Departments.

CONCRETE-ROAD STRESSES. Stresses in Concrete Roads. Mun. Jl. & Public Works, vol. 46, no. 26, June 28, 1919, pp. 446-467. Experiments made by Bur. of Public Roads believed to have shown that concrete road under action of traffic or perhaps under influence of frost and different percentages of moisture in subgrades is continually bending so that reaction pressures between subgrade and slab are neither constant nor uniform in intensity.

COSTS. The Cost of a Mile of Road, George A. Duren. Can. Engr., vol. 37, no. 4, July 24, 1919, pp. 161-163, 3 figs. Tabulation of figures compiled by State Highway Engineer of Texas. From paper presented at Eng. & Road Builders' Congress.

Character and Cost of Highways for Motor Truck Use, S. Whinery. Eng. News-Rec., vol. 83, no. 2, July 10, 1919, pp. 77-78. Estimates they will have concrete foundations, will be not less than 20-ft. wide and will cost from $35,000 to $40,000 per mile.

DRAINAGE. *See Subsoil.*

GRANITE-BLOCK PAVEMENTS. The Design and Construction of Granite Block Pavements in Cincinnati, H. F. Shipley. Mun. & County Eng., vol. 57, no. 1, July 1919, pp. 19-21, 6 figs. Presents specifications.

The Design and Construction of Modern Granite Block Pavements with Special Reference to Practice in Borough of Manhattan, C. M. Pinckney. Mun. & County Eng., vol. 56, no. 6, June 1919, pp. 199-202, 11 figs. Specifications and requirements.

IOWA STATE ROAD LAW. The New State Road Law of Iowa. Good Roads, vol. 56, no. 3, July 16, 1919, pp. 25-26. Measure provides for improvement of 6000-mile system of primary highways.

LABOR. Convict Labor on Highways, Good Business. Good Roads, vol. 18, no. 5, July 30, 1919, pp. 65-67, 4 figs. Experiences of highway officials in various states claimed to demonstrate efficiency and economy of prison labor on roads, and physical, mental and moral benefits accruing to convicts.

MAINTENANCE. Macadam and Gravel Road Maintenance, R. C. Heath. Good Roads, vol. 18, no. 2, July 9, 1919, pp. 16 and 22. Practice followed by Kentucky Dept. Public Works.

NIGHT WORK. Road Building Twenty-four Hours a Day, William Ord. Contract Rec., vol. 33, no. 30, July 23, 1919, pp. 709-711, 2 figs. Examples quoted where it is said to have been found that night work effected economies and required less labor.

PIPE LINES, SUBSURFACE. Location of Subsurface Pipe Lines to Conserve Street Pavements, Harry M. Adams. Mun. & County Eng., vol. 56, no. 6, June 1919, pp. 225-226. Policies suggested from conditions in New York City.

ROAD DESIGN FOR MOTOR TRAFFIC. Influence of Motor Traffic on Road Design, Arthur H. Blanchard. Good Roads, vol. 18, no. 4, July 23, 1919, pp. 50-52. Transportation, surveys, laws and regulations, widths, grades, curves, bridges, drainage and foundations, wearing surfaces, detours and other considerations.

Highways and the Duty of Their Builders, S. M. Williams. Good Roads, vol. 18, no. 4, July 23, 1919, pp. 35-37, 5 figs. Observes that modern motor-truck transportation demands durable all-year roads that will make profits.

Highway Requirements for Twentieth Century Transportation, with Special Reference to New Jersey Practice, Wm. G. Thompson. Mun. & County Eng., vol. 56, no. 6, June 1919, pp. 208-210. Address delivered to Nat. Highway Traffic Assn.

RUBBER PAVEMENTS. Rubber Pavements: A Historical Résumé. India Rubber World, vol. 60, no. 4, July 1, 1919, pp. 548-550. Although cost of rubber pavement is estimated at about $25 per sq. yd., it is alleged that experience has shown that it will last much longer than any other and will be less expensive in the long run. Pioneer work in England is quoted.

SIDEWALK SPECIFICATIONS. Some Suggested Changes in Concrete Sidewalk Specifications, Chas. E. de Leuw. Mun. & County Eng., vol. 57, no. 1, July 1919, pp. 16-17. Recommends elimination of cinder foundation unless soil is impervious.

SUBSOIL. Comparison of Road Subgrade and Air Temperatures, C. C. Wiley. Eng. News-Rec., vol. 83, no. 3, July 17, 1919, pp. 128-129, 2 figs. Experiments at University of Illinois claimed to have shown that changes in air temperatures are slow to affect subsoil.

Notes on Road Foundations, Drainage and Culverts, U. W. Christie. Mun. & County Eng., vol. 57, no. 1, July 1919, pp. 17-18. Including table showing height to which capillary water rises in certain soils in 24 hours.

Cleveland Underdrains All New Pavements, Fred R. Williams. Am. City, City Ed., vol. 21, no. 1, July 1919, pp. 9-11, 3 figs. Methods and advantages of artificially draining subsoil.

SANITARY ENGINEERING

AIR DIFFUSES FOR ACTIVATED SLUDGE PROCESS. Test of Air Diffusers for Activated Sludge Process. Eng. & Contracting, vol. 52, no. 2, July 9, 1919, pp. 41-42. "Filtros" plates said to have proved more effective under test than perforated pipe, and basswool blocks.

FACTORY SANITATION. Design and Construction of Factories—VI. Eng. & Indus. Management, vol. 1, no. 19, June 19, 1919, pp. 588-589, Sanitation.

GARBAGE DISPOSAL. Garbage Disposal by Feeding Successfully Practiced at Lansing, Mich. Mun. & County Eng., vol. 57, no. 1, July 1919, pp. 23-25. Comparison of garbage-fed with grain-fed hogs.

INDUSTRIAL WASTES. The Disposal of Industrial Wastes, Jacob L. Crane, Jr. Am. Industries, vol. 19, no. 12, July 1919, pp. 22-24. Fundamentals in solution of problem and remarks on attitude of law and recent developments in this direction.

REFUSE COLLECTION. Organization for Refuse Collection. Mun. Jl. & Public Works, vol. 47, no. 2 & 3, July 12 & 19, 1919, pp. 16-19 & 35-37, 4 figs. Study of operation and efficiency of existing plant at Rochester and recommended oranization of Bureau of Sanitation. (Continued.)

Refuse Collection in Rochester. Mun. Jl. & Public Works, vol. 46, no. 26, June 28, 1919, pp. 464-466, 2 figs. Report of Bureau of Municipal Research. (To be continued.)

SANITATION AND MORTALITY RATES. Reducing the Mortality Rate by Sanitation (Diminucion de la mortalidad por el saneamiento), George A. Soper. Ingenieria Internacional, vol. 2, no. 1, July 1919, pp. 29-32, 4 figs. Illustrating sanitary measures conducted in representative European cities.

SEWAGE. Indianapolis Sewage Purification Plant, Edwin C. Hurd. Fire & Water Eng., vol. 66, no. 5, July 30, 1919, pp. 250-251, 1 fig. Inverted siphon used to convey sewage under river.

The Utilization of Sewage Sludge, John D. Watson. Surveyor, vol. 56, no. 1433, July 4, 1919, pp. 5-8, 1 fig. Diagram illustrating method of purifying sewage at Birmingham. Paper presented at annual meeting of Instn. of Municipal and County Engrs.

Some Unusual Sewerage Problems and How They Were Solved at Ocean Beach, New York, Andrew J. Provost, Jr. Mun. & County Eng., vol. 56, no. 6, June 1919, pp. 203-205, 7 figs. Precautions taken to prevent excessive infiltration of ground water into sewers through joints and at manholes.

SURVEYING

CLASSIFICATION OF LANDS. Classification of Lands, L. Brenot. Annual Report of Assn. of Dominion Land Surveyors, January 29, 30 and 31, 1919, pp. 51-56. Methods of classifying land for soldiers' settlement.

HIGHWAY SURVEYING. Surveying for Highway Improvement, F. G. Phillips. Good Roads, vol. 18 (new series), no. 2, July 9, 1919, pp. 11-12, 1 fig. Advises making thorough survey of road that is to be rebuilt and resurfaced.

MAPS, MILITARY. The Military Mapping Problem in the United States, R. C. Kuldell. Prof. Memoirs, Corps Engrs. U. S. Army & Eng. Dept., vol. 11, no. 56, Mar.-Apr. 1919, pp. 229-244, 2 figs. Advocates making all military maps of the U. S. as complete as A. E. F. found available in France. System of scales for both metric and English systems is suggested.

PHOTOGRAPHIC SURVEYING. New Method in Photogrammetry, Robert Heindl. Sci. Am. Supp., vol. 88, no. 2272, July 19, 1919, pp. 44-47, 21 figs. Offered as accurate and convenient method for photographic surveying with any camera. Translated from Archive fur Kriminal-Antropol. u. Kriminalistik, 1916.

ROD FOR TRIANGULAR WORK. Topographical Surveying on Atacama Desert in Chile, B. L. G. Rees. Eng. News-Rec., vol. 83, no. 5, July 31, 1919, pp. 224-226, 2 figs. Special rod designed for triangulation work.

WATER SUPPLY

ARTESIAN WELLS. Artesian Well Supply at Baton Rouge, La., L. R. Howson. Eng. & Contracting, vol. 52, no. 2, July 9, 1919, pp. 40-41, 2 figs. Consists of 915 ft. of 12-in., 934 ft. of 10-in., 44 ft. of 8-in. casing, and a 70-ft. strainer. Paper, read before Am. Water Works Assn.

CHLORINATION. Chlorination in West Virginia. Mun. Jl. & Public Works, vol. 47 no. 2, July 12, 1919, pp. 20-22. Reported results of disinfection in lowering typhoid rates.

See also Filtration Plants.

Contamination. Contamination of Bello Springs of Mantanzas Aqueduct (La contaminacion de los manantiales de Bello del Acueducto de Matanzas), Jos. M. Cadenas. Revista de la Sociedad Cubana de Ingenieros, vol. 11, no. 6, June 1919, pp. 259-270. Survey undertaken to determine cause of contamination.

Corrosion, Elimination of. The Chemical Treatment of Corrosive Cooling Water, W. O. Andrews. Jl. of South African Instn. of Engrs., vol. 17, no. 11, June 1919, pp. 239-244 and (discussion), pp. 244-246, 5 figs. Forms of rapid corrosion observed by Victoria Falls and Transvaal Power Co. and causes to which they attribute them.

Covering Water Basins. The Need and Cost of Covering the Clear Water Basins of the St. Louis, Missouri Water Works, Cornelius M. Daily. Mun. & County Eng., vol. 57, no. 1, July 1919, pp. 42-44, 1 fig. Typical sections of proposed cover.

Filtration Plant. The Design and Operation of the Water Filtration Plant at Camp Meade, Maryland, C. R. Potteiger. Mun. & County Eng., vol. 57, no. 1, July 1919, pp. 33-38. Design of rapid sand-filter plant.

Point St. Charles Filtration Works, Montreal. Can. Engr., vol. 37, no. 4, July 24, 1919, pp. 155-160, 8 figs. Efficiencies during last nine months claimed to be from 96.2 per cent to 99.1 per cent without chlorination and from 98.1 per cent to 99.8 per cent with chlorination.

Army Water Purification Units, William J. Orchard. Fire & Water Eng., vol. 66, no. 4, July 23, 1919, pp. 185-187, 4 figs. Motor-driven water trucks for chlorinating and filtering supply for A. E. F.

Gallery Collection System. The Gallery Collecting System of the Des Moines (Ia.) Water Co. Eng. & Contracting, vol. 52, no. 2, July 9, 1919, pp. 32-34, 7 figs. Water is obtained primarily from Raccoon River. Drainage area 3677 sq. miles above city.

Madison Water Works. The New Madison Water Works. Power, vol. 50, no. 4, July 22, 1919, pp. 128-133, 8 figs. Building new plant over old one while maintaining service. Choice of artesian or lake water and comparative costs.

Metering. Water Waste Control by House Inspections with District Metering, E. D. Case. Can. Engr., vol. 37, no. 4, July 24, 1919, pp. 163-165. Results obtained by pitometer at various cities. Paper read before Southwestern Water Works Assn.

Pitometer Surveys. Reduction of Water Consumption by Means of Pitometer Survey and Constant Inspection at Buffalo, N. Y., George C. Andrews. Mun. & County Eng., vol. 56, no. 6, June 1919, pp. 236-240.

See also Metering.

Purification of Water. *See Filtration Plants.*

Water Softeners. English and American Water Softeners. Power House, vol. 12, no. 10, July 5, 1919, pp. 278-280, 5 figs. Description of various types.

Water Testing. Water Testing Stations, W. T. McClenahan and R. S. Rankin. Fire and Water Eng., vol. 66, no. 2, July 9, 1919, pp. 63-65, 1 fig. Result of tests at Whiting Testing Station. Paper read before Am. Water Works Assn.

HYDRAULIC ENGINEERING

Spillways. Spillway Capacities Required for Reservoirs in Western United States, John T. Whistler. Eng. News-Rec., vol. 83, no. 1, July 3, 1919, pp. 28-32, 1 fig. Said to be based on a study of the flood discharges of 402 North American and 60 European and Indian records, with curves of probable flood discharges for far-western streams.

Thunderstorms and Storm Sewers. Some Broader Aspects of Rain Intensities in Relation to Storm Sewer Design, Robert E. Horton. Mun. & County Eng., vol. 56 & 57, no. 6 & 1, June and July, 1919, pp. 218-222 & 3-9, 16 figs. Comparative study of rain-intensity formulæ with a view to determining what, if any, general relations exist between rain intensity and the various meterological factors to which it is related. Simpson's theory of thunderstorm.

MUNICIPAL ENGINEERING

City Planning. Actual Accomplishments in City Planning in America, Andrew Wright Crawford. Jl. Engrs. Club of Philadelphia, vol. 36, no. 177, August 1919, pp. 291-299, 11 figs. Examples of improvements at various cities.

Town-Planning and Tramways. Tramway & Railway World, vol. 45, no. 30, June 19, 1919, pp. 309-311, 3 figs. Tramways on special track in parkway free from obstruction as proposed at Dundee.

Bolton's Housing Problems—Past, Present and Future, E. Morgan. Surveyor, vol. 55, no. 1431, June 20, 1919, pp. 462-464, 4 figs. Bolton Corporation Act gives powers to insist upon intersecting street at every 200 ft. and forbids construction of blocks of buildings exceeding this length.

VARIA

Architects, Registration. Model Form of Law for the Registration of Architects. Jl. Am. Inst. Architects, vol. 7, no. 7, July 1919, pp. 335-338. Regulation by State legislation of practice of architecture is proposed at annual convention of Am. Inst. of Architects.

Contract Work, Methods of Letting. Advantages and Disadvantages of Various Methods of Letting Contract Work, J. A. L. Waddell. Eng. & Contracting, vol. 52, no. 4, July 23, 1919, pp. 89-90, 1 fig. Diagram indicating basis for division of profits between contractor and client.

Storage Tanks, Moving. Moving 60-Ft. Oil Storage Tanks 150 Miles by Water, A. J. J. Taylor. Can. Engr., vol. 37, no. 1, July 3, 1919, pp. 107-108, 7 figs. Each tank was moved in one piece.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

Bleaching, Electrolytic. Electrolytic Bleach, Anson G. Betts. Paper, vol. 24, no. 18, July 9, 1919, pp. 15-16. Technical details of operation in electrolytic bleach plants.

ELECTRODEPOSITION

Electrochemical Industry. Utilization of Electrical Energy in Electro-chemical and Electrometallurgical Industry (Consommation d'énergie électrique dans la fabrication de divers produits de l'électrochimie et de l'électrométallurgie). Revue Générale de l'électricité, vol. 5, no. 26, June 28, 1919, pp. 913-923. Figures indicating kilowatts consumed in electrolytical processes.

ELECTROPHYSICS

Alternating Current Circuits. Calculation of Alternating Current Circuits Terrell Croft. Nat. Engr., vol. 23, no. 7, July 1919, pp. 338-342, 10 figs. Graphic method of computing wire sizes with Mershon diagram for two- and three-phase circuits. (Continuation of serial.)

Audion. *See Vacuum Valve.*

Cables, Heating. Heating of Underground Cables, A. L. Freret. Jl. Engrs., Club. of Philadelphia, vol. 36, no. 177, August 1919, pp. 301-303, 4 figs. Experiments to determine safe operating intermittent leads on underground cables.

Circuit Breakers. Calculation of Current Intensity Required to Operate a Circuit Breaker and Study of the Effects of a Short-Circuit (Calcul de l'intensité de déclanchement d'un disjoncteur et recherche d'un court-circuit), B. Guerschinovitch. Industrie Electrique, vol. 28, no. 648, June 25, 1919, pp. 224-227, 3 figs. Application of previously derived formula to various examples. (Concluded.)

Electromagnetic Waves. Electromagnetic Waves, T. J. I. Bromwich, Lond., Edinburgh, and Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 143-164. General solution of electromagnetic equations of wave propagation.

The Production and Measurement of Short Continuous Electromagnetic Waves, Balth, van der Pol. Lond., Edinburgh, and Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 90-97, 4 figs. By means of three-electrode thermionic tube with suitable circuits.

Gyro Compass. The Electrical Gyro Compass, O. B. Whittaker. Elec. Rev., vol. 74, no. 26, June 28, 1919. pp. 1078-1081, 7 figs. Principle upon which it operates is said to be a combination of laws of gravity and of rotation of the earth and the two characteristics of the gyroscope. Lecture delivered before Am. Soc. Mech. Inspectors.

Inductances. Calculating Growth of Current in an Inductance, Carl Hering. Elec. World, vol. 74, no. 4, July 26, 1919, p. 75. Method offered for simplifying computations when plotting curves showing rise in current in induction coils.

Simplified Inductance Calculations, with Special Reference to Thick Coils, Philip R. Coursey. Phys. Soc. of London, vol. 31, no. 4, June 15, 1919, pp. 155-167, 8 figs. Method based on extension of Nagaoka's formula for single-layer coils, to include as well all ordinary forms of thick coils. Rosa's formula for thick coils is put into the same form as Nagaoka's and by it a series of correction factors is calculated for various coil thicknesses.

Kenotron. Thermoelectric Emission and Its Applications: The Kenotron (L'émission thermo-électrique et ses applications: Le kénotron), G. Johannés. Revue Générale de l'Electricité, vol. 5, no. 24, June 14, 1919, pp. 857-864, 5 figs. Technical study of rectifiers operating by electronic discharges. (To be continued.)

Nitrogen Electrode. The Potential of a Nitrogen Electrode, Francis Lawry Usher and Ramavenkatasubbier Venkateswaran. Jl. Chem. Soc., vol. 115 & 116, no. 680, June 1919, pp. 613-618, 1 fig. Evidence in support of assumption that during electrolysis of acid solution substance set free at anode is active form of ordinary nitrogen.

Power Flow. The Flow of Power in Electrical Machines, J. Slepian. Elec. Jl., vol. 16, no. 7, July 1919, pp. 303-311, 23 figs. Definitions and properties of Poynting vector and illustration of its appliction for picturing power flow in reactor, transformer, direct-current generator, alternator, synchronous condenser and induction motor.

Spark Potential. Influence of a Transverse Magnetic Field on the Spark Potential (Ueber die Beeinflussung des Funkenpotentials durch ein transversales Magnetfeld), Edgar Meyer. Annalen der Physik, vol. 58, no. 4, 1919, pp. 297-332, 10 figs. Theory of influence of magnetic field. Dependence from cross-section of spark gap.

Thermionic and Photo-Electric Phenomena at the Lowest Obtainable Pressure, C. F. Hagenow. Physical Rev., vol. 13, no. 6, June 1919, pp. 415-433, 5 figs. Studied specially after illuminated plate had been denuded of occluded gases by continued electric bombardment.

Thermoelectric Equations. The Thermoelectric Equation $P = TdV/dT$ Once More, Edwin H. Hall. Proc. Nat. Acad. Sciences, vol. 5, no. 6, June 15, 1919, pp. 197-198. Questions validity of equation as commonly understood, P being taken as ordinary Peltier effect, and V the Volta effect between any two metals.

Three-Electrode Lamp. Maintenance of Mechanical Oscillations by Means of Three-Electrode Lamp (Sur l'entretien des oscillations mécaniques au moyen des lampes à trois électrodes), Henri Abraham and Eugéne Bloch. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 24, June 16, 1919, pp. 1197-1198. Based on property of audions which permits introducing in electrical circuit an inductive resistance.

Vacuum Valves. Maintaining Electrical Oscillations by Means of a Three-electrode Valve (Entretien des oscillations électriques par une lampe-valve à trois électrodes), G. Gutton. Revue Générale de l'Electricité, vol. 6, no. 1, July 5, 1919, pp. 14-24, 10 figs. Scheme developed by the division of military radiotelegraphy of the French army for the purpose of maintaining oscillations of antennæ. A suggested theory of phenomenon involved is presented. (Properties of valves were treated in R. G. E., April 26, 1919, p. 629.)

The Audion as a Circuit Element, H. W. Nichols. Physical Rev., vol. 13, no. 6, June 1919, pp. 404-414, 5 figs. Functional equations for three-element audion used to deduce actions taking place in any circuit containing the audion.

The Theory of Valve Rectification, W. S. Barrell. Wireless World, vol. 7, no. 76, July 1919, pp. 181-186, 6 figs. Outlines elementary theory of thermionic valve in its application to (1) two-electrode or Fleming valve, and (2) three-electrode valve. (To be continued.)

FURNACES

Bailey Furnace. Electric Furnace Progress, L. F. Bailey. Metal Indus., vol. 17, no. 7, July 1919, pp. 316-317, 2 figs. Bailey furnace.

Booth-Hall. The Booth-Hall Electric Furnace, W. K. Booth. Foundry Trade Jl., vol. 21, no. 209, May 1919, pp. 301-302, 4 figs. Vertical-arc type with conducting hearth.

Brass Furnace. Utilization of Electric Brass Furnaces, H. W. Gillett. Jl. Indus. & Eng. Chem., vol. 11, no. 7, July 1, 1919, pp. 664-668. Development and growth of electric brass furnace applications, and table giving performance of various types of electric brass furnaces.

Design. *See Requirements.*

Great Britain. Electric Furnaces in the United Kingdom, 1918, R. G. Mercer. Foundry Trade Jl., vol. 21, no. 209, May 1919, pp. 295-301. Elecn., vol. 82, no. 25, June 20, 1919, pp. 694-695. Figures quoted indicate that there are installed or being installed 141 electric furnaces with a total capacity of 112,000 kva. Of these, 117 are electric steel furnaces.

Metal Melting Furnaces. Application of Electrical Energy to the Melting of Metals, H. A. Greaves. Engineering, vol. 108 no. 2793, July 11, 1919, pp. 42-43, 8 figs. Suggested connections to enable three-phase or two-phase current to be applied to furnace with an unequal resistance in one of the phases and still maintain balance load as regards both power and power factor on primary phases. Paper read at joint meeting of Instn. of Elec. Engrs. and Iron and Steel Inst.

Moffat Steel Furnace. The New Moffat Electric Steel Furnace, W. F. Sutherland, Can. Machy., vol. 22, no. 4, July 24, 1919, pp. 69-70, 3 figs. Designed, it is said, to overcome troubles frequently encountered by reason of crescent-shaped masses of partially fused raw material found clinging to walls between electrodes. This is claimed to have been accomplished by shaping body to conform to lines of current flow in bath of molten metal.

Morgan Crucibles. Electric Furnace Developments for Non-Ferroua Metals. Metal Industry, vol. 14, no. 22, May 30, 1919, pp. 444-447, 6 figa. Morgan crucibles. New feature said to be that crucible is container and also conductor to be heated.

Records. Operating Records of Electric Steel Furnaces. Elec. World, vol. 74, no. 3, July 19, 1919, pp. 125-127, 2 figa. Characteristica, 1918 energy consumption, maximum demand and steel output of eighteen arc-type furnaces in Milwaukee district, with experience of some uaers in operating them.

Requirements. Large Electric Steel-Melting Furnaces, Victor Stobie. Foundry Trade Jl., vol. 21, no. 209, May 1919, pp. 304-311, 8 figs. Technical requirements formulated from experiments and observations.

Developments in Electric Iron and Steel Furnaces, J. Birby. Foundry Trade Jl., vol. 21, no. 209, May 1919, pp. 311-323, 24 figs. Urges that engineera designing electric furnaces for use in manufacture of iron and ateel fully grasp requirements of metallurgists and be fully acquainted with working conditions of blast furnacea and with ateel foundries.

Sahlin Furnace. A New Type of Electric Furnace, Axel Sahlin. Foundry Trade Jl., vol. 21, no. 209, May 1919, pp. 302-304, 2 figs. Sahlin Furnace. Said to have been designed with a view to embodying advantages of both the direct-arc and the free-burning arc furnaces, at the same time avoiding aa far aa possible the disadvantagea of both. Built aa circular ladle with contracted top and dished bottom.

Steel Making. Electric Furnaces in Steel Making, Victor Stobie. Jl. of West of Scotland Iron & Steel Inst., vol. 26, no. 7, Mar. 1919, pp. 90-94 and (diacussion) pp. 94-103, 9 figs. on 4 supp. plates. Claims following improvements for thorough sealing up of furnace roof; (1) no cold air is drawn into furnace; (2) no flames or highly heated air burn away the electrodes above roof; (3) electrodes can be of smaller diameter for a given current aupply. Also other economic advantages and conveniences in manufacture of various alloys.

Temperature Regulator. A. Furnace Temperature Regulator, Walter P. White and Leason H. Adams. Physical Rev., vol. 14, no. 1, July 1919, pp. 44-48, 1 fig. By making heating coil of an electric furnace one arm of a wheatstone bridge and combining this with galvanometer regulator, thus keeping resistance of coil constant, writers assert it is possible, regardless of variations in current supply, and with no attention, to maintain constant temperature of furnace not too directly influenced by temperature of room.

Automatic Temperature Control. Automotive Indus., vol. 41, no. 3, July 17, 1919, pp. 118-119, 2 figs. Thermo-couple of nickel-chromium alloy installed in electric furnace actuates high tension millivoltmeter; arm depressor depresses pointer at regular time intervals and in doing so pointer forcea two contact pieces carried by table.

GENERATING STATIONS

Buenos Aires. New Generating and Distributing Electrical Installations of Buenos Aires (Les nouvelles installations de production et de distribution d'électricité de Buenos Aires), Bulletin Technique de la Suisse Romande, vol. 45, no. 11, May 31, 1919, pp. 97-99, 3 figs. Sub-stationa where alternating current ia transformed into direct current. (Concluded.)

Busbar, Emergency. New Emergency Bus Feature in Brantford Hydro-Electric. Station. Elec. News, vol. 28, no. 9, May 1, 1919, pp. 29-30, 3 figs. Scheme contemplates use of double-throw single-pole disconnecting awitches, three disconnecting switches being used to each circuit.

Lima. Notes on the Installations of the Associated Electric Enterprises of Lima (Algunas informaciones sobre las instalaciones de las Empresas Electricas Asociadas de Lima), Boletin de Minaa, vol. 11, noa. 1-3, March 31, 1919, pp. 32-45. Characteristics of turbine alternators and transformers.

Load Dispatching. Central Station Load Dispatching, P. B. Juhnke. Power Plant Eng., vol. 23, no. 15, August 1, 1919, pp. 661-666, 6 figs. Methods employed to carry load most efficiently and precautions adopted to safeguard workmen.

Load Distribution. Station Load and Economy, Ths. Norberg Schulz. Elecn., vol. 82, no. 25, June 20, 1919, pp. 700-701, 4 figs. Results obtained by studying distribution of load when several machines or atations are working in parallel.

Operation, Combined. Advantages of Combined Operation of Water and Electric Utilities and Selling Electric Current for Private Use in Springfield, Ill., Willis J. Spaulding. Mun. & County Eng., vol. 56, no. 6, June 1919, pp. 229-230. Net earning said to have been over $92,000 for fiscal year ending Feb. 28, 1919.

Overload Protection. Overload Protection for Electric Motors, O. C. Callow. Power, vol. 50, no. 2, July 8, 1919, pp. 60-62, 3 figs. Discusses various types of overload protection for motors, and suggests arrangements to suit special conditions.

Oxygen and Hydrogen Manufacture. Oxygen and Hydrogen—A New Source of Revenue for the Central Station, F. G. Clark. Elec. News, vol. 28, no. 14, July 15, 1919, pp. 30-32, 1 fig. Electrolytic cell suggested as means of smoothing out rough curve of variable load.

Rates. Central Station Rates in Theory and Practice—I, II & III, H. E. Eisenmenger. Elec. Rev., vol. 75, nos. 2, 3 & 4, July 12, 19, and 26, 1919, pp. 47-51, 94-97, and 138-143, 7 figs. General principles by which service costs can be determined. Cost analysis; energy cost and demand cost; load curve and load factor. Capital charges of central stations and how they effect the demand cost.

Rotherham. The New Power Station at Rotherham. Elecn., vol. 82, no. 26, June 27, 1919, pp. 750-760 and vol. 83, no. 1, July 4, 1919, pp. 6-11, 20 figs. June 27: Total generating capacity has increased from 45000 kw. in 1914 to 70,500 at present time. July 4: Switch-gear and accessories; diagram of connection of synchronizing arrangement.

Selection of Electric System. Selection of an Electric System. Terrell Croft. Coal Age, vol. 16, no. 5, July 31, 1919, pp. 178-184, 5 figs. Formulae and examples of application as applied to electrical problema incident to mine installations are given.

Shanghai. Shanghai Municipal Electricity Undertaking. Elec. Times, vol. 56, no. 1446, July 3, 1919, pp. 3-4, 2 figs. With reference to economical aspect. Electricity Supply at Shanghai. Electrical Rev., vol. 84, no. 2170, June 27, 1919, pp. 747-749, 5 figs. Turbo-generator installation.

Switzerland. The Massaboden Electric Power Plant (near Brig) of the Swiss State Railroads (Das Elektrizitatswerk Massaboden bei Brig der Schweiz, Bundesbahmen). H. Eggenberger and J. Danzer. Schweizerische Bauzeitung, vol. 73, no. 24, June 14, pp. 275-278 and vol. 74, no. 1, July 5, 1919, pp. 301-307, 24 figs. June 14: Reservoir holds 8000 cu. m., thus allowing for considerable height of peak loads. Power is transmitted partly by aerial line and partly by underground cable. July 5: Plant has three 3500 hp. double turbines of Francis type; two of the turbines are coupled with 3300-volt alternator generators; the two aets of transformers consist each of a synchronous motor of 210 hp. and 4000-volt generator.

GENERATORS AND MOTORS

Alternator Characteristics. Experimental Determination of Alternator Characteristics (Méthode d'analyse expérimentale dea propriétéa des alternateurs). A. Blondel and F. Carbenay. Revue Générale de l'Electricité, vol. 5, no. 24, June 14, 1919, pp. 843-855, 12 figa. Illustrating applications to special cases of methods of analyses described in preceding article. (Concluded.)

Armature Conductors Current Distribution. Current Distribution in Armature Conductors, Waldo V. Lyon. Elec. World, vol. 74, no. 2, July 12, 1919, pp. 66-68, 3 figs. Equations are derived showing how alternating current resistance depends upon depth of slot.

Commutator Motors. Graphs of Single-Phase Commutator Motors (Constructions graphiques élémentaires relatives aux moteurs à Collecteur monophasés) Osc. Collard. Société Belge des Electriciens, vol. 33, April-June 1919, pp. 133-145, 5 figs. Based on writer's analytical theory developed in Soc. Belge des Elec., issue Aug. 1906, p. 357.

Mill Motors. A 3000 HP. Mill Motor by the G. E. C. Elecn., vol. 82, no. 25, June 20, 1919, pp. 696-698, 6 figs. Motor is for driving a three-high, non-reversing plate mill and is believed to be the largest non-reversing motor driving a rolling mill in England.

IGNITION APPARATUS

Spark Discharge. Some Characteristics of the Spark Discharge and Its Effect in Igniting Explosive Mixtures, Clifford C. Paterson and Norman Campbell. Phys. Soc. of London, vol. 31, no. 4, June 15, 1919, pp. 168-228, 12 figs. Research to determine relation between electric charactertisics of a spark discharge and its power of igniting explosive mixture. Main experiments of ignition of mixtures of petrol and air are described.

LIGHTING AND LAMP MANUFACTURE

Churches. Lighting Installation for a Church Auditorium, H. O. Stewart. Elec. Rev., vol. 75, no. 1, July 5, 1919, pp. 1-3, 5 figs. Indirect lighting with luminous bowl and urn fixtures.

Gases, Residual. Residual Gases and Vapors in Highly Exhausted Glass Bulbs, J. E. Sharder. Physical Rev., vol. 13, no. 6, June 1919, pp. 434-437, 2 figs. Investigation reported to show that vacuum in sealed vessels deteriorates with time, rapidly at first and then more slowly and that subsequent heating even at temperatures lower than the heat treating temperature results in increase of pressure due to further liberation of gases and vapors from glass.

Industrial Lighting. Industrial Lighting, C. E. Clewell. Jl. Franklin Inst., vol. 188, no. 1, July 1919, pp. 51-90, 18 figs. Engineering details of factory lighting and economical advantages derived from efficient illumination of industrial establishments.

Design of Industrial Lighting System, Ward Harrison and H. H. Magdsick, Elec. World, vol. 74, no. 1 and 4, July 5 and 26, 1919, pp. 7-11 and 184-187, 13 figs. July 5: Analysis of deflecting and diffusing units for lighting industrial plants, giving advantages and limitations of each. Data concerning distribution curves, efficiency and mounting heights. July 26: Table giving present intensity standards in industrial lighting and coefficient of utilization.

Inverted Burners. The Regenerative Effect as Influencing Lighting Efficiency of the Inverted Incandescent Burner, J. S. G. Thomas. Jl. Soc. Chem. Indus., vol. 38, no. 12, June 30, 1919, pp. 168T-171T, 3 figs. Concluded from experimental research that efficiency is increased when gaseous mixture of coal gas and primary air is preheated.

Lenses. Luminous Power of Lighthouse Lenses (Studio sulla potenza luminosa delle ottiche dei fari), A. Coacci. Rivista Marittima, vol. 52, no. 5, May 1919, pp. 195-208, 7 figs. Lambert law considered as giving close approximation. Analytical formula offered for what is believed to be correct estimate of power.

Motion Picture Projection. Mazda Lamps for Motion Picture Projection, L. C. Porter. Gen. Elec. Rev., vol. 22, no. 7, July 1919, pp. 556-559, 11 figs. It is reported that lamp wattage has been increased to 900 and a tubular bulb used in place of spherical bulb, for the purpose of adapting Mazda lamps for motion picture projection.

Searchlights. The Development of Anti-Aircraft Searchlights, James B. Cross. Prof. Memoirs, Corps Engrs. U. S. Army & Engr. Dept., vol. 11, no. 56, Mar.-Apr. 1919, pp. 139-149, 6 figs. Types used (1) for seacoast defense, and (2) battlefield illumination.

Street Lighting. Street-Lighting Reconstruction Problems, L. Gaster. Gas. Jl., vol. 147, no. 2920, July 1, pp. 29-30. Experiences in London during war.

Wartime. Lighting in Wartime, Preston S. Millar. Jl. Engrs. Club of Philadelphia, vol. 36, no. 176, July 1919, pp. 259-265, 2 figs. Work done by Illuminating Society and Lighting Industry in co-operating with government in promoting industrial production, preventing accidents and saving fuel. Paper presented at joint meeting of Phila. section of Am. Inst. Elec. Engrs. and Illuminating Eng. Soc.

MEASUREMENTS AND TESTS

Asynchronous Machines. New Method for Indirect Testing of Asynchronous Machines (Sur une nouvelle méthode d'essai indirecte des machines asynchrones), J. Le Monnier. Revue Générale de l'Electricité, vol. 6, no. 2, July 12, 1919, pp. 35-40, 6 figs. Method of Commuting coefficient necessary for constructing diagram.

Electrodynamometer. An Electrodynamometer Using the Vibration Telescope, Carl Barus. Proc. Nat. Acad. Sciences, vol. 5, no. 6, June 15, 1919, pp. 211-217, 2 figs. Its possible use for finding magnetic field within helix of unknown constants pointed out.

Magnetic Materials, Testing. Rapid Testing of Magnetic Materials, Thomas Spooner. Elec. World, vol. 74, no. 1, July 5, 1919, pp. 4-6, 5 figs. Use of small ring samples and ballistic method of testing.

Meters. Service Tests of Small Capacity Meters, Arthur Horace Bryant. Elec. Rev., vol. 75, no. 4, July 26, 1919, pp. 155-157. Recommends that thorough inspection be made in place of usual 36 months' test and that where inspection raises no question as to accuracy of any given meter, its test be set at 60 months (24 months after inspection.)

Potentiometers. A Rectangular-Component Two-Dimensional Alternating-Current Potentiometer, A. E. Kennelly. Jl. Franklin Inst., vol. 188, no. 1, July 1919, pp. 1-26. 20 figs. Form adapted for telephonic-frequency measurements. Readings are given in two rectangular components of the voltage measured.

Transformers, Instrument. Field Testing of Instrument Transformers—II, H. M. Crothers. Elec. World, vol. 74, no. 3, July 19, 1919, pp. 119-121, 5 figs. Experience with differential methods as applied to voltage and current transformers and to acceptance testing of series transformers for street-lighting circuits. Possible simplifications are suggested.

Voltameters. A Note on the Accuracy of Copper Voltameter), J. Obata (in Japanese. Denki Gakkwai Zasshi, no. 371, June 10, 1919.

POWER APPLICATIONS

Conference Grounds. Electricity at Summer Conference Grounds. Jl. Electricity, vol. 43, no. 1, July 1, 1919, pp. 6-8, 5 figs. Electrical equipment at Y. W. C. A. Conference Grounds.

Heating. High Frequency Induction Heating Today, E. F. Northrup. Chem. Engr., vol. 27, no. 7, July 1919, pp. 167-168 & 174. Recent developments. Paper read before Convention of Am. Inst. of Chem. Engrs.

High Power Factor Induction Heaters, C. Edward Magnusson. Jl. Electricity, vol. 43, no. 1, July 1, 1919, pp. 17.18, 5 figs. Design said to eliminate annoying humming noise.

Hotels. Electricity in the World's Largest Hotel, Wm. H. Easton. Elec. Jl., vol. 16, no. 7, July 1919, pp. 288-294, 18 figs. Pennsylvania Hotel New York City. Distributing system divided into two separate parts: (1) direct current system for motors driving elevators, ventilating fans, and other machinery requiring speed control, and (2) alternating current for lighting, cooking and miscellaneous applications.

Sugar, Beet, Factories. Electricity in Beet Sugar Factories, Joseph P. Collopy. Elec. World, vol. 74, no. 4, July 26, 1919, pp. 178-181, 3 figs. Consideration of manufacturing process in its relation to load characteristics and some suggestions on the choice of electrical equipment.

Textile Mills. Canadian Textile Mill Operated by Central Station Service, V. K. Stalford. Elec. Rev., vol. 75, no. 4, July 26, 1919, pp. 135-137, 7 figs. Remote control and other features of motor service.

STANDARDS

Generators for Electrotyping. Standardization of Generators for Electrotyping, Floyd T. Taylor, Metal Indus., vol. 17, no. 7, July 1919, pp. 323-325, 4 figs. Suggestion in regard to selecting standard.

Polyphase Currents. Two Suggestions to the International Electric Committee (Deux propositions au comité électrotechnique international), E. Pierard. Société Belge des Electriciens, vol. 33, April-June, 1919, pp. 146-151, 3 figs. With reference to a general formula for determining polyphase currents and a symbol for weakening of transmission in long lines.

Transformers. Standardization of Transformers in Germany (Erläuterungen zu den Normen für Einheitstransformatoren), G. Stern. Elektrotechnische Zeitschrift, vol. 40, no. 3, Jan. 16,1919, pp. 33-34. Rules for constructing transformers with aluminum windings, issued by German Standardization Committee. Capacities, voltages, percentage of short-circuit voltages, temperature rise, overload capacity, and structural data are laid down.

STORAGE BATTERIES

Efficiency. On the Efficiency of Storage Batteries, K. Kimura. (In Japanese.) Denki Gakkwai Zasshi, no. 371, June 10, 1919.

TELEGRAPHY AND TELEPHONY

Antenna. Radio Transmission Formulas for Antenna and Coil Aerials, J. H. Dellinger. Jl. Franklin Inst., vol. 188, no. 1, July 1919, pp. 95-96. Derived from electromagnetic theory.

Baudot Quadruplex. Italian Submarine Cables Operated by Quadruplex Baudot (Le baudot quadruple sur les cables sous-marins Italiens), M. Cesaire Albanese. Annales des Postes, Télégraphes et Téléphones, vol. 8, no. 2, June 1919, pp. 228-238, 6 figs. Scheme of arrangement and account of tests performed.

Direction Finders. Aircraft Radio Direction Finding Equipment Developed by the Navy Department, Edgar H. Felix. Aerial Age, vol. 9, no. 18, July 14, 1919, pp. 852-853, 4 figs. Designed by Bur. of Steam Eng. Navy Dept.

Multiplex Operation. High Frequency Currents on Wires, J. O. Mauborgne. Jl. Franklin Inst., vol. 188, no. 1, July 1919, pp. 91-93. Experiments undertaken to examine possibility of adapting existing types of radio-telephone and telegraphic apparatus to multiplex operation.

Perforators, Keyboard. The Story of the Keyboard Perforator, H. H. Harrison. Instn. Post Office Elec. Engrs., no. 71, January 8, 1917, 40 pp., 18 figs. Varieties in design occurring in respect to (1) selection from a gang assembly of punches corresponding to character key operated, (2) propulsion of punches through paper and their retraction to normal, and (3) feed forward of paper by amount in accordance with length of letter plus space element these three conditions being quoted as essential in constructing an automatic keyboard perforator.

Photographs. The Electrical Transmission of Photographs, Marcus J. Martin. Model Engr. & Elecn., vol. 41, no. 949, July 3, 1919, pp. 13-17, 5 figs. Historical account of work done by various experimenters. (To be continued.)

Pupinization. Effect of Pupinization of Short Telephone Lines (Wirksamkeit der Pupinisierung kurzer Fernsprechleitungen), Ludwig Schultheiss. Telegraphen-u. Fernsprech-Technik, vol. 7, no. 21-22, Feb. 15, 1919, pp. 81-83, 1 fig. Tables showing results of tests. (Concluded.)

Relays. The Oscillatory Valve Relay: A Thermionic Trigger Device, L. B. Turner. Elecn., vol. 83, no. 2147 and 2148, July 4 and 11, 1919, pp. 4-5 and 34-35, and (discussion) pp. 35-36, 9 figs. July 4: Distinguishes between relays and amplifiers and explains operation of triode. July 11: Analysis is made of sensitivity and selectivity of the tuned high-frequency valve relay and general limitations on sensitivity and speed of working are discussed.

Static Interference. *See Weagent Static Prevention.*

Telephones, Automatic. The Western Electric Company's Automatic Telephone System, B. O. Anson. Instn. Post Office Elec. Engrs., no. 72, Dec. 4, 1916, 62 pp., 22 figs., partly on supp. plate. Including enumeration of requirement writer considers as essential to a mechanical switching system.

Telephone, Wireless. Wireless Telephone Transmitter for Seaplanes. Telegraph & Telephone Age, no. 14, July 16, 1919, pp. 342-346, 4 figs. Marconi type S. E. 1100 set.

Field Wireless Telephony and Direction-Finding. Wireless World, vol. 7, no. 76, July 1919, pp. 199-205, 7 figs. Account of demonstration.

Wireless Telephony and Directional Wireless. Aeronautics, vol. 16, no. 294, June 5, 1919, pp. 586-588, 2 figs. Features for military and commercial purposes. (Continued.)

Radio Transmitting Sets on the NC Type Seaplanes. Telegraph and Telephone Age, no. 13, July 1, 1919, pp. 330-331, 2 figs. Diagram showing connections and arrangement.

Telephony, Secret. Secret Telephony (Procédé de téléphone secret), M. Poirson. Annales des Postes, Télégraphes et Téléphones, vol. 8, no. 2, June 1919, pp. 239-248, 5 figs. Periodic inversion of currents (without superposition of external current) at starting point and their rectification at receiving point. Scheme evolved by Service d'Etudes des Postes et Télégraphes of France.

Weagent Static Prevention. The Weagent "X-Stopper," Wireless World, vol. 7, no. 76, July 1919, pp. 209-211, 5 figs. Diagrammatic exposition of necessity for spacing two loop aerials comprising this type of receiver. (Concluded.)

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

CONVERTERS, ROTARY. Pulsation of the D.C. Terminal Voltage in Rotary Converters, J. K. Kostoko. Elecn., vol. 83, no. 2147, July 11, 1919, pp. 37-39. Diagrams and formulæ. (To be continued.)

DESIGN. On the Most Economical Design of Transformers, T. Hayakawa. (In Japanese.) Denki Gakkwai Zasshi, no. 371, June 10, 1919.

DESSAUER TRANSFORMER. Dessauer's High-Tension Transformer, E. Walter. Elecn., vol. 83, no. 2146, July 4, 1919, pp. 12-13, 2 figs. Scheme by which high-tension stresses are so controlled that they are removed to position where they can be safely dealt with.

FREQUENCY AMPLIFIER. Theory of Stationary Frequency Doublers (Beitrag zur Theorie und Wirkungsweise des stationaren Frequenzverdopplers), M. Osnos. Elektrotechnik u. Maschinenbau, vol. 37, no. 5, Feb. 2, 1919, pp. 45-48, 7 figs. Argument to demonstrate Epstein frequency doubler is equivalent to two transformers with their primary windings in series and their secondary windings in opposition.

RECTIFIERS. The Tungar Rectifier—Its Theory, Characteristics and Application—II. F. Keith d'Alton. Elec. News, vol. 28, no. 10, May 15, 1919, pp. 30-35, 26 figs. Performance of simple single-phase rectifier is outlined and claimed advantages of different possible combinations of two or more single-phase rectifiers are presented and discussed.
The Use of Mercury Rectifiers at Hirschberg, Silesia J. Obach. Elecn., vol. 82, no. 25, June 20, 1919, pp. 698-699. Three rectifying cylinders mounted side by side on wrought-iron frame work; together with the vacuum pump they occupy as much floor space as a rotary converter, giving 100 kw., whereas they themselves have a capacity of 750 kw. From Elektrotechnische Zeitschrift, no. 42, 1918.

TRANSFORMERS, POWER. Power Transformers, A. F. Berry. Elecn., vol. 82, no. 26, June 27, 1919, pp. 733-739, 8 figs. Variety in requirements that must be met in transformer design. Points in design of building of sub-stations, such as desirability of being able to run a crocodile truck into building and the need for ample head room.

TRANSFORMER PRACTICE. Essentials of Transformer Practice—XXIV, E. G. Reed. Elec. Jl., vol. 16, no. 7, July 1919, pp. 301-303, 8 figs. Polarity.
Operation at Holtwood, Charles H. Bromley. Power, vol. 50, no. I, July 1, 1919, pp. 8-9, 4 figs. How transformers are cleaned and inspected.

TRANSMISSION, DISTRIBUTION CONTROL

ALUMINUM CONDUCTORS. Aluminum Conductors for Overhead Power Transmission Lines, Arthur Jacob. Elecn., vol. 82, no. 26, June 27, 1919, pp. 743-748, 7 figs. Conductivity of aluminum and copper, their relative densities, tensile strength and other qualities are discussed.

CABLES. Varnished Cambric Cable for Underground Service, W. E. Hazeltine. General Elec. Rev., vol. 22, no. 6, June 1919, pp. 442-444. Describes structure of varnished cambric cable and points out features wherein this cable is superior to those of paper or rubber insulated type.

GROUNDING. Grounding (Erdung), Karl Michalke. Dinglers Polytechnisches Journal, vol. 6, no. 334, Mar. 22, 1919, pp. 57-60, 2 figs. Discusses various points which have to be considered in grounding.

HIGH POTENTIAL SYSTEMS. Distribution of Current Intensity and Potential in line of High Tension System (Etude de la répartion de l'intensité et du potential le long d'une ligne de distribution à très haute tension), Léon Drin. Revue Générale de l'Electricité, vol. 6, no. 1, July 5, 1919, pp. 3-12, 14 figs. Graphical study by means of characteristics which are defined as geometrical loci of points corresponding to extremities of vectors of tensions and intensities of each element of network.
The Practicability of Transmission Lines at Highest Voltages in This Country, G. V. Twiss. Elecn., vol. 82, no. 26. June 27, 1919, pp. 732-736. 4 figs. Considerations alleged to have militated against use of overhead lines in England found exaggerated.

INSULATORS. Notes on Suspension Insulator Design, H. L. Garbutt. Jl. Electricity, vol. 43, no. I, July 1, 1919, pp. 19-21, 4 figs. Theories accounting for deterioration of cap-and-pin type suspension insulator.

OVERHEAD LINES. Overhead Net Works (Canalisations aériennes), Ch. Vallet. Industrie Eléctrique, vol. 28, no. 648, June 25, 1919, pp. 232-236. Formula for determining maximum safe distance between consecutive poles. (Continuation of serial.)

POWER FACTOR CORRECTION. Power Factor Correction. Power Plant Eng., vol. 23, no. 14, July 15, 1919, pp. 635-639, 8 figs. From report of sub-committee on power factor correction presented at Convention of Nat. Elec. Light Assn.

POWER TRANSMISSION. On the Limits of Power Transmission by Alternating Currents (Uber die Grenzen der Kraftubertragung durch Wechselstrome), M. Dolivo-Dobrowolsky. Elektrotechnische Zeitschrift, vol. 40, no. 1, Jan. 2, 1919, pp. 1-4, 1 fig. Discusses question whether system of high-tension a.c. will be given preference, as now, for future power transmissions; writer comes to the conclusion that, since the underground cable will be the future means of transmission, high-tension d.c. will be used for future power transmission.

RELAY PROTECTION. Transmission Line Relay Protection, D. W. Roper, H. R. Woodrow, O. C. Traver and P. Mac Gahan. Elec. Rev., vol. 75, no. 1, July 5, 1919, pp. 13-18, 15 figs. Typical application of current and directional relays.

RELAYS, REVERSE-CURRENT. Reverse-Current Relays-Principles of Operation, Victor H. Todd. Power, vol. 50, no. 3, July 15, 1919, pp. 96-99, 15 figs. Schematic diagrams. Construction of features of various types.

SUBSTATIONS. Railway Converter Substations—I. C. F. Lloyd. Power House, vol. 12, no. 11, July 19, 1919, pp. 303-307, 10 figs. Concerning class of equipment to be used and its arrangement in substation buildings.
Canal Substation at Columbus, E. W. Clark. Elec. Eng., vol. 53, no. 5. May 1919, pp. 204-205, 3 figs. Transformers, lightning arresters and other high tension equipment located out-of-doors; oil switches, buses, switchboard and auxiliary equipment placed in small building.
Substations for Y-connected Systems, A. V. Taylor. Elec. World, vol. 74, no. 4, July 26, 1919, pp. 172-175, 7 figs. As standardized by company operating in Northwest States, where light loads and long distances prevail.

SWITCHBOARDS. Developments in Switchboard Apparatus. Gen. Elec. Rev., vol. 22, no. 7, July 1919, pp. 535-537, 8 figs. Plunger type for overload protection.

THREE-PHASE CURRENT TRANSMISSION. Comparative Technical and Economical Study of an Overhead Line and an Underground Line to transmit Three-Phase Current at 50,000 volt and 50 Cycles (Etude comparative, technique et économique, d'une ligne aérienne et d'une ligne souterraine à courant triphasé 50,000 volts 50), P. Yersin. Bulletin Association Suisse des Electriciens, vol. 10, no. 5, May 1919, pp. 141-149, 10 figs. Although in various respects underground lines are found more advantageous, the cost of aerial line is estimated to be less than one-half of that of underground.

TRANSMISSION AT 220 KILOVOLTS. Problems of Power Transmission at 220 Kilovolts, A. E. Silver. Elec. Rev., vol. 75, no. 2, July 12, 1919, pp. 52-55, 4 figs. Design features of line and apparatus. Paper read before A. I. E.E.

TRANSMISSION CIRCUITS. Electrical Characteristics of Transmission Circuits—I, Wm. Nesbit. Elec. Jl., vol. 16, no. 7, July 1919, pp. 279-287, 6 figs. Approximate methods including Mershon and Dwight charts. Resistance of conductors.

TTRANSMISSION COSTS. Transmitting Electric Power at Mines—II, S. W. Farnham. Coal Industry, vol. 2, no. 7, July 1919, pp. 275-279. Computing and comparing cost of a. c. and d. c. and efficiency of locomotives. Paper presented before Ill. Coal Min. Inst.

TRANSMISSION LINE COMPUTATION. An Extension of the Step-by-Step Method of Transmission Line Computation, Frederick Eugene Pernot. University of Cal. Pub. in Eng., vol. 2, no. 4, pp. 131-138, 2 figs. Based on assuming one-sixth of total line admittance at each end of line and the remaining two-thirds in the middle.

TRANSMISSION ROUTES. Selection of Economical Transmission Route, P. O. Reyneau. Elec. World, vol. 74, no. 4, July 26, 1919, pp. 176-178, 1 fig. Equations and curves which are said to simplify choice between several available routes.

VOLTAGE REGULATION OF FEEDERS. Voltage Regulation of Distributing Feeders as a Means of Improving Central Station Efficiency, Frank Hershey. Gen. Elec. Rev., vol. 22, no. 7, July 1919, pp. 544-551, 6 figs. With notes on control of distributing feeders. Paper read before Ohio Elec. Light Assn.

VARIA

HOLLAND. Some Particulars Regarding Inventors in the Electrical Field and Holland's Part in the Development of Electrotechnics (Eenige bijzonderheden over uitvinders op het gebied der electriciteit en het aandeel dat Nederlanders in de ontwikkeling van de electrotechniek hebben gehad), E. J. F. Thierens. Ingenieur, vol. 34, no. 24, June 24, 1919, pp. 446-453, 4 figs. Historical account.

LIGHTNING ARRESTERS. Records and Maintenance of Aluminum-Cell Lightning Arresters, F. S. Piper. General Elec. Rev., vol. 22, no. 6. June 1919, pp. 475-478, 8 figs. Method followed by Manchester Traction, Light & Power Co.

SODA, CAUSTIC.—CHLORINE CELLS. Electrolytic Caustic Soda-Chlorine Cells. Karl Horine. Chem. & Metallurgical Eng., vol. 21, no. 2, July 15, 1919, pp. 69-72, 1 fig. Four classes of cells defined after reviewing patent situation—Diaphragm, mercury, Bell and fused electrolyte. An electrolytic caustic of soda-chlorine cell chart is presented.

WIRE PULLING. Pulling in Conductors with a Crane, Terrell Croft. Power, vol. 50, no. 4, July 22, 1919, pp. 136-137, 7 figs. Suggestions on how to use traveling crane to pull large electrical conductors into conduits.

MARINE ENGINEERING

AUXILIARY MACHINERY

COMPASS. The Navigational Magnetic Compass Considered as an Instrument of Precision, M. B. Field. Jl. Instn. Elec. Engrs., vol. 57, no. 282, May 1919, pp. 349-386, 45 figs. Physico-mathematical study of forces entering in operation of varous types, with reference to British Admiralty practice in regard to effecting corrections and recording measurements.

ELECTRIC AUXILIARIES. First American Full-Powered Motorship Equipped with Electric Auxiliaries, H. W. C. Smith. Motorship, vol. 4, no. 8, August 1919, pp. 31-35, 16 figs. Machinery details of the "Benowa."

HAWTHORNE-COCKBURN VALVES. The Supply of Superheated Steam to Astern Turbines. Shipbuilding & Shipping Rec., vol. 13, no. 25, June 19, 1919, p. 775, 2 figs. Hawthorne-Cockburn patent valves for mixing of saturated and superheated steam.

MARINE TWO-CYLINDER ENGINE SETS. Novel Features in a Two-Cylinder Marine Set. Automotive Industries, vol. 40, no. 26, June 26, 1919, pp. 1449-1451, 3 figs. Engine combined with reverse gear in single unit.

TURBINE DRIVE FOR AUXILIARIES. Turbine-driven Marine Auxiliaries. Eng., vol. 127, no. 3313, June 27, 1919, pp. 636-638, and 640, 10 figs. Equipments for merchant steamers, built by Franco Tosi Company of Legnano, Italy.

SHIPS

CONCRETE SHIPS. Auxiliary Motor Sailing Ship of Reinforced Concrete (Motosegler aus Beton), Beton & Eisen, vol. 18, nos. 2-3, Feb. 3, 1919, p. 32, 2 figs. Danish vessel 112 ft. long provided with screw propeller driven by 80-hp. oil engine.

Advantages, Progress and Permanance of Concrete Sbips, Robert W. Lesley. Concrete Craft, vol. 1, no. 5, June 1919, pp. 119-122 and 126 and 132, 1 fig. Sees concrete ship, both large and small craft, better, cbeaper and of lower upkeep and for many uses essentially superior to any other type of hull.

Barge Building in Scotland. Ferro-Concrete, vol. 10, no. 2, August 1919, pp. 35-38, 4 figs. Construction of 1,000-ton reinforced-concrete barges.

Concrete Coaling Barges. Colliery Guardian, vol. 117, no. 3050, June 13, 1919, p. 1413, 3 figs. Length, 185 ft.; beam, 35 ft.; depth, 18 ft.; hull is of straight-line type.

Concrete Merchant Ships. Concrete Craft, vol. 1, no. 5, June 1919, pp. 123-126, 5 figs. Their chance of development in time of peace.

DESIGN. Suggestions for Increasing Revenue from Cargo Carriers, M. F. Carr. Shipping, vol. 8, no. 2, July 12, 1919, pp. 15-16, 2 figs. Concerning modifications, in design of 8,800-deadweight-ton cargo carrier.

DIESEL. The Diesel Engine in Great Lakes Freighters, R. D. Karr. Motorship, vol. 4, no. 8, August 1919, pp. 28-29, 2 figs. Recommends operating freighters with internal-combustion engine as economical measure and necessity because, "low price of coal heretofore prevailing in the Great Lakes trade will never be reached again."

ELECTRIC PROPULSION OF SUBMARINES. Electrical Equipment Used on Submarines, H. C. Coleman. Elec. Jl., vol. 16, no. 7, July 1919, pp. 295-299, 9 figs. General arrangement of propelling machinery. There are two main motors, each having its own shaft which is connected by heavy clutches to engine shaft at one end and to propeller sbaft at the otber.

LJUNGSTROM SYSTEM. The Ljungstrom System Steam Turbo-electric Marine Propulsion. Pac. Mar. Rev., vol. 16, no. 7, July 1919, pp. 71-80, 10 figs. Plant consists of two turbo-generators of equal power, delivering their power electrically to two motors.

MOTOR SHIPS. Motor Ship Glenapp. Engr., vol. 127, no. 3312, June 20, 1919, pp. 612-613, 1 fig. Alteration as compared with "Selandia" referred to are cooling of piston with water instead of oil, and substitution of water for eight fuel pumps for the eight cylinders in each engine instead of a single pump for eacb set of four cylinders.

PROPELLING MACHINERY TYPE. Crude-Oil Motors vs. Steam Engines in Marine Practice, J. W. Morton. Mech. Eng., vol. 41, no. 7, July 1919, pp. 609-612, 1 fig. Discussion of various factors to be considered, also exposition of advantages and disadvantages, as compared to steam engines, of crude oil motors of constant pressure, constant-volume, four-stroke cycle and two-stroke cycle types.

SPECIFICATIONS FOR MACHINERY. Specifications for Machinery for 8,100 Ton d.w. Steamships for Canadian Government Merchant Marine Ltd. Can. Ry. & Mar. World, no. 257, July 1919, pp. 394-399, 4 figs. Propelling machinery is to consist of one set of inverted, vertical, direct acting, triple expansion, surface condensing engines, having 3 cylinders working on separate cranks placed at angles of 120 deg. with each other, supplied with steam from 3 multitubular boilers at a working pressure of 180 lb. per sq. in.

YARDS

CONCRETE SHIPBUILDING. British Concrete Shipbuilding: Unit System Construction, W. Noble Twelvetrees. Eng., vol. 107, no. 2791, June 27, 1919, pp. 825-826, 17 figs., partly on supp. plates. Developed, it is said, with a view to reduce the absolute minimum amount of timber supports and shuttering required on building berth and arranging and spacing frame members in a manner similar to that generally specified for steel ships.

A New Irish Industry. Concrete Shipbuilding at Warrenpoint. Ferro-Concrete, vol. 10, no. 8, January 1919, pp. 177-187, 12 figs. Yard suitable for construction of concrete ships up to 10,000 tons capacity.

COSTS. Sbipyard Costs and Ship Wages—a Comparison, Winthrop L. Marvin. Pac. Mar. Rev., vol. 16, no. 7, July 1919, pp. 81-86. Comparison of American and British sbip wages.

FABRICATED SHIPS. The Fabricated Ship, Henry R. Sutphen. Universal Engr., vol. 29, no. 6, June 1919, pp. 21-27, 6 figs. Operations at Newark Bay shipyard.

Fabricated-Ship Plant Planned for Later General Use, M. E. Allen. Eng. News-Rec., vol. 83, no. 2, July 10, 1919, pp. 79-83, 5 figs. Mobile Shipbuilding Co. forced to revise steel design to make use of timber at Birmingham shop for fabricating ship material.

FORD METHODS. Ford Methods in Ship Manufacture—VII, Fred E. Rogers. Indus. Management, vol. 58, no. 1, July 1919, pp. 8-11, 10 figs. Outfitting operations and power plant.

FORE RIVER YARDS. Shipbuilding Equipment and Methods at Fore River—I. Hull Construction Plant. Eng. News-Rec., vol. 83, no. 1, July 3, 1919, pp. 19-22, 5 figs. Single type of berth for various kinds of ships. Concrete substructure and bridge crane equipment.

RECONDITIONING WAR SERVICE VESSELS. Refitting War Fleet is Big Job, V. G. Iden. Mar. Rev., vol. 49, no. 8, August 1919, pp. 375-378, 5 figs. Reconditioning vessels used for war service is taxing capacity of repair yards.

REPAIRS. Repair of the "Curaca" a Triumph of Skill and Ingenuity. Shipping, vol. 8, no. 1, July 5, 1919, pp. 15-16, 4 figs. Straightening out bottom of ship sunk during explosion in Halifax Harbor.

See also Welding.

WELDING. Some Experiences with Electric Welding in Warships, W. H. Gard. Eng., vol. 108, no. 2792, July 4, 1919, pp. 25-30, 12 figs. Sketches illustrating such repair work as required by broken cast steel stem of "P" boat, shaft bracket of a large 36-knot destroyer broken through, and lower portion of stern post of a Castle liner broken off, etc.Paper read before Instn. Naval Architects.

Repairing the Broken Stern-Post of the "Northern Pacific"—tbe Biggest Marine Weld in the World. Reactions, Vol. 12, no. 2, Second Quarter, 1919, pp. 23-31, 13 figs. Cast steel stern post was cracked through just above uppermost gudgeon, cross-section of break forming roughly a triangle, each side of which was about two feet in length.

VARIA

GREAT-CIRCLE SAILING. Great Circle Sailing—A Few "Wrinkles" to Save Time, H. G. S. Wallace. U. S. Naval Inst. Proc., vol. 45, no. 7, July 1919, pp. 1197-1199, 2 figs. Marcq Saint-Hilaire metbod.

SOUNDINGS. Sea Sounding on Board a Moving Vessel, Based on Propagation of Sound in Water (Sur un procédé de sondage en mer, à bord d'un bateau en marche, basé sur la propagation du son dans l'eau), M. Marti. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 22, June 2, 1919, pp. 1100-1102. Micropbone fixed to vessel and immersed at convenient deptb registers explosion on surface of water and its reflection from sea bottom.

SURVEYS. The Safeguarding of Our Seafarers, Robert G. Skerrett. Rudder, vol. 35, no. 7, July 1919, pp. 305-311, 19 figs. Work done by U. S. Coast and Geodetic Survey, including illustrations of corrections that bave been made during a single year in chart of New York harbor.

METALLURGY

ALUMINUM

ALUMINUM-COPPER-MAGNESIUM ALLOYS. Constitution and Metallography of Aluminum and Its light Alloys with Copper and with Magnesium, P. D. Mercia, R. G. Waltenberg and J. R. Freeman. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1031-1049, 28 figs. Temperature solubility curves of $CuAl_2$ and of Mg_4Al_3 in aluminum obtained by method of annealing and microscopic examination.

LYNITE. Aluminum Alloy Combines Strength with Toughness. Automotive Indus., vol. 41, no. 3, July 17, 1919, pp. 108-109, 4 figs. Tests on lynite alloy said to have indicated that this material may be applied in parts subjected to shock, such as axle housings and differential carriers.

MECHANICAL PROPERTIES. Mechanical Properties and Resistance to Corrosion of Rolled Light Alloys of Aluminum and Magnesium with Copper, Nickel, and Manganese, P. D. Merica, R. G. Waltenberg and A. N. Finn. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1051-1062, 3 figs. Light aluminum alloys of several compositions belonging to each of three series—aluminum-magnesium-copper, aluminum-magnesium-manganese, and aluminum-magnesium-nickel—were rolled out into sheets and tested in tension as cold-rolled, after annealing and after heat treatment.

BEARING METALS

Researches on Bearing Metals. Antimony, Lead, Tin Alloys, E. Heyn and O. Bayer. Metal Industry, vol. 15, no. 1, July 4, 1919, pp. 1-7, 17 figs. Investigation covered (1) chemical analysis of raw materials for preparation of alloys, (2) behavior during solidification and fusion, (3) influence of rate of cooling and subsequent heat treatment on microstructure and ball hardness, (4) mechanical properties, (5) experiments on effect of additions of copper on microstructure and melting point.

BLAST FURNACES

DESIGN. The Principal Changes in Blast Furnace Lines. Iron & Coal Trades Rev., vol. 99, no. 2679, July 4, 1919, pp. 6-7, 6 figs. Review of developments during past twelve years, especially in regard to capacity leads to conclusion that 1,000-ton furnace will be attained, either along present lines or completely revolutionizing useful designs.

EXPLOSIONS. Blast-Furnace Explosions, B. B. Hood. Eng. & Min. Jl., vol. 108, no. 2, July 12, 1919, pp. 47-49, 2 figs. Disastrous accident occurred wben blowing engine was shut down, believed to have been due to leaky jacket permitting contact of water and hot coke, and consequent generation of water gas.

PULVERIZED COAL. Application of Pulverized Coal in Blast Furnaces, E. P. Matbewson and W. L. Wotherspoon. Can. Min. Inst. Bul., no. 87, July 1919, pp. 737-760, 11 figs. Experiments by various plants, notably Tennessee Copper Co., and International Nickel Co. smelters.

STEEL TURNINGS IN BLAST FURNACE. On the Utilization of Steel Turnings in the Blast Furnace. Engineering, vol. 108, no. 2793, July 11, 1919, p. 58. Practice at iron works in North of France. Translated from Comptes rendus de la Société de l'Industrie Minérale.

COPPER AND NICKEL

ELECTRIC FURNACE SMELTING OF SPEISS. Smelting Copper Speiss in tbe Electric Furnace, P. Papencordt. Metal Industry, vol. 14, no. 25, June 20, 1919, pp. 502-504, 2 figs. Experiments said to have yielded copper matte containing merely traces of arsenic, speiss high in antimony but free from arsenic, slag and sublimate. (From Metall und Erz.)

MONEL METAL. Some Facts About Monel Metal, Hugh R. Williams. Power, vol. 50, no. 1, July 1, 1919, pp. 14-16, 3 figs. Charts comparing behavior of monel metal and nickel steel; also of monel and other metals of high temperature.

FLOTATION

Recent Metallurgical Progress, Hugh K. Picard. Eng. & Min. Jl., vol. 108, no. 2, July 12, 1919, pp. 65-69. Following progress emphasized: that flotation has revolutionized concentration: that zinc metallurgy has slightly advanced in smelting: that in copper, reverberatory practice and ammonia leaching are chiefly to be noted.

CONCENTRATE TREATMENT. Considerations on the Treatment of Flotation Concentrate, Oliver E. Jager. Min. & Sci. Press, vol. 119, no. 20 July 12, 1919, pp. 43-44. States what changes, if any, must be made in smelting process and equipment, and what differences are to be expected in results, when considerable proportion of material to be treated consists of flotation concentrate. The question is taken up by assuming the case of a smelting plant baving a concentrator, the whole being in operation, and tbat the latter is about to install flotation.

Copper Ores. Flotation Concentration of Copper Ores, Chem. Eng. & Min. Rev., vol. 11, no. 123, Dec. 5, 1918, pp. 68-72, 5 figs. Device installed at Wallaroo, Australia, mines concentrating plant to deal with overflow from mine.

Physics of Concentration. Concentration by Flotation (Concentracion par flotacion), Frederico C. Fuchs. Boletin Minero de la Sociedad Nacional Mineria, vol. 31, no. 239, Jan. 1919, pp. 37-49. Experiments said to have established that phenomena taking place in concentration by flotation are principally those of capillarity, surface tension and molecular cohesion.

FURNACES

Booth Electric Brass Furnace. The Booth Electric Rotating Brass Furnace, Carl H. Booth. Metal Indus., vol. 17, no. 7, July 1919, pp. 317-319, 2 figs. Modified by placing door in one end of furnace and having tapping hole in other end, in order to overcome difficulties that have been experienced in maintaining lining around former combination spout and door.

Crucible Furnace. Crucible Furnace with Blower and Detachable Preheater (Gchlase-Tiegel-Schmelzofen mit aufgesetztem und wegnehmbarem Vorschmelzer). Metall-Technik, vol. 45, no. 7-8, Feb. 22, 1919, p. 28, 4 figs. Special feature claimed is arrangement for exhaust gases to escape from side of preheater instead of from center.

Design. Metallurgical Furnaces, A. Bregman. Metal Industry, vol. 14, no. 25, June 20, 1919, pp. 507-509, 5 figs. Conditions that govern size, shape and type of metal-melting furnace. (Concluded.)

Detroit Rocking Furnace. The Detroit Rocking Furnace for Melting Brass and Bronze, H. M. St. John. Metal Indus., vol. 17, no. 7, July 1919, pp. 320-322, 3 figs. Consists essentially of cylindrical steel shell with refractories, and mounted on rollers and ring gears which permit it to be rocked through any desired arc of revolution up to maximum of 200 deg.

Furnace Selection. Melting Process Chosen Depends on Requirements, H. E. Diller. Foundry, vol. 47, no. 326, July 1, 1919, pp. 411-415, 9 figs. Acid open hearth and converter both operated by Detroit Steel Casting Co. Illustration of application.

Pulverized Coal. The Use of Pulverized Coal, L. C. Harvey. Engineering, vol. 108, no. 2793, July 11, 1919, pp. 62-67, 5 figs. With special reference to its application in metallurgy. (To be continued.) Paper read before Iron and Steel Inst.

Reveberatory Furnaces. Continuous Overflow and Its Effect on the Slag Loss of Reveberatory Furnaces, Oliver E. Jager. Min. & Sci. Press, vol. 118, no. 26, June 28, 1919, pp. 875-876. Continuous flow considered as most important factor in reduction of slag-loss (particularly when using pulverized coal as fuel), because, it is argued, there is a better opportunity for any entrained metal to settle out of slag blanket.

Prolonging the Life of the Roofs of Reverberatory Furnaces at Anaconda, Oliver E. Jager. Min. & Sci. Press, vol. 119, no. 3, July 19, 1919, pp. 85-86, 3 figs. Ribs are built on roof; when this is burnt in, space between ribs is filled with brickwork, thus forming new roof on top of old one.

Slag in Electric Furnace. How Slag Influences Electric Steel, J. L. Dixon. Foundry, vol. 47, no. 327, July 15, 1919, pp. 483-484. Removal of first slag and making of second not considered necessary. Superiority of acid steel questioned.

IRON AND STEEL

Differential Crystallization. Differential Crystallization in a Cast-Steel Runner, Francis B. Foley. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1117-1121, 4 figs. Photomicrographs of open-hearth runner metal, 2 in. in diameter, that had been fractured, presented as sample of cast-steel structure.

German Industry. Light on the German Iron and Steel Industry. Iron Age, vol. 104, no. 4, July 24, 1919, pp. 246-247. German views of stipulations of peace terms; study of wartime conditions of iron and steel industry: labor an obstacle to quick resumption of peace-time operations. Discussed in report of May meeting of the Verein Deutcher Eisenhüttenleute.

Graphitization. Graphitization in Iron-Carbon Alloys. Kunichi Tawara and Genshichi Asahara. Foundry Trade Jl., vol. 22, no. 210, June 1919, pp. 398-401, 2 figs. Report of experiments made at Tokio University.

Magnet Steel. Steel for Magnets—III, Carbon. Mech. World, vol. 65, no. 1694, June 20, 1919, pp. 292-293, 1 fig. Magnetic materials and their composition. (Continuation of serial.)

Malleable Iron. Research Work on Malleable Iron. Enrique Touceda. Mech. Eng., vol. 41, no. 7, July 1919, pp. 593-600, 17 figs. Account of work undertaken during four years for American Malleable Castings Assn.

Oxygen in Cast Iron. Oxygen in Cast-Iron and Its Applications, Wilford L. Stork. Metal Trades, vol. 10, no. 7, July 1919; pp. 295-296. Offers evidence in support of theory developed by J. E. Johnson in regard to good effect of oxygen on cast iron. To be presented at September meeting of Am. Inst. Min. & Metallurgical Engrs.

Slag. The Acid Hearth and Slag, J. H. Whiteley and A. F. Hallimond. Eng., vol. 108, no. 2792, July 4, 1919, pp. 852-860, 26 figs. Records of observations and experiments dealing with micro-structure of slag, structure of hearth and reaction occurring in molten slag. Paper presented before Iron & Steel Inst.

Tool Steel. Making High-Grade Tool Steel, John D. Knox. Iron Trade Rev., vol. 65, no. 3, July 17, 1919, pp. 153-157, 7 figs. Care exercised in cooling ingots after they are stripped. Importance of annealing and hardening processes.

Vanadium. Manufacture of Modern High Speed Steel, John A. Mathews. Iron Age, vol. 104, no. 1, July 3, 1919, pp. 17-20. Use of vanadium found as most notable change in recent years. Paper read before Am. Soc. for Testing Materials.

METALLOGRAPHY

Etching, Deep. Deep Etching and Rail and Forging Defects, F. M. Waring and K. E. Hofammann. Iron Age, vol. 104, no. 1, July 3, 1919, pp. 13-14 and (discussion), pp. 14-16, 7 figs. and Ry. Rev., vol. 65, no. 1, July 5, 1919, pp. 11-15. 10 figs. Investigation by means of deep etching with hot acid at Pa. R. R. laboratories said to have disclosed that interior defects appear to be more frequent in rails that had developed a number of transverse fissures than in others which had only a few or no such fissures. Paper read before Am. Soc for Testing Materials.

Non-Ferrous Metals. Metallography Applied to Non-ferrous Metals—VII Ernest J. Davis. Foundry, vol. 47, no. 326, July 1, 1919, pp. 438-439, 3 figs. On deoxidation of metals and alloys by use of elements having strong affinity for oxygen.

MECHANICAL ENGINEERING

AIR MACHINERY

Air Leakage. Determination of Amount of Air Leakage for a System of Pipes and Receivers the Volume of Which Cannot Easily be Measured, P. H. Trout, Jr. Compressed Air Magazine, vol. 24, no. 7, July 1919, pp. 9216-9218, 1 fig. By cutting off compressors after filling system to convenient pressure and taking readings of pressure gage and times, readings are plotted in two curves from which amount of leakage is calculated.

Psychometric Chart. The Psychometric Chart Explained, L. A. Wilson. Sibley Jl., vol. 33, no. 5, June 1919, pp. 68-70, 1 fig. How it can be constructed for any given pressure.

Receivers. The Air Receiver—II, Frank Richards. Engr., vol. 127, no. 3311, June 13, 1919, pp. 573-574. Features of two-stage compressor arrangement.

CORROSION

Calcium Chloride. Corrosion Tests on Commercial Calcium Chloride Used in Automobile "Anti-Freeze Solutions," Paul Rudnick. Jl. Indus. & Eng. Chem., vol. 11, no. 7, July 1, 1919, pp. 668-670, 3 figs. Reported that aluminum was attacked most severely, iron next, and copper least; rate of corrosion increased sharply on eighteenth to twentieth day of immersion. Composition of solutions varied from 28 to 30 per cent. of calcium chloride and from 0.5 to 3.0 per cent magnesium chloride. Paper read before Div. of Indus. Chemists & Chem. Engrs., at meeting of Am. Chem. Soc.

Conduits. Apparatus for the Prevention of Corrosion in Conduits, Flue-Gas Feed Heaters, Superheaters, Boilers and Steam Turbines (Ueber Apparaite zur Verhutung von Anfressungen in Rohrleitungen, Rauchgasyorwarmern. Ueberhitzern, Dampfkesseln und Dampfturbinen), M. R. Shulz. Zeitschrift fur Dampfkessel u. Maschinenbetrieb, vol. 42, no. 8, Feb. 21, 1919, pp. 49-51, 4 figs. Types described are the Steinmuller, Huismeyer and Balcke apparatus and those made by the Deutsche Sanitatswerke at Frankfort, Germany.

Copper. Corrosion of Copper—VI. Metal Industry, vol. 15, no. 1, July 4, 1919, pp. 8-10, 2 figs. Experiment with sea water, one electrode aerated. From 4th report of Corrosion Committee of Inst. of Metals.

Manganese Bronze. Effect of Corrosion on Wrought Manganese Bronze Under Tensile Stress, P. D. Merica and R. W. Woodward. Am. Mach., vol. 51, no. 5, July 31, 1919, pp. 217-220, 3 figs. Tests claimed to have indicated that proportional limit is to be regarded as maximum safe stress for bronzes of harder tempers, but that it is not certain that this limit may not be slightly exceeded in materials which are soft, i. e., free from work hardness.

Paints. Efficient Protection of Iron and Steel Structures Obtained by Properly Selected Paints, John Grieve. Contract Rec., vol. 33, no. 26, June 25, 1919, pp. 617-619. Functions of various coats and factors governing their efficient application.

Rust Prevention. Rust Prevention, Edward T. Birdsall. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 55-57. Classification of rust-proofing processes and enumeration of principal requirements of a rust-prevention process as applied to automobiles, aircraft and other machined and hardened parts.

FORGING

Drop-Stamping. Drop-Stamping, Drop-Forgings, Etc.—IV & V, Joseph Horner. Mech. World, vol. 65 & 66, no. 1694 & 1697, June 20 & July 11, 1919, p. 295 & 18, 14 figs. Method of fastening stamps into anvil and top of steam hammer. Manufacturing operations. (Continuation of serial.)

Forge Shops. An Example of Forge Shop Construction. Iron Age, vol. 104, no. 4, July 24, 1919, pp. 219-223, 7 figs. Arrangement providing for high and economical production.

Forging Plants. Equips Plant to Make Forgings. Mar. Rev., vol. 49, no. 8, August 1919, pp. 384-385, 4 figs. Addition to Camden Forge Co.'s plant to enable it to handle marine forgings besides the railroad work in which plant formerly specialized.

Welding. Fusion Welding Applied to Drop Forgings, S. W. Miller. Iron Age, vol. 104. no. 5, July 31, 1919, pp. 287-293. Oxyacetylene and electric welds and their applicability to defective forgings. Paper read before Am. Drop. Forge Assn.

FOUNDRIES

Automotive Cylinders. Making Automobile Cylinders Without Flasks, Pat Dwyer. Foundry, vol. 47, no. 326, July 1, 1919, pp. 421-425, 9 figs. Cylinders are cast in vertical cores at plant of Buda Co., Harvey, Ill.

Brass Foundries. Materials and Chemicals Used in Brass Foundry Practice, Phosphorus—VII, Charles Vickers. Brass World, vol. 15, no. 7, July 1919, pp. 231-233, 2 figs. Series of articles dealing with history, properties, appearance, physiological action and commercial use of substances commonly employed in brass founding.

Bronze Castings. Cupola Metal for Bronze Castings, Charles Vickers. Foundry, vol. 47, no. 327, July 15, 1919, pp. 479-481,3 figs. Methods used in large Canadian plant.

Bronze Statuary. Foundry Trade Jl., vol. 21, no. 210, June 1919, pp. 383-385, 7 figs. Historical account of industry with reference to composition of bronzes used by ancient craftsmen as determined by recent analytical analysis and standard compositions adopted in various nations. From Stahl and Eisen.

Cupola Practice. Notes on Cupola Practice, J. Bagley. Foundry Trade Jl., vol. 21, no. 210, June 1919, pp. 391-395. Based on operating practice and results obtained at various plants. Paper read before Lancashire Branch of British Foundrymen's Assn.

Die Casting. Modern Developments in Die Casting, Adolph Bregman. Metal Indus., vol. 17, no. 7, July 1919, pp. 327-330, 7 figs. Description of plant of Dochler Die-Casting Co.

Use Die. Casting and Eliminate Machining. Can. Machy., vol.. 22, no. 3. July 17, 1919, pp. 46-47, 4 figs. Viewpoint of Franklin Co. as to why die castings should be used in design of machinery to greater extent than they are at present.

Electric Furnace. Employment of Electric Furnace in Foundry Work (Utilisation du four électrique en fonderie). Fonderie Moderne, no. 2, Feb. 1919, pp. 266-267. Result of experiences had with a 6-ton Héroult furnace. Advantage of electric furnace considered to lie chiefly in reducing cost of production.

French Foundry. Modern French Foundry in Suburbs of Paris, H. Cole Estep. Foundry, vol. 47, no. 326, July 1, 1919, pp. 429-431, and p 437, 17 figs. Equipped with hydraulic molding machines. Special machine mentioned is one which fills both cope and drag flasks with sand simultaneously and rams two parts of mold at one stroke.

Layout. Steel Foundry Opened in Wilkes-Barre, Pa. Iron Trade Rev., vol. 64, no. 26, June 26, 1919, pp. 1677-1678, 3 figs. Plan showing location of furnace with reference to molding and pouring-off floors.

Semi-Steel. Semi-Steel and General Foundry Practice, David McLain. Can. Foundryman, vol. 10, no. 7, July 1919, pp. 180-183. Suggestions in regard to various foundry processes. Address delivered at annual Convention of Southern Metal Trades Assn.

Ship Castings. Eastern Plant Makes Ship Castings, E. C. Kreutzberg. Foundry, vol. 47, no. 327, July 15, 1919, pp. 468-471, 9 figs. Castings for stern frames, anchors, rudders and stems.

Making Castings Used in Ship Construction — V. Ben Shaw and James Edgar. Foundry, vol. 47, no. 326, July 1, 1919, pp. 417-420, 22 figs. Solid and skeleton construction contrasted.

Stem-Piece Casting. Castings for Ship Construction—VI, Ben Shaw and James Edgar. Foundry, vol. 47, no. 327, July 15, 1919, pp. 474-478, 17 figs. Difficulties attendant upon molding and casting three common types of stem pieces are described.

Valve Castings. Producing Sound Nonferrous Castings for Valves, R. R. Clarke. Foundry, vol. 47, no. 326, July 1, 1919, pp. 441-447, 4 figs. With reference to practice of Eagle Brass Foundry Co., Seattle.

Zinc Castings. The Production of Zinc Castings, E. H. Schulz and R. Fielder. Metal Industry, vol. 14, no. 23, June 6, 1919, pp. 461-462, 3 figs. Copper and aluminum, preferably together, are believed to form most suitable metals for alloying with zinc for production of castings. From Giesserie Zeitung.

FUELS AND FIRING

Anthracite Burning. Burning Steam Sizes of Anthracite With or Without Admixture of Soft Coal. Bur. of Mines, technical paper no. 220, reprint of eng. bul. no. 5, prepared by U. S. Fuel Administration 1919, 8 pp., 1 fig. Emphasizes that greatest loss in burning fine anthracite is on account of excess air of fire and advises that best way to keep this down to proper minimum is by using uptake damper, throttled as much as possible so as to produce highest CO_2 with formation of unburnt gases.

Coal Combustion. The Economic Use of Coal for Steam-Raising and House Heating, John Blizard. Can. Dept. of Mines, bul. 28, no. 502, Jan. 30, 1919, 21 pp. General principles of combustion of coal and generation and uses of steam.

Gas Fired Furnaces. The Utilization of Gaseous Fuel in Commercial Practice. With Consideration of the Types of Gas-Fired Furnaces and Methods for Their Control, F. W. Epworth. Gas Jl., vol. 146, no. 2927-2928, June 17 & 24, 1919, pp. 755-759 & 804-806, 9 figs. Gas-fired furnaces are grouped under three main headings—(1) natural-draft furnaces, (2) forced-draft furnaces, and (3) compressed gas and air furnaces. A scheme for placing any furnace in its correct group is developed from this classification. (Concluded).

Gas Fuel. Some Considerations with Regard to Fuel Gas, Fred Crabtree. Proc. Engrs. Soc. Western Pa., vol. 35, no. 3, April 1919, pp. 117-125 and (discussion) pp. 126-139, 1 fig. Based on survey of various works. Remarks refer to stages in manufacturing processes, methods of cleaning and costs.

Holbeck System Pulverized Coal. The Combustion of Powdered Fuel, J. S. Atkinson. Elecn., vol. 82, no. 26, June 27, 1919, pp. 730-732, 2 figs. Details of Holbeck system described and importance of proper design of burner emphasized.

Illinois Coal. Characteristics of Illinois Coal and How to Burn It, T. A. Marsh. Power vol. 50, no. 3, July 15, 1919, pp. 93-95. Relative values of steaming coals their characteristics and analysis.

Lignite. Methods for More Efficiently Utilizing Our Fuel Resources. Arthur V. White General Elec. Rev., vol. 22, no. 6, June 1919, pp. 465-474. Steps being taken in Canada toward development of vast deposits of lignite in Saskatchewan and Alberta.

Low-Grade Fuels. Problems in the Utilization of Fuels, Raymond F. Bacon and William A. Hamor. Jl. Soc. Chem. Indus., vol. 38, no. 12, June 30, 1919, pp. 161T-168T. Problems to be found in developing methods for utilizing various low-grade fuels, with notes on work done in this direction both in Europe and America.

Oil Fuel. The Utilization of Oil as Fuel (Neues uber Oelfeuerung), Petroleum, vol. 14, no. 14, Apr. 15, 1919, pp. 658-661, 6 figs. Koerting steam jet sprayer, centrifugal atomizers; oil-fired crucible furnace for melting tungsten; air atomizers.

Powdered Coal. *See Pulverized Coal.*

Pulverized Coal. Firing Boilers with Powdered Coal, L. C. Harvey. Blast Furnace & Steel Plant, vol. 7, no. 7, July 1919, pp. 352-353, 2 figs. Also Elecn., vol. 82, no. 26, June 27, 1919, pp. 740-741, 1 fig. Points out that it is essential to provide sufficient combustion area per pound of coal burned per unit time; otherwise ash is not deposited in slag chamber. " Fuller " powdered coal equipment.

See also Holbeck System.

Pulverized Coal as a Fuel, N. C. Harrison. Mech. Eng., vol. 41, no. 8, August 1919, pp. 645-649. Review of uses in industries. Report of tests of 468-hp. Edge Moor boiler with pulverized-coal equipment is included.

Pulverized Coal for Stationary Boilers. Fred'k A. Scheffler and H. G. Barnhurst. Mech. Eng., vol. 41, no. 8, August 1919, pp. 650-652. Comparison of stoker and pulverized-fuel plants with particular reference to reliability, cost, adaptability and efficiency.

Smoke Prevention. Fuel Economy and Smoke Prevention. Can. Ry. & Mar. World, no. 257, July 1919, pp. 357-361, 3 figs. Report of Mech. Section Committee of Am. R.R. Assn.

Spontaneous Combustion. " Spontaneous Combustion," Especially with Reference to Ships' Cargoes. Coal, Charcoal, Cotton, and Textile Fibres Generally; Hay, Tobacco, and Certain Chemicals; Dyestuffs and Pigments, etc., Watson Smith. Jl. Roy. Soc. Arts, vol. 67, no. 3474, June 20, 1919, pp. 500-507. Study of causes producing it based on records of accidents as reported in various publications.

FURNACES

Brickwork, Coke-Oven. Patching of Jamb Leaks on Coke-Oven Brickwork, R. L. Fletcher. Gas Age, vol. 44, no. 1, July 1, 1919, pp .15-17, 5 figs. Blowing material into crack in just sufficient quantity to insure getting inner part of joint filled while outer part will be covered by hand work.

Gas Burners. The Development of Gas Burners for Industrial Purposes (Zur Entwicklungsgeschichte der Gasbrenner fur industrielle Feuerungsanlagen), Dr. Gwosdz. Feurengstechnik, vol. 7. nos. 9 10, Feb. 1 & 15, 1919, pp. 69-71 and 78-80, 9 figs. Description of burners developed by Gesellschaft Westfälische Maschinenbau-Industrie Gustav Moll & Co. Type described is principally used for heating steam boilers.

Heat-Treating Furnaces. Heating Furnaces and Annealing Furnaces — VII, W. Trinks. Blast Furnace and Steel Plant, vol. 7, no. 7, July 1919, pp. 321-324, 7 figs. Curves are given for finding recuperator surface for any recuperative furnace.

Anchor Chain Heat Treating Furnaces, T. F. Baily. Blast Furnace & Steel Plant, vol. 7, no. 7, July 1919, pp. 329-330. Heat-treating rails in electric furnaces suggested.

Continuous Furnaces for Heating Forgings. Blast Furnace & Steel Plant, vol. 7, no. 7, July 1919, pp. 346-348 2 figs. " Oilgas " type. Advantages claimed are uniform heating, maximum economy and constant production.

Kilns. What to Consider in the Design and Layout of Periodic Kilns, T. W. Garve. Brick & Clay Rec., vol. 55, no. 1, July 1, 1919, pp. 29-35, 19 figs. Comparison of various arrangements.

GAGES

Gage Making. Various Examples in the Art of Gauge Marking, H. G. Robson. Can Machy., vol. 22, no. 1, July 3, 1919, pp. 9-12, 33 figs. Illustrating particularly modus operandi rather than extent of calculations required.

Hoke Gages. A Millionth of an Inch. How the Wave-Length of Light is Used to Detect Errors of This Infinitesimal Amount. Sci. Am., vol. 121, no. 3, July 19, 1919, pp. 62-63, 8 figs. Light-interference method of measuring gages developed by Bur. of Standards. Apparatus for throwing beam of monochromatic light and photograph of interference fringes thus obtained are illustrated.

Thread Gages. Improved Design of " Not Go " Thread Gage, II, L. Van. Keuren and I. H. Fullmer. Machinery, vol. 25, no. 11, July 1919, pp. 1076-1077, 2 figs. Thread form.

GAS ENGINEERING

Carbonizing Plants. Carbonizing Plants of the Future, Having Regard to the Scarcity of Labor, and the Gas Best Fitted to the Consumer, H. D. Madden. Gas. Jl., vol. 146, no. 2928, June 24, 1919, pp. 809-810, and (discussion) pp. 810-811. Gas best suited to consumer is believed to be one having for its basis a heating standard. Paper read before Wales and Monmouthshire District Instn. of Gas Engrs.

Gas Investigating Committee Report. Second Report of the Gas Investigating Committee, Gas World, vol. 70, no. 1819, May 31, 1919, pp. 429-440, 16 figs., and Gas Jl., vol. 146, no. 2925, June 3, 1919, pp. 607-619, 16 figs. Data with regard to performance of gases of relatively low colorific value. Tests were made with ring and incandescent burners of various types. Account of tests on relative efficiencies in use of different grades of gas continued from first report.

Governors. A New Governor for Close Pressure Regulation of Gas Exhausters and Boosters. Chem. & Metallurgical Eng., vol. 21, no. 2, July 15, 1919, pp. 99-100, 2 figs. Two-fold type, provided with compensating return.

PROVIDENCE GAS COMPANY. Manufacturing Plant of the Providence Gas Co. — I & II, Walter M. Russell. Chem. & Metallurgical Eng., vol. 21, no. 1 & 2, July 1 & 15, 1919, pp. 34-39 & 88-95, 19 figs. Water and producer-gas machinery and apparatus. Measuring and recording instruments. Review of gas industry in Providence. Paper read before Am. Inst. of Chem. Engrs.

WATER GAS. Exhaust Steam in Water Gas Machines, Raymond L. Green. Gas Age, vol. 44, no. 1, July 1, 1919, pp. 1-5, 7 figs. Results obtained in actual experience.

HANDLING OF MATERIALS

BUNKERING. *See Coal Handling.*

COAL HANDLING. Coal-Handling Plant at Pembrey. Engineering, vol. 108, no. 2793, July 11, 1919, pp. 38-41 and 50, 29 figs., partly on supp. plate. Equipment designed to permit delivery to be made (1) direct from coal wagon to boiler-house overhead coal bunker, (2) from coal wagon to reserve coal store, or (3) from reserve coal store to overhead coal bunker, leaving clear way for (4) trucking on portable railway or wheeling coal into boiler-house at stoking-floor level, for providing machinery in case of breakdown of mechanical plant.

A British Plant for Handling Domestic Coal, H. Hubert. Coal Trade Jl., vol. 50, no. 28, July 9, 1919, pp. 835-837, 3 figs. Description of tidewater coal plant for handling domestic grades and notes on difference between American and British systems of handling.

Bunkering Big Ships, J. F. Springer. Sci. Am., vol. 108, no. 2, July 12, 1919, pp. 34-35, 3 figs. Conveyor apparatus for moving coal from barge to bunker and distributing it evenly in bunker.

Mechanical Coaling Stage at Hull, North Eastern Railway. Ry. Gaz., vol. 30, no. 26, June 27, 1919, pp. 1027-1029, 5 figs. Coal is emptied from wagons into underground hopper, from which it is mechanically elevated to overhead storage bunkers which are provided with chutes for delivering it to various locomotives as required.

The Atlas Coal Co.'s Plant at Louisville, Ky. Coal Trade Jl., vol. 50, no. 27, July 2, 1919, pp. 806-808. Installation of two 50-ton hoppers.

GRAIN LOADING. Mechanical Grain Loading Devices on the Roumanian Danube, Eng. & Indus. Management, vol. 2, no. 1, July 3, 1919. pp. 28-31, 6 figs. Floating grain elevators and pneumatic unloading plant. (Continuation of serial).

OIL, VEGETABLE, HANDLING. Handling Vegetable Oils at Pacific Coast Port Terminals Eng. News-Rec., vol. 83, no. 5, July 31, 1919, pp. 204-207, 5 figs. Layout of Philippine Vegetable Company's terminal at San Francisco.

ORE, UNLOADING. Unloading Ore Quickly and Cheaply. Elec. Rev., vol. 75, no. 2, July 12, 1919, pp. 56-59, 3 figs. How iron ore is unloaded from lake steamers by means of electrically operated automatic ore unloaders.
See Unloading Machines.

SHELL PARTS, HANDLING. Making Three Million Trench Mortar Shells, E. C. DeWolfe. Iron Age, vol. 104, no. 1, July 3, 1919, pp. 1-7, 12 figs. System of convoyors, belt, roller, gravity and slat, used in transfer of parts from operation to operation, until delivery of completed and boxed shells to freight cars.

UNLOADING MACHINE. A Rapid Unloading Machine. Coal Age, vol. 16, no. 5, July 31, 1919, pp. 188-190, 2 figs. Wellman-Seaver-Morgan Co. Machine consists of main framework mounted on trucks which travel along runway rails. Design is heavy.

Description of Automatic Ore Unloader, Blast Furnace and Steel Plant, vol. 7, no. 7, July 1919, pp. 317-320, 4 figs. Unloader consists of main framework mounted on trucks which travel along railway rails; hoisting mechanism is located in enclosed house at rear end of walking beam.

HEAT-TREATING

CASE-HARDENING. Improved Case-Hardening Process. Iron Age, vol. 104, no. 3, July 17, 1919, pp. 163-165, 5 figs. Slow cooling of nickel-steel gears for automobile and airplane engines prevents flaking and chipping. Paper read before Iron & Steel Inst.

Modern Practice in Case-Hardening, A. Best. Machy. (Lond.), vol. 14, no. 354, July 10, 1919, pp. 436-439, 5 figs. Material suitable for carburizing and notes on selection of carburizing furnace.

CAST IRON, GRAPHITIZATION OF. Graphitization of White Cast Iron Upon Annealing, Paul D. Merica and Louis J. Gurevich, Bul. Am. Inst. Min. & Metallurgical Engrs. no. 151, July 1919, pp. 1063-1072, 7 figs. Annealing ranges of temperatures determined for three different compositions used for car wheels.
See also Metallurgy, Iron and Steel (graphitization).

CAST IRON, GRAY. The Heat Treatment of Grey Cast Iron at Low Temperatures, J. E. Hurst. Eng., vol. 108, no. 2792, July 4, 1919, pp. 1-3, 2 figs. Results of experiments of heat treatment at temperatures of 575 to 600 deg. cent. of a series of commercial cast-iron bars.

CHROME-NICKEL STEEL. Heat Treating Chrome Nickel Steel, with Special Reference to Impact Testing, Mr. Loudenbeck. Proc. Steel Treating Research, vol. 2, no. 5, 1919, pp. 18-24 & 54, and 58, 7 figs. Photomicrographs of pieces tested under both high and low impact.

ELECTRICAL HEAT TREATMENT OF STEEL. Electrical Heat Treatment of Steel, H. P. MacDonald. J. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 69-74, 10 figs. Processes developed at plant of Snead & Co. Iron Works, Jersey City.

HARDENING STEEL. Modern View of the Hardening of Steel, Haakon Styri. Jl. Am. Steel Treaters Soc., vol. 1, no. 9, June 1919, pp. 286-298, 14 figs. Review of facts occuring when steel is heated and cooled, with reference to what takes place when steel is hardened.

HEAT TREATING PLANTS. A Complete and Modern Heat-Treating Plant, L. A. Danse. Am. Mach., vol. 51, no. 4, July 24, 1919, pp. 149-160, 24 figs. Structural features of building and details of equipment of Lincoln Motor Co. plant.

HIGH-SPEED STEEL. The Heat Treatment of High Speed Steel, C. U. Scott. Jl. Am. Steel Treaters Soc., vol. 1, no. 9, June 1919, pp. 299-301. Recommendations in regard to various operations in process of heat-treating.

MALLEABLE IRON. Experiments in Annealing Malleable Iron, H. E. Diller. Can. Foundryman, vol. 10, no. 7, July 1919, pp. 184-186, 4 figs. While manner in which annealing process is proceeded with is considered of vital importance, it is further observed that proper analysis of raw material must not be neglected.

RAILROAD MATERIALS. Heat Treatment of Railroad Materials, C. B. Bronson. Ry. Rev., vol. 65, no. 2, July 12, 1919, pp. 71-73. Also Iron Age, vol. 104, no. 1, July 3, 1919, pp. 25-27. Practice of New York Central RR., particularly in use and treatment of manganese-steel rails, carbon and alloy steel axles, tires and cast-steel wheels. Paper presented before N. Y. Cap. Am. Steel Treaters' Soc.

SIZE IN HEAT TREATMENT. Relative Size in Heat Treatment, T. G. Straub. Iron Age, vol. 104, no. 3, July 17, 1919, pp. 167-168. Conclusion is drawn from experiments that in actual practice large forgings required considerable judgment regarding heat treatment in order to bring desired results.

STEEL, MEDIUM-CARBON. Effect of Time and Low Temperature on Physical. Properties of Medium-Carbon Steel, G. A. Heinhardt and H. L. Cutler. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1091-1098. Test to determine cause of difference in elongation and reduction of area shown by core tests made directly after drilling and machining and of core tests that had rested after these operations.

HEATING AND VENTILATION

GAS AND ELECTRIC HEATING COMPARED. Comparative Cost of Electric and Gas Heating (Prix de revient comparés du chauffage électrique et du chauffage au gaz). Ach. Delamarre. Revue Générale de l'Electricité, vol. 6, no. 2, July 12, 1919, pp. 45-47, 1 fig. Graph based on assumption that kilowatt-hour and cubic meter of gas are sold at the same price.

SCHOOLS. New Heating and Ventilating System for Chicago Schools, John Howatt. Power, vol. 50, no. 3, July 15, 1919, pp. 109-110, 1 fig. Piping layout designed by Bureau of School Engineering, Chicago.

WORKSHOPS. The Heating and Ventilation of Workshops—II. Engr., vol. 127, no. 3312, June 30, 1919, pp. 599-602 and 608, 12 figs. System employed in works of Austin Motor Co. Ltd.

Heating of Large Industrial Plants (Chauffage des Grands Locaux Industriels, Utilisation du chauffage comme régulateur de charge des centrales électriques), M. A. Beaurrienne, Mémoire et Compte rendu des Travaux de la Société des Ingénieurs Civils de France, Bulletin, vol. 8, no. 1, 2 & 3, Jan.-Mar. 1919, pp. 49-77, 10 figs. Technical study of comparative economy of various systems of heating.

HOISTING AND CONVEYING

BELT CONVEYOR, STEEL. The Steel Belt Conveyor, or How the Rubber Shortage Can be Met by Employing Flexible Steel Bands. Eng. & Indus. Management, vol. 1, no. 19, June 19, 1919, pp. 605-609, 12 figs. Concerning flexible Swedish steel bands known under the name "Sandvik."

BARNARD'S AUTOMATIC GRAB' "Bernard's Automatic Grab," G. F. Zimmer. Eng. & Indus. Management, vol. 2, no. 1, July 3, 1919, pp. 25-27, 6 figs. It works on hlock-and-tackle principle. Light self-weight for given capacity claimed as important feature.

CABLE TRANSPORTATION. Aerial Cable Transportation (Transporte aereo por cable), Walter C. Kretz. Ingenieria Internacional, vol. 2, no. 1, July 1919, pp. 13-17, 7 figs. As auxiliary service in railway and steamship trafic. Application in mines.

CRANES, LADLE, MAIN HOISTS FOR. Main Hoists for Open Hearth Ladle Cranes, W. W. Garrett, Jr. Jl. Engrs. Club of Philadelphia, vol. 36, no. 177, August 1919, pp. 319-321. Tests made on main hoists of two overhead electric traveling open-hearth ladle cranes.

CRANES, PONTOON. Designs Massive Pontoon Cranes. Mar. Rev., vol. 49, no. 8, August 1919, pp. 372-373, 2 figs. Revolving crane of 150-ton capacity recently installed at Navy Yard, Norfolk, Va.

HOISTING BUCKET. Handling Materials in Construction of New York Hotels. Eng. News-Rec., vol. 83, no. 5, July 31, 1919, pp. 222-223, 3 figs. Type of hoisting bucket designed, it is said, to prevent excessive vibration of steel frame. Cost figures.

HOISTING EQUIPMENT, ELECTRIC. Electric Hosting Equipment at the Butte & Superior Mine, Oliver E. Jager. Min. & Sci. Press, vol. 119, no. 1, July 5, 1919, pp. 18-21, 3 figs. Historical account o its installation.

SWING-SPAN BRIDGES. Protecting Platforms and Fenders for Swing Span Bridge. Commonwealth Engr., vol. 6, no. 8, Mar. 1, 1919, pp. 242-244, 2 figs. Particulars of piers.

HYDRAULIC MACHINERY

GOVERNORS, HYDRAULIC TURBINE. The Seewer Universal Governor for High-Pressure-Pelton Turbines (Universal Regulierung System Seewer fur Hockbruck-Pelton-Turbinen), Franz Prasil. Schweizerische Bauzeitung, vol. 73, no. 22, May 31, 1919, pp. 251-254, 8 figs. Details of method of regulating by changing cylindrical jet to one of hollow conical type.

GROUND WATER MOVEMENT. Ground Water Movement Between Canals with a Different Water Level (Grondwaterbeweging tusschen kanalen met verchillende waterstanden), J. Versluys. Ingenieur, vol. 34, no. 24, June 14, 1919, pp. 454 456. Questions to be considered when planning irrigation or drainage canals.

PIPE, WOOD-STAVE. Extension to the Ontario Power Co.'s Plant. Contract Rec., vol. 33, no. 29, July 16, 1919, pp. 685-693, 15 figs. Features particularly remarked are wood-stave pipe 13½ in. in diameter and 6,700 ft. long, dimensions of differential surge tank, and power house with walls designed to withstand 40 ft. rise in tail water.

PIPES. Diagrams for Excess Loss of Head in Pipe Lines, Frank S. Bailey. Eng. News-Rec., vol. 83, no. 4, July 24, 1919, pp. 162-163, 2 figs. For determining losses due to 90 deg. bends, increasers, gate valves, reducers and branches.

PIPE, VELOCITY OF WATER IN. Hexagonal Chart for Finding Velocity of Water in Pipes, C. Warrington Anthony. Eng. News-Rec., vol. 83, no. 4, July 24, 1919, p. 169. Diagram embraces six variable quantities without using a single curve.

SPAIN. Hydro-Electric Central Station at Seros (Spain) Le station centrale de Seros (Espagne). Génie Civil, vol. 74, no. 26, June 28, 1919, pp. 517-521, 8 figs. Illustrating Escher Wyss 14,500-hp. vertical turbines used in installation.

TURBINES, HYDRAULIC. New Kern River Development, G. E. Armstrong. Elec. World, vol. 74, no. 3, July 19, 1919, pp. 116-118, 3 figs. Francis turbines to operate under head of 800-ft. at Southern California Edison plant. Two turbines, each with two runners and distributers, furnisb 32,000-kw. energy of eitber 50 cycles or 60 cycles at maximum efficiency.
See also Governors.
Break in No. 2. Hydraulic Turbine at Wachusett Power Station, Clinton, Mass., William E. Foss. N. E. Water Works Assn., vol. 33, no. 2, June 1919, pp. 143-152, 5 figs. Section of scroll case blew out immediately after pulling out governor clutch to change from automatic to hand control. Accident attributed to sudden closing of gates causing sufficient water ram to break casting.

WATER HAMMER. Water Hammer in Conduits Under Pressure (Note sur le calcul du coup de bélier dans les conduites sous pression), Ed. Carey, Bulletin Tecbnique de la Suisse Romande, vol. 45, nos. 11 & 13, May 31 and June 28, 1919, pp. 102-104, and 122-127, 8 figs. Distribution of force along conduits. In two cases when distributor is open and when sluice is opened suddenly. (Continuation of serial.)

INTERNAL-COMBUSTION ENGINES

ACETYLENE. Acetylene as a Motor Fuel (Das Azetylen als Motorenbetriebsstoff), A. Wimplinger. Dinglers Polytechnisches Journal, vol. 334, no. 5, Mar. 8, 1919, pp. 50-51, 1 fig. Changes necessary in gasoline motor if acetylene is to be used as fuel; automobile using acetylene. Developments along this line in Switzerland.

ALCOHOL. Alcohol as Motor Fuel. Autocar, vol. 43, no. 1237, July 5, 1919, pp. 10-11. Summary of report of Government Alcobol Committee. Report does not specifically advocate modification of engines so as to use alcobol but favors ratber employment of alcohol mixtures in existing engines.

BOLINDER MARINE ENGINE. The Bolinder Crude Oil Marine Engine. Mar. Eng. & Can. Mercbant Service Guild Rev., vol. 9, no. 7, July 1919, pp. 236-238, 5 figs. Fuel is mixed with compressed air before injecting it in cylinder. special nozzle being used for this purpose. Engine is manufactured by Bolinder Co. of Stockholm, Sweden.

CARBURETOR PERFORMANCE STANDARD. Standards of Carburetor Performance, O. C. Berry. Mecb. Eng., vol. 41, no. 8, August 1919, pp. 674-678, 12 figs. List of essential factors to proper carburetion and record of experimental data.

CYCLES, FUTURE. Working Processes of Future Internal Combustion Engines, C. A. Norman. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 3-12, 10 figs. Theoretical and practically attainable energy utilization of engines and turbines of the compression, explosion and evaporation types are given.

DESIGN. An Unconventional British Engine. Automotive Industries, vol. 41, no. 1, July 3, 1919, pp. 27-28, 5 figs. Aluminum jackets witb cast-iron cylinder sleeves inserted.

DIESEL-ENGINE REGULATION. Kinematics of Diesel Motor Regulation (Studio cinematico della regolazione nei motori Diesel), Guglielmo Piperno. Industria, vol. 33, no. 10, May 31, 1919, pp. 292-297, 12 figs. Calculations and diagrams for studying operation of valves.

DIESEL ENGINES. A British 400 H.P. Highspeed Diesel Engine. Motorship, vol. 4, no. 8, August 1919, pp. 46-47, 2 figs. Details and trial results of Armstrong-Whitworth type used in British submarines.
Piston and Valve Cooling in Diesel Engines. Motorship, vol. 4, no. 8, August 1919, pp. 36-37, 9 figs. Examples of designs in use. (Concluded.)

DIESEL ENGINES WITH SUPERCOMPRESSED AIR INJECTION. Super-Compressed-Air Applied to Solid-Injection Diesel Engines, Chas. G. Barrett. Motorship, vol, 4, no. 8, August 1919, pp. 43-44, 1 fig. Recommends compressing small portion of air in cylinder walls to pressure considerably in excess of prevailing compression pressure of engine and describes arrangement for effecting this compression.

EXHAUST UTILIZATION. Plan to Use Exhaust Heat in Vaporization of Low Grade Fuels, F. C. Mock. Automotive Indus., vol. 41, no. 3, July 17, 1919, pp. 110-114, 4 figs. Curve claimed to simplify computation of air velocity.

GAS ENGINES. Operation of Large Gas Engines, Frank Foster. Power, vol. 50, no. 3, July 15, 1919, pp. 100-102. Considerations in regard to valve timing, ignition timing, overrating of power and blower engines.

KEROSENE ENGINE RATING. Suggested Formula for Rating Kerosene Engines, D. L. Arnold. Mech. Eng., vol. 41, no. 8, August 1919, pp. 672-673. Suggests tbat piston displacement of 13,000 cu. in. per min., be taken as one brake horsepower.

LUBRICATION. *See Oiling.*

MOTOR-SHIP ENGINES. Internal Combustion Engine on the Pacific Coast, George Dow. Jl. Electricity, vol. 43, no. 1, July 1, 1919, pp. 27-29, 3 figs. With particular reference to motorship installation.

OILING. Accessible Oiling System Features New Allen Engine. Automotive Indus., vol. 41, no. 3, July 17, 1919, pp. 106-107, 4 figs. New engine bas bore of 3½-in. and stroke of 5-in., its four cylinders being cast in block.

STILL ENGINE. A New Prime Mover of High Efficiency, Frank E. D. Acland. Motorship, vol. 4, no. 7, July 1919, pp. 25-27, 6 figs. Still-Acland combination type steam and Diesel engine. Consumption of 0.302 lb. of fuel oil per sbaft bp. said to be obtained. From paper read before Roy. Soc. Arts.

TANK MOTORS. Motors Used in British Tanks (Moteurs Thermiques), Génie Civil, vol. 75, no. 1, July 5, 1919, pp. 14-16, 1 fig. Motors are six-cylinder, of 158 bp. Construction of piston, wbich is provided witb inner structure for gliding in cylinder guide and acting as crosshead, noted as special feature.

TORQUE RECOIL. Torque Recoil and Car Weight, L. H. Pomeroy. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 45-47. Factors governing torque recoil, particularly in multi-cylinder engines.

TRACTOR ENGINES. The Royal Agricultural Sbow—I. Engr., vol. 127, no. 3313, June 27, 1919, pp. 627-630, 10 figs. Notes on oil engines and tractors driven by gasoline exhibited at annual show at Cardiff.

TREGO COMPANY ENGINES. Valve-in-Hand and "L" Engines Built of Common Parts, P. M. Heldt. Can. Machy., vol. 22, no. 4, July 24, 1919, pp. 157-161, 10 figs. Twin six-cylinder models being built by Trego Motors Corp. Oil distributing pipes cast in crankcase and arrangement for hot spots in manifold quoted as notable features.

VALVE SETTING. Valve Setting. Automobile Engr., vol. 9, no. 128, July 1919, pp. 231-232, 4 figs. Systems for defining timing.

LUBRICATION

CARBONIZATION. Carbonizing in Valve Chambers and Cylinders, F. P. Roesch. Ry. Rev., vol. 65, no. 1, July 5, 1919, pp. 30-33, 4 figs. With respect to use of relief and drifting valves for overcoming carbonizing troubles in lubrication. Paper read before Am. R.R. Assn.

FRICTION, STATIC. Note on Static Friction and on the Lubricating Properties of Certain Chemical Substances, W. B. Hardy and J. K. Hardy. Lond., Edinburgh and Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 32-48. Examining further Lord Rayleigh's experimental research into the reason why "a few drops of water wetting the parts in contact will prevent a cup of tea from slipping about in a saucer." (Phil. Mag., Febr. 1918.)

MITCHELL THRUST BLOCK. *See Pressure-Film Lubrication.*

OIL GROOVES. Arrangement of Oil Grooves (Die Anordnung der Schmiernuten), W. Kucharski. Dinglers Polytechnisches Journal, vol. 334, nos. 1 & 2, Jan. 11 & 25, 1919, pp. 2-4 and 14-16, 7 figs. Critical discussion of Renolds' theory of lubrication friction. Experiments made by writer especially witb reference to temperature changes and thickness of layer of lubricant.

PRESSURE-FILM LUBRICATION. The Michell Thrust Block, J. Hamilton Gibson. Eng., vol. 107, no. 2789, June 13, 1919, pp. 765-768, 19 figs. Application of pressure-film lubrication principle to tbrust bearing. Paper read before Instn. Naval Architects.

VISCOSITY. Lubrication in the Power Plant, J. D. Roberts. Power, vol. 50, no. 4, July 22, 1919, pp. 134-135. Tests suggested to determine viscosity of lubricants.
See also Internal-Combustion Engineering (Oiling).

MACHINE ELEMENTS AND DESIGN

BEARINGS. Ball and Roller Bearings, J. H. Swan. Automobile Engr., vol. 9, no. 128, July 1919, pp. 200-204, 5 figs. Consideration of tbeir behavior when subjected to centrifugal loads. From data compiled in records of Technical Dept., Aircraft Production, Min. of Munitions.
Load-Carrying Possibilities of Angular-Contact Ball Bearings, F. C. Goldsmith. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 49-53, 8 figs. Writer analyzes possibilities of angular-contact type of bearing, and tries to determine the load-carrying powers of such bearings, both for axial (thrust) loads as well as for radial loads and to determine tbe law of variation of load-carrying capacity in such a bearing.

CAMS. Analytical Method of Investigating Motion produced by Cams, B. C. Carter. Automobile Engr., vol. 9, no. 128, July 1919, pp. 209-210, 3 figs. Direct-attack cams and flat tappets.
A New Design for a High-Speed Inlet Cam, H. S. Burdett. Automobile Engr., vol. 9, no. 128, July 1919, pp. 224-230, 8 figs. Exemplifying manner of proceeding in actual case. Paper presented to Instn. Automobile Engrs.

CRANKSHAFTS, POWER-PRESS. The Strength of Power-Press Crankshafts, W. J. Smith. Machinery (Lond.), vol. 14, no. 351, June 19, 1919, pp 337-340, 5 figs. Method of determining approximately safe working loads. Following types of crankshafts are dealt with: overhanging, single-throw, double-throw, double-tbrow with central support, and double-throw with two supports. Stresses considered are those caused by actual blow or load on sbaft.

GEAR DESIGN. Involute Gear Tooth Contact, A. Fisher. Machy. (Lond.). vol. 14, no. 354, July 10, 1919, pp. 456-460, 3 figs. Technical study of relation of gear diameters, number of teeth and line of action. Derivation of interference formulæ and contact formulæ.

GEARS, BEVEL. The Correction of Spiral and Straight Bevel Gears. Machinery (Lond.), vol. 14, no. 352, June 26, 1919, pp. 368-369. Table intended to be used in conjunction with a pressure angle of 14½ deg.

MICHELL THRUST BEARING. Development of tbe "Michell" Marine Thrust Shaft Bearing, J. Hamilton Gibson. Shipping, vol. 8, no. 1, July 5, 1919, pp. 17-19, 13 figs. Said to be built on principle of application "pressure oil film lubrication" to thrust bearing. Paper read before Instn. of Naval Arcbitects.
See also Lubrication (Pressure-Film Lubrication).

PISTON RINGS. A Novel Two Part Piston Ring, Ellsworth Sheldon. Am. Mach., vol. 51, no. 5, July 31, 1919, pp. 199-202, 10 figs. Consists of outer part of soft gray iron perfoming usual function of piston rings, and an inner ring of tempered steel which furnishes tension necessary to hold outer part in contact with cylinder walls.

SNAP VALVE RINGS. Use of Bronze for Snap Valve Rings and Piston Surfaces. C. E. Fuller. Ry. Rev., vol. 64, no. 26, June 28, 1919, pp. 992-994, 1 fig. Experience of Union Pacific Ry. in reducing piston and valve ring wear by introducing bronze as-material for those parts. Bronze-faced pistons when worn are built up by autogenous welding processes. Paper read before Am. R.R. Assn.

WILLIAMS-JANNEY SPEED GEAR. Applications of the Williams-Janney variable Speed Gear. Eng., vol. 107, no. 2790, June 20, 1919, pp. 794-796. Examples of application to traction purposes. (Concluded.)

MACHINE SHOP

BROACH. A Special Tension Broach. Machy. (Lond.), vol. 14, no. 354, July 10, 1919. pp. 434-435, 3 figs. Claims that method of slotting may be greatly cheapened by roughly slotting to within 0.02 in. of finished size; then by pulling a series of broaches through the work a fine finish may readily be obtained and of correct size.

CHUCKING. Chucking Methods. Machy. (Lond.), vol. 14, no. 353, July 3, 1919, pp. 424-427, 14 figs. Uses to which Coventry's chuck is put.

CONNECTING RODS, MACHINING. Machining Connecting Rods, A. Thomas. Automobile Engr., vol. 9, no. 128, July 1919, pp. 222-223, 9 figs. Operations in making connecting rod for 4-cylinder motor lorry engine from nickel-steel drop forging.

GRINDING. Latest Practice in Cutter Grinding—I & II. Am. Mach., vol. 51, no. 3 & 4, July 17 & 24, 1919, pp. 135-138 & 185-188, 20 figs. Grinding of modern shank and shell end mills, large face mills, side milling cutters and staggered-tooth slotting cutters, as recommended by Cincinnati Milling Machine Co.

Grinding at the C. L. Best Plant. Metal Trades, vol. 10, no. 7, July 1919, pp. 291.294, 10 figs. Arrangement of machines which is said to permit minimum amount of handling.

Cylinder Grinding. Machy. (Lond.), vol. 14, no. 354, July 10, 1919, pp. 440-443, 11 figs. Advantages claimed for finishing cylinder bores by grinding; practice in plants making automobile and airplane engines. (Second article.)

LATHES. Inspection and Adjustment of Lathes. Machy. (Lond.), vol. 14, no. 354, July 10, 1919, pp. 429-433, 7 figs. Alignment tests between different parts and calculations for determining amount of metal to remove for a given adjustment when fitting carriage or headstock to bed.

Inspection and Adjustment of Lathes, James Forrest. Machy. (N.Y.), vol. 25, no. 11, July 1919, pp. 1039-1043, 7 figs. Alignment tests between different parts and calculations for determining amount of metal to remove for a given adjustment when fitting carriage or headstock to bed.

MICROSCOPE IN THE TOOL-ROOM. The Microscope in the Tool-Room, John Scott. Machy. (Lond.), vol. 14, no. 352, June 26, 1919, pp. 370-373, 6 figs. Application of simple and micrometer type microscopes to precision work on master plates and for cutting screw threads.

MILLING, ROTARY. Continuous Rotary Milling—II, Machy. (Lond.), vol. 14, no. 350, June 12, 1919, pp. 305-309, 10 figs. Work-holding fixtures and methods of setting up parts to be milled.

MOTOR DRIVE. New Plant for Manufacturing Radio Apparatus, W. A. Scott. Elec. Rev., vol. 75, no. 3, July 19, 1919, pp. 103-104, 3 figs. Motor drive throughout a feature of plant.

OPERATIONS. A Plea for Better Harmony Between Theory and Practice. Machy. (Lond.), vol. 14, no. 353, July 3, 1919, pp. 397-402, 35 figs. In casting and machining operations with illustrations of actual cases.

PLANER MILLING. Planer Milling Practice in Automobile Plants, Edward K. Hammond. Machy. (N. Y.), vol. 25, no. 11, July 1919, pp. 1044-1049, 9 figs. Also Machy. (Lond.), vol. 14, no. 352, June 26, 1919, pp. 374-379, 8 figs. Milling operations on cylinder blocks and cylinder heads. Second and last article.

STANDARDIZED PART PRODUCTION. Jigs, Tools and Special Machines. Model Engr. & Elecn., vol. 40, no. 944, May 29, 1919, pp. 422-426, 4 figs. With relation to production of standardized parts. Investigating possibilities of continuous cutting with special machine tools. (Concluded.)

MACHINERY, METAL-WORKING

BROACH-MAKING, MATERIALS FOR. Materials for Broach Making. Machinery (Lond.), vol. 14, no. 351, June 19, 1919, pp. 341-343. Former analysis of bar which is said to have been used in making a successful set of 6 broaches, and note on maintenance of broaches.

CHUCKS, MAGNETIC. Relative Characteristics of Magnetic Chucks, Otis Allen Kenyon. Elec. World, vol. 74, no. 1, July 5, 1919, pp. 11-14, 12 figs. Three general types, neutral-pole, single-pole, and multiplepole, intended for holding work on surface grinders, milling machines, planers, etc.

GORTON PLANING MACHINES. *See Planing Machines.*

LATHES. Notes on Capstan and Turret Lathes—I, Joseph Horner. Mech. World, vol. 65, no. 1695, June 27, 1919, pp. 302-303, 3 figs. Features of construction.

Lathe for Cutting Screw Threads on Gauges. Eng., vol. 107, no. 2790, June 20, 1919, pp. 799-801, 10 figs. Lathe consists of rigid cast-iron cylindrical bed, with a portion cut away to allow work to be placed between centers in the head and tailstocks and for the operator to view the work.

MACHINE-TOOL DEVELOPMENTS. Recent Machine Tool Developments—I, Joseph Horner. Engineering, vol. 108, no. 2793, July 11, 1919, pp. 36-38. First article of a series. Classifies and divides subject.

MILLING CUTTERS. Inserted-Tooth Milling Cutters, Joseph Horner. Machinery (Lond.), vol. 14, no. 351, June 19, 1919, pp. 344-347, 28 figs. Illustrating methods of tool fastening and designs of face mills.

Drop-Forging High-Speed Milling Cutters, J. V. Hunter. Am. Mach., vol. 51, no. 4, July 24, 1919, pp. 165-168, 8 figs. Tests made by Ford Motor Co. on high-speed-steel milling cutters.

PISTON-RING TOOLING EQUIPMENT. Tooling Equipment for an Automobile Piston-ring, Thomas Orchard. Machy. (N. Y.), vol. 25, no. 11, July 1919, pp. 1058-1060, 7 figs. Fixture for holding ring and special multiplespindle milling head having capacity for holding two cutters.

PLANERS. Bement Horizontal and Vertical Wall Planer. Machy. (N. Y.), vol. 25, no. 11, July 1919, pp. 1087-1088, 1 fig. Consists of wall plate on which vertical rail is mounted and is so arranged as to permit horizontal and vertical planing.

PLANING MACHINES. The Gordon Planing Machines, J. V. Hunter. Am. Mach., vol. 51, no. 1, July 3, 1919, pp 1-4, 8 figs. Heavy design intended for use without foundation excepting when placed on soil that is soft and yielding.

THREAD-MILLING MACHINE. Continuous Thread Milling Machine of Unusual Design, Machy. (Lond.), vol. 14, no. 350, June 12, 1919, pp. 317-319, 2 figs. Machine is furnished with means for turning bar down to required diameter ready to start thread-milling operation, thus bringing actual center of bar into accurate alignment with milled threads.

THREADING TOOLS. Description of a New Automatic Threading Tool. Can. Machy., vol. 22, no. 2, July 10, 1919, pp. 26-27, 6 figs. In its assembled state it is in two parts; a tool box and an abutment or stop piece.

MACHINERY, SPECIAL

BREAKING MACHINE. Breaking Machine for Handling Frozen Coal, J. P. Considine. Coal Trade, Jl., vol. 50, no. 28, July 9, 1919, pp. 838-839, 3 figs. Said to be capable of breaking up in a few minutes a car of frozen coal.

CRUSHER, GYRATORY. Largest Gyratory Crusher in the World, William B. Eastwood. Cement, Mill & Quarry, vol. 15, no. 1, July 5, 1919, pp. 13-17, 5 figs. Bulldog crusher said to be capable of producing 2500 tons of material per hr.

DRILLING MACHINE. A Small Sensitive Drilling Machine, C. H. Copeland. Model Engr. & Elecn., vol. 40, no. 947, June 19, 1919, pp. 498-500, 3 figs. Designed to be made for greater part from ½-in. standard pipe fittings, only castings being table and driving and jockey pulleys.

MOLTEN-METAL DISCHARGER. Device for the Uninterrupted Discharge of Molten Metals (Eine Vorrichtung zur ununterbrochenen Ausstossung geschmolzener Metalle). Metall-Technik, vol. 45, no. 11-12, Mar. 22, 1919, p. 42, 1 fig. It is claimed that this device does not require complicated pumping apparatus nor special liquids nor any interruption while recharging.

PERIODIGRAPH. The Periodograph, a Decimal Time-Keeping Machine—II, J. V. Hunter. Am. Mach., vol. 51, no. 4, July 24, 1919, pp. 161-164, 17 figs. Milling drilling and inspecting operations.

SAND BLAST. Application of the Sand Blast, H. D. Gates. Compressed Air Magazine, vol. 24, no. 7, July 1919, pp. 9229-9232, 3 figs. Effect of air pressure on abrasive action. From address before Newark Foundrymen's Assn.

TINNING MACHINE. The Thomas & Davies Tinning Machine, Melingriffith Works, Cardiff. Iron & Coal Trades Rev., vol. 99, no. 2679, July 4, 1919, pp. 4-5, 2 figs. Daigrammatic details of tinning machine.

TYPEWRITER MACHINES. Typewriter Mechanism—Typewheel Machines, Nathan Sharpe. Model Engr. & Elecn., vol. 40, nos. 944 and 945, May 29, and June 5, 1919, pp. 426-429, and 444-447, 12 figs. Features of Block machine. Shift Mechanism of Blick. Third article.

EVAPORATORS, VACUUM. Industrial Vacuum Evaporators—IX, Frank Coxon. Mech. World, vol. 66, no. 1696, July 4, 1919, p. 6, 8 figs. Instrument reliability. (Continuation of serial).

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

ABRASIVE WHEELS, TESTING. Testing Machines for Grading Abrasive Wheels, J. H. Vincent. Am. Mach., vol. 51, no. 4, July 24, 1919, pp. 177-179, 7 figs. Machines for testing the cutting or abrasive factor and for abrasive wheels and their degree of hardness.

BALL BEARINGS, MAGNETIC ANALYSIS OF. Application of Magnetic Analysis to the Testing of Ball Bearing Races, R. L. Sanford and M. F. Fischer. Preprint, Am. Soc. for Testing Materials, University of Pa. Topical Discussion on Magnetic Analysis, 1919, pp. 65-75, 4 figs. It is concluded that magnetic properties and in particular coercive force and rotary hysteresis measurements constitute good criteria of degree of hardness of a ball-bearing race.

COIR. The Mechanical Properties of Philippine Coir and Coir Cordage Compared with Abaca (Manila Hemp), Albert E. W. King. Philippine Jl. Sci., vol. 13, Sec. A, no. 6, November 1918, pp. 285-338, 4 figs. Cocoanut fiber in Philippines is extracted in small quantities entirely by retting and beating process. Retted filaments average 228 mm., and machine-cleaned filaments 245 mm. in lengths. Tensile tests conducted on single filaments averaged, it is said, 832 kg. per sq. cm. for retting and 1208 kg. per sq. cm. for machine-cleaned fiber.

COLUMNS, CONCRETE. Hooped Concrete Columns with Cast Iron Cores, L. J. Mensch. Am. Architect, vol. 116, no. 2275, July 30, 1919, pp. 155-162, 4 figs. Testing machine of U. S. Bureau of Standards at Pittsburgh, Pa., and results obtained with it.

GAS TUBING. Flexible Gas Tubing Tests, R. S. McBride and W. M. Berry. Gas Rec., vol. 15, no. 12, June 25, 1919, pp. 393-400, 2 figs. Scope of investigations made by U. S. Bur. of Standards and tentative specifications proposed for criticism before adoption.

Machinability Tests. Machinability Tests on Copper Alloys, Alex. E. Tucker. Metal Industry, vol. 14, no. 25, June 20, 1919, pp. 501-502, 3 figs. Machine for making tests. Its action consists in measuring comparative depth of holes cut in piece under test and standard piece by same number of revolutions o ¼-in. drill under constant load.

Magnetic Analysis. Magnetic Analysis as a Criterion of the Quality of Steel and Steel Products, Chas. W. Burrows and Frank P. Fahy. Preprint, Am. Soc. for Testing Materials, University of Pa., Topical Discussion on Magnetic Analysis 1919, pp. 1-46, 25 figs. Based upon experimental work conducted by writers at U. S. Bur. of Standards. Among objects examined were steel rails, knife blades, drills, etc. Conclusion is reached that there is a very close relationship between magnetic and mechanical characteristics of steel and that the commercial application of this to shop routine is practicable.

Certain Aspects of Magnetic Analysis, C. Nusbaum. Preprint, Am. Soc. for Testing Materials, University of Pa., Topical Discussion on Magnetic Analysis, 1919, pp. 92-112, 8 figs. Methods based on following propositions which, are termed experimental facts: (1) that magnetic properties of steel are indicative of transformations which it undergoes with heat treatment; (2) that definite relationship exists between magnetic and mechanical properties of a steel product.

See also Steel, Rails, Ball Bearings.

Malleable Iron. What and Why is Malleable Iron. H. A. Schwartz. Proc. Car Foremen's Assn. of Chicago, no. 163, May 1919, pp. 20-42 and (discussion) pp. 42-62. Processes of manufacture followed by National Malleable Castings Co , Indianapolis.

Physical Constants for Malleable, H. A. Schwartz. Foundry, vol. 47, no. 327, July 15, 1919, pp. 462-466, 12 figs. Based upon tests made on material described as complying with present specifications. Curves indicate tensile strength in relation to chemical composition and effect of heat on dimensions and tensile strength.

Monel Metal Sheets. Monel Metal Sheets and Their Characteristics. Metal Worker,vol. 92, no. 4, July 25, 1919, pp. 93-95. Some of physical properties mentioned are: Melting point 2480 deg. fahr.; specific gravity, 8.87; modulus of elasticity, 22,000,000 to 23,000,000 lb. per sq. in.

Nickel Steel Some Fatigue Tests of Nickel Steel and Chrome-Nickel Steel, H. F. Moore and Arthur G. Gehrig. Am. Soc. for Testing Materials, University of Pa. Annual Meeting, June 24-27, 1919, pp., 13 5 figs. Results interpreted as indicating that neither static tension tests nor high-stress short-time fatigue tests are a reliable index of fatigue strength of a material under oft-repeated low stresses.

Plates, Flat Steel, Stress Determination in. Further Experiments on Stress Determination in Flat Steel Plates, J. Mongomerie. Eng., vol. 107, no. 2789, June 13, 1919, pp. 786-790, 13 figs. Investigation to determine condition of walls below elastic limit.

Rails, Magnetic Analysis. Magnetic Surveys on New and Failed Rails, P. H. Dudley. Preprint, Am. Soc. for Testing Materials, University of Pa., Topical Discussion on Magnetic Analysis, 1919, pp. 47-63, 9 figs. Possibility is visualized of developing magnetic apparatus for testing railroad axles, crankpins, connecting, parallel and piston rods, etc., without destruction.

Rubber. The Tensile Strength of Rubber-Sulphur Mixtures, O. de Vries and H. J. Hellendoorn. India-Rubber Jl., vol. 57, no. 26, June 28, 1919, pp. 17-19, 4 figs. Stress-strain curves obtained on Schopper testing machine.

Steel, Electric. Electrically-Melted Steel Castings, John A. Holden. Iron & Coal Trades Rev., vol. 98, no. 2677, June 20, 1919, p. 851, 2 figs. Tests obtained from castings made from Héroult steel.

Steel, Magnetic and Mechanical Properties of. A Systematic Investigation of the Correlation of the Magnetic and Mechanical Properties of Steel, N. J. Gebert. Jl. Am. Steel Treaters Soc., vol. 1, no. 9, June 1919, pp. 302-311, 10 figs. Tests with nickel steel, chrome-nickel steel, straight carbon tool steel, and Swedish chrome file steel.

Steel, Time Factor in Tests. Time is Factor in Tests on Steel, G. A. Reinhardt and H. L. Cutler. Iron Trade Rev., vol. 65, no. 3, July 17, 1919, pp. 164-166. Experiments carried on in laboratories of Youngstown Sheet & Tube Co. said to have indicated that specimens of medium-carbon steel show widely varying tensile strengths, influenced by temperature and time elapsing between moment metal, is tested and time it is machined.

Torsion Testing Machine. A Simple Apparatus for Repeated Torsion Test, F. Yamanouchi, (In Japanese), Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 56, Feb. 1919.

MEASUREMENTS AND MEASURING APPARATUS

Brinell Hardness Testing Machine. A New Brinell Hardness Testing Machine, Automobile Engr., vol. 9, no. 128, July 1919, pp. 211-212, 2 figs. "Avery" machine designed on dead-weight lever system.

Dynamometers. Commercial Dynamometers—XII, P. Field Foster. Mech. World, vol. 65, no. 1695, June 27, 1919, pp. 307-309, 3 figs. Torsion meter type. (Continuation of serial).

Manometer, Glass. Glass Manometer with Elastic Walls (Sur un manomètre en verre, à parois élastiques), Georges Baume and Marius Robert. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 24, June 16, 1919, pp. 1199-1201, 3 figs. For measuring pressure of fluids which attack mercury. Fluid does not come in contact with mercury but acts on bulb of thin glass which, by its change in size, forces mercury along vertical tube.

Meters, Gas-Flow. Gas-Flow Meters for Small Rates of Flow. A. F. Benton. Jl. Indus. & Eng. Chem., vol. 11, no. 7, July 1, 1919, pp. 623-629, 6 figs. Resistance-tube flow meter, developed in Bur. of Mines, and specifications for construction, calibration and operation are included, and influence of temperature and pressure changes discussed.

Meters, Steam and Water. The Measurement of Steam and Water in Power Stations, W. M. Selvey. Elecn., vol. 82, no. 26, June 27, 1919, pp. 721-729, 26 figs. After briefly indicating application of Bernoulli's theorem to meters of steam and water, writer discusses various types which he classifies under headings (1) direct weighing, (2) automatic weighing, (3) automatic volume measurements, (4) flow meters, and (5) motor meters.

Steam Meters. Engr., vol. 127, no. 3311, June 13, 1919, pp. 580-582, 8 figs. Kent meters; they depend for their action on law governing volume of a gas which will pass through an orifice in a plate when impelled by a known difference in pressures on opposite sides of plate.

Minimeter. The National Physical Laboratory, Engineering, vol. 108, no. 2793, July 11, 1919, pp. 33-36, 11 figs. Minimeter for slip gages and electric graphite ring furnace. (Continuation of serial).

Pine, Yellow, Shear Tests. Concentrated Load Tests of Yellow-Pine Beams for Shear, L. R. Manville and C. R. Hill. Eng. News-Rec., vol. 83, no. 2, July 10, 1919, pp. 69-71, 4 figs. Results considered as showing previous horizontal shear values used in design too low, and 50 per cent increase is recommended.

Pyrometers. Thermo-Electric Pyrometers for Plant Use, A. O. Ascman. Chem. & Metallurgical Eng., vol. 21, no. 2, July 15, 1919, pp. 85-87, 3 figs. Illustrating temperature millivolt relation for principal types of couples.

Refractometry. Refractometry and Its Applications in Technical Analysis, James C. Philip. Chem. Indus., vol. 38, no. 11, June 16, 1919, pp. 139T-146T and (discussion) pp. 146T-150T, 5 figs. Plan of Pulfrich's refractometer, which is used in examination of liquids and in commercial testing of optical glass; accuracy control in manufacture of Abbe and Pulfrich's refractometer; use of refractometer in determination of protein content of sera, and in examination of chlorhydrin.

Temperature Indicators. Electric Temperature Indicator, Victor H. Todd. Power, vol. 50, no. 5, July 29, 1919, pp. 180-181, 7 figs. Illustrates various methods of applying temperature indicator.

Temperature Indicating and Controlling Systems, Franklin D. Jones. Machy. (N. Y.), vol. 25, no 11, July 1919, pp. 1015-1023, 16 figs. Types of thermoelectric apparatus for indicating and recording temperatures in heat-treating furnaces and for controlling temperatures by signals and by automatic regulation. First of three articles.

Volumeter. Direct Volume-Determination in a Volumeter of the Pycnometer Type, J. B. Shaw, Jl. Am. Ceramic Soc., vol. 2, no. 6, June 1919, pp. 481-483, and (discussion) pp. 483-487, 2 figs. Experimental error obtained in manipulating writer's pycnometer which is described as similar to type developed by H. G. Schurecht. (See Jl. Am. Ceramic Soc., 1, 556, 1918).

MECHANICS

Beam Committee Report. Report of the Beam Committee (Berich des Trägertypen-Ausschusses). Zeitschrift des Roman österr. Ingenieur-und Architekten-Vereins, vol. 70, nos. 51 & 52, Dec. 20 & 27, 1918, pp. 539-542 and 549-555, 11 figs. Tables and equations for angles with equal and unequal legs, Z-bars, Phoenix column sections, etc. (Concluded).

Columns. Résumé of Study on the Resistance of Columns (Résumé d'une étude sur la résistance des colonnes. H. Lefebvre, Mémoires et Compte rendu des Travaux de la Société des Ingénieurs Civils de France, Bulletin, vol. 8, No. 1, 2 & 3, Jan. Mar. 1919, pp. 78-82. Formula for computing dimensions in case of non-homogeneous reinforced-concrete columns and also in case of homogeneous columns.

Girders, Elastic Curve of. The Elastic Curve of Girders with Double Bend (Die elastische Linie des doppelt gekrümmten Trägers), H. Marcus. Zeitschrift fur Bauwesen, vol. 69, nos. 1-3, 1919, pp. 163-179, 15 figs. Regarding deformation, stresses, center of pressure, etc.

Shafting. Shafting Calculations Simplified, H. N. Trumbull. Belting, vol. 15, no. 2, July 20, 1919, pp. 34-37, 3 figs. Charts giving relations between power, shaft diameter, torsional stress and speed.

Stresses, Combined. Combined Stresses, Victor M. Summa, Machinery, vol. 25, no. 11, July 1919, pp. 1061-1062, 2 figs. Application to square and rectangular bars of Rankine's general equations for composition of tensile or compressive stress and of shearing stress acting simultaneously and normally to each other on the same particle of a strained body.

Vibration, Struts. Vibration and Strength of Struts and Continuous Beams under End Thrusts, W. L. Cowley. Proc. Roy. Soc., Series A, vol. 95, no. A 672, June 4, 1919, pp. 440-457, 1 fig. Method of analysis outlined in Proc. Roy. Soc., A, vol. 94, 1918, p. 405, extended to include general problem of vibration of continuous beam simply supported at any number of non-collinear points, external loading being constant longitudinal end thrust, varying from bay to bay and periodic lateral loading. In addition, supports are assumed in state of periodic vibration. Generalized form of equation of three moments is derived and conditions for resonance and crippling are expressed in determinantal form.

MECHANICAL PROCESSES

Boxes, Packing. Balanced Packing-Box Construction. India Rubber World, vol. 60, no. 6. August 1, 1919, pp. 626-628, 4 figs. Investigations and tests to determine box design conducted during war by Forest Products Laboratory.

Crushing, Stone. Plant of Temescal Rock Company, W. A. Scott. Cement, Mill & Quarry, vol. 15, no. 1, July 5, 1919, pp. 19-21, 4 figs. Equipment which is said to permit attainment of high capacity and speed in handling crushed stone and riprap simultaneously.

Drill Chucks, Ettco. Manufacturing the Ettco Drill Chuck. Am. Mach., vol. 51, no. 5, July 31, 1919, pp. 209-212, 10 figs. Chuck consists of five components—body cone screw, jaws, cap and ball thrust bearing operations on each of these are explained.

FILES. Some Points in the Manufacture of Files—III. Machy. (Lond.), vol. 14, no. 350, June 12, 1919, pp. 322-324, 4 figs. Influence of overcut and upcut to axle of file on efficiency of Tool.

GRINDING WOOD PULP. Groundwood Pulpstones. Paper, vol. 24, no. 20, July 23, 1919, pp. 15-20, 4 figs. Experimentation with Canadian sandstone in connection with mechanical grinding of wood pulp.

LENS MANUFACTURE. Making Lenses for Optical Apparatus—I & II (Die Herstellung von Linsen fur optisches Gerät), Reishahs. Deutshe Optische Wochenschrift, nos. 11-12 and 13-14, Mar. 17, and 31, 1919, pp. 67-69, and 83-84, 12 figs. Describes manufacture of lenses, expecially of very large lenses used in astronomic instruments.

LIBERTY MOTOR. Assembling Liberty Motor Cylinders, H. A. Carhart. Am. Mach., vol. 51, no. 1, July 3, 1919, pp. 27-30, 4 figs. Final minor operations before assembling.

MARINE-ENGINE BUILDING. Building Marine Engines on a Quantity Basis, F. B. Jacobs. Mar. Rev., vol. 49, no. 8, August 1919, pp. 388-392 & 397, 5 figs. Assembly operations at works of Hooven, Owens, Rentshler Co., Hamilton, O.

MOTOR-CAR MANUFACTURE. Manufacturing the Chevrolet Motor Car. J. H. Moore. Can. Machy., vol. 22, no. 1, July 3, 1919, pp. 1-7, 10 figs. Steps in production from framework to finished car, ready for shipment.

PEBBLES FOR TUBE MILLS. Mari's Onyx Pebbles for Tube Mills, William B. Eastwood. Cement, Mill and Quarry, vol. 15, no. 2, July 20, 1919, pp. 11-14, 6 figs. Claimed as results of tests that artificial balls from immense onyx deposit in Nevada prove equal to foreign flint product for efficient grinding service in ore and cement plants.

ROLLING MILLS. Rolling Equipment of the Inland Steel Co. Iron Age, vol. 104, no. 3, July 17, 1919, pp. 155-161, 11 figs. Details of 28-in. 32-in. and 40-in rolling mills, motor room and turbine station.

Tho New Steel Works and Rolling Mills of the Witkowitz Iron Works (Die neue Stahlund Walzwerksanlage des Eisenwerkes Witkowitz). Montanistische Rundschau, vol. 11, nos. 7 & 8, Apr. 1-16, 1919, pp. 198-202 and 228-232, 14 figs. Describes rolling mill running at 160 r.p.m. and used for manufacture of channels, beams, rails; tank-plate rolling mill and preheating furnace; yards for storing rails and beams; employees' cafeteria; kitchen for same. (Concluded).

The Morgan Continuous Wire-rod Rolling Mill. Engr., vol. 127, no. 3312, June 20, 1919, pp. 597-599, 16 figs. partly on supp. plates. Plant at Sheffield built in accordance with system developed by Morgan Construction Co. of Worcester, Mass.

Builds Steel Plant in Far East. Iron Trade Rev., vol. 65, no. 4, July 24, 1919, pp. 230-231, 3 figs. General plans of plate and structural mill for Kiushu Steel Works, Japan, which is expected to cost about $3,000,000.

SHEET IRON. Manufacture of Sheet Iron in Southern Russia (La fabrication des tôles minces dans la Russie méridionale), F. Couleru. Génie Civil, vol. 75, no. 1, July 5, 1919, pp. 10-14, 8 figs. Details of processes in manufacture of sheet iron for use in roofs at various works, particularly at plant of Russian Tube Mfg. Co. (To be continued). From Stahl und Eisen.

MOTOR-CAR ENGINEERING

AUTOVAC GASOLINE FEED SYSTEM. The Autovac Petrol Feed System. Autocar, vol. 43, no. 1237, July 5, 1919, pp. 8-9, 4 figs. Mounted in position above level of carburetter is small cylindrical tank divided into two chambers, and so arranged and connected that it utilizes partial vacuum created in induction pipe of engine for supplying continuous stream of gasoline to carburetter from main storage tank regardless of position of latter.

BIANCHI. The New 12 hp. Bianchi. Autocar, vol. 42, no. 1235, June 21. 1919, pp. 971-972, 7 figs. Four eylinders, 65 x 110 mm.; thermo-siphon cooling; single-disk dry clutch.

CARBURETORS. Tests on the Homa Carburetor (Versuch-sergebnisse mit dem Homa-Vergaser). Ing. Praetorius. Motorwagen, vol. 22, no. 7, Mar. 10, 1919, pp. 114-115, 4 figs. Results of tests made. Lowest consumption at various loads and constant speed. Tests made on motor of passenger automobile.

DESIGN. The Relation of Motor Truck Ability to the Trend of Design, Lewis P. Kalb. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 18-22, 1 fig. An ability formula is developed, the purpose of which is said to be to determine a factor of experience from which the proper engine size and gear radius can be calculated.

DIFFERENTIALS. Is the Differential Indispensable? (Ist das Differential unentbehrlich?), W. Rödiger. Automobil-Rundschau, vol. 18, nos. 5-6. Mar. 1919, pp. 54-56. Discusses various attempts to replace the differential, as for instance the belt transmission. Special reference is made to the free wheel mechanism.

ENFIELD-ALLDAY. The 10 hp. Enfield-Allday. Autocar, vol. 42, no. 1234, June 14, 1919, pp. 913-916, 9 figs. Chassis fitted with 5-cylinder air-cooled radial power units.

FUEL PROBLEM. The Engine Fuel Problem, Joseph E. Pogue. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 14-17, As situation now stands, writer considers that "most effective means for expanding supply of gasoline is throught rapid development of cracking methods of refining whereby gasolino is made from fuel oil and kerosene."

LIBERTY ENGINE APPLICATIONS. Application of Liberty Engine Materials to the Automotive Industry, Harold F. Wood. Jl. Soc. Automotive Engrs., vol.5, no. 1, July 1919, pp. 23-30. Various materials are considered and it is particularly noted that one of the most important developments during the Liberty engine program was the fact that it is not necessary to use a high-analysis alloy steel to secure a finished part which will give proper service.

LOCKS. Foiling the Car Thief. Autocar, vol. 43, no. 1237, July 5, 1919, pp. 12-14, 6 figs. Locking mechanisms, notably Cowey's patent arrangement which, when actuated, short-circuits to earth high-tension leads from magneto to sparking plugs.

MAUDSLAY. Maudslay Industrial Chassis. Motor Traction, vol. 28, no. 747, June 25, 1919, pp. 550-552, 5 figs. Three-four-five-ton chassis, the three-ton having engine of 32 hp. and other engines of 40 hp.

SPYKER. The 13-30 hp. Spyker. Autocar, vol. 43, no. 1238, July 12, 1919, pp. 43-44, 6 figs. Dutch car with engine-operated-type pump.

TIRES. Important and Neglected Features of Tire Maintenance. A. F. Masury. Eng. News-Rec., vol. 82, no. 26, June 26, 1919, pp. 1262-1264, 5 figs. Effects of overloading, overspeeding, running in car tracks, neglecting cuts and tears, spinning, skidding and sliding, and wheel misalignment.

TRACTORS. Agricultural Tractors (La Motoculture), M. Paul Lecler. Mémoires et Compte rendu des Travaux de la Société des Ingénieurs Civils de France, Bulletin, vol. 8, no. 1, 2 & 3, Jan.-Mar. 1919, pp. 97-124, 14 figs. Classification and description of various types.

TRACTOR, RATING CHART. Tractor Rating Chart Prepared by the S. A. E. Automotive Industries, vol. 40, no. 26, June 26, 1919. p. 1436, 1 fig. Based on formula: Horsepower = $0.7854\ D^2\ LRN/13{,}000$.

TRACTOR TESTS. Class B. Rules for Tractor Tests. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 58-60. Compiled and copyrighted by Am. Soc. of Agricultural Engrs. and designed to govern state or national demonstrations conducted by manufacturers, distributors, dealers, etc.

TRUCK, IDEAL. British Idea of a Truck That Will Meet the Widest Demand. Automotive Indus., vol. 41, no. 4, July 24, 1919, pp. 164-166, 6 figs. Truck is of two-ton capacity, has four-speed gear box, medium-speed engine with first speed of 26.5:1, overhead worm drive, three-plate type of clutch, and east-steel wheels with hollow spokes.

Visualizing the Future Truck. Automotive Industries, vol. 40, no. 26, June 26, 1919, pp. 1432-1435. and (discussion) pp. 1435 and 1451. Develops ability formula. Paper read before Soc. Automotive Engrs.

PIPE

CAST-IRON PIPE. Flanges for Light Cast Iron Pipe, John Knickerbocker. Fire & Water Eng., vol. 66, no. 3, July 16, 1919, pp. 122-123, 1 fig. Analysis of proposed standard suggested by Am. Soc. Mech. Engrs.' Committee, and proposal that Am. Water Works Assn. take matter up with other societies. Paper read before Am. Water Works Assn.

CEMENT JOINTS. Successful use of Cement joints for Cast Iron Water and Gas Mains, Stephen E. Kieffer. Mun. & County Eng., vol. 57, no. 1, July 1919, p. 42. Results in construction of U. S. Housing Corporation project at Vallejo, Cal.

CEMENT PIPE. Friction Tests and Capacity Table for Cement Pipe, G. E. P. Smith. Eng. & Contracting. vol. 52, no. 2, July 9, 1919, pp. 37-38. Conducted at University of Arizona. Paper read before Am. Water Works Assn.

CONCRETE PIPE. Concrete Pipe Fails From Unequal Expansion of Shell, G. E. P. Smith. Eng. News-Rec., vol. 83, no. 3, July 17, 1919, pp. 113-115, 3 figs. Longitudinal cracks in non-reinforced pipe conduit believed to be due to differential movement because of partial wetness.

DISCHARGE PIPES. Machinery and Pipe Arrangement—XVIII, C. C. Pounder. Mech. World, vol. 66, no. 1696, July 4, 1919, p. 7, 2 figs. Arrangement of discharge pipes. (Continuation of serial).

METALIUM JOINTS. Experience with Metalium Joints in Water—Pipe Lines in Davenport, Iowa, Thomas Healy. Mun & County Eng., vol. 57, no. 1, July 1919, pp. 47-48. Among advantages claimed is that material is cheaper per joint than lead.

See also Hydraulic Machinery (Pipe, Wood-Stave) and CIVIL ENGINEERING, Cement and Concrete (Concrete Pipe Manufacture).

POWER GENERATION

FRANCE. New Project for Establishing a Law Governing Utilization of Hydraulic Forces (Le nouveau projet de loi sur les forces hydrauliques). Houille Blanche, vol. 18, nos. 29 & 30, May-June 1919, pp. 81-108. Including review of world situation and legislation existing in various countries.

Hydroelectric Power Station at Barberine (Valais) France (Construction de l'usine électrique de la Barberine (Valais). Bulletin Technique de la Suisse Romande, vol. 45, no. 12, June 14, 1919, pp. 109-112, 3 figs. Concerning union of two waterfalls which is expected will furnish an aggregate of 38,500 hp.

Harnessing the French Rhone (L'Aménagement hydraulique du Rhone Français), Auguste Pawlowski. Génie Civil, vol. 74, no. 24, June 14, 1919, pp. 481-487, 3 figs. Projects to make it navigable, of irrigation and of power utilization. Presented to the Congrès de la Houille Blanche (Grenoble, June 1919).

Hydroelectric Energy in France, C. W. A. Vedits. Elec. World, vol. 74, no. 4, July 28, 1919, pp. 182-183. France possesses about 5,857,000 available hydroelectric horsepower. Writer explain that cooperation of American engineers and American financiers would be welcomed in developing natural resources of republic and in reorganizing her war-stricken industries.

GOVERNMENT OWNERSHIP. Government Ownership of Water Power in Relation to Electrochemical Industry, F. A. J. FitzGerald. Chem. & Metallurgical Eng., vol. 21, no. 2, July 15, 1919, pp. 95-98. Claims that arguments advanced by advocates of Government ownership are generally a priori and not based on actual experiences, and presents examples of Government activities in various fields which can be undertaken by private enterprise as offering evidence against public ownership in such cases.

Spain. Spain Plans National Transmission Network. George F. Paul. Elec. World, vol. 74, no. 3, July 19, 1919, pp. 122-123. 1 fig. To connect all industrial centers with power plants at larger waterfalls and coal mines. Contemplated development will harness 2,000,000 hp.

Stand-by Operation. Converting a Steam Plant to Stand-by Operation, L. M. Klauber. Nat. Elec. Light Assn. Bul., vol. 6, no. 6, June 1919, pp. 343-347, 3 figs. Problems met in actual case following tie-in with transmission service.

Water Power. Some Features of Hydroelectric Engineering Practice and Possibilities, H. de B. Parsons. Mun. & County Eng., vol. 57, no. 1, July 1919, pp. 13-16. Advocates nation-wide plan and policy to encourage use of water power to the fullest extent and conserve mineral fuels

Hydraulic Energy (Creacion de la fuerza hidraulica). Boletin Minero de la Sociedad Nacional de Mineria, vol. 31, no. 241, March 1919, pp. 236-254. Notes on legislation relative to utilization of water power in France, England, United States and other nations.

Water Works, Engines for. Engines for Small Water Works, Henry A. Symonds. N. E. Water Works Assn., vol. 33, no. 2, June 1919, pp. 153-169 and (discussion) pp. 169-185. 3 figs. Economical selection.

POWER PLANTS

Boiler Auxiliaries. Boilers and Auxiliaries. Power Plant Eng., vol. 23, no. 14, July 15, 1919, pp. 624-627. From report of Committee on Prime Movers read at Convention of Nat. Elec. Light Assn.

Boiler-House Equipment. Steam-Electric Plant of the Dominion Power and Transmission Company, Hamilton. Elec. News, vol. 28, no. 10, May 15, 1919, pp. 26-29, 6 figs. Coal-handling and boiler-house equipment. (First article.)

Condensers. Particulars of a 56,000 Sq. Ft. Surface Condenser. Power, vol. 50, no. 3, July 15, 1919, pp. 90-92, 5 figs. Condenser is of Worthington type.

Draft Induced. Artificial Induced Draft in Steam Boilers (Kunstlicher Saugzug bei Dampfkesselanlagen), Mr. Nerger. Zeitschrift für Dampfkessel u. Maschinentrieb, vol. 42, nos. 5 & 6, Jan. 31 & Feb. 7, 1919, pp. 25-27 and 33-37, 9 figs. Draft blower with casing governor for Burkhardt Boiler. Writer points out close connection between proper draft and fuel economy and discusses various types of blowers.

Economizers. Economizers and Economizer Practice, Robert June. Power House, vol. 12, no. 10, July 5, 1919, pp. 270-272, 4 figs. Illustrating its usefulness as aid to boiler-room economy.

Power Plant Management, Robert June. Refrigerating World, vol. 54, no. 7, July 1919, pp. 24-26, 4 figs. Claimed advantages and disadvantages of economizers.

Equipment, Moving. New Power Plant for St. Mary's Training School. Power, vol. 50, no. 1, July 1, 1919, pp. 2-6, 8 figs. Difficulty encountered while moving equipment from old to new plant without interrupting service.

Fuel Consumption. Steam and Coal Consumption in Power Stations, R. H. Parsons. Eng., vol. 108, no. 2792, July 4, 1919, pp. 3-4, 1 fig. Record of station having rated capacity of about 6000 kw. presented with view to indicating general possibilities of improvement in economy.

Furnace Patents. New Patents Regarding Steam Boiler Furnaces (Neue Patente auf dem Gebiete der Dampfkesselfeuerung), Pradel. Zeitschrift für Dampfkessel u. Maschinenbetrieb, vol. 42, nos. 1 and 3, Jan. 3 and 17, 1919, pp. 3-5 and 11-15, 19 figs. Stopping device for Babcock-Wilcox traveling grate; regulator for fuel layer on Kropelin traveling grates; safety pressure regulation, Gentrup type; exhaust suction and cleaning apparatus, Simon type.

Soot Blowers. What the Mechanical Soot Blower Accomplishes, Robert June. Power House, vol. 12, no. 11, July 19, 1919, pp. 310-315, 6 figs. Results of tests in power station. Importance of keeping tubes free from soot is emphasized.

Steam-Consumption Charts. Finding the Efficiency Ratio, H. L. Doolittle. Power, vol. 50, no. 4, July 22, 1919, pp. 140-141, 1 fig. Chart, consisting of portion of total-heat-entropy chart with curves superimposed thereon indicating steam consumption per kilowatt-hour.

Stokers. Sudden Peak Loads on Chain-Grade Stokers, H. F. Gauss. Power, vol. 50, no. 1, July 1, 1919, pp. 20-22, 1 fig. Chart for finding airspace area for a given boiler output.

Testing, Boiler and Furnace. Boiler and Furnace Testing, Rufus Strohm. Steam, vol. 23, no. 1, July 1919, pp. 11-15, 2 figs. How to make tests and interpret their results.

U. S. Nitrate Plant No. 2. U. S. Nitrate Plant No. 2, Edward R. Welles and W. A. Shoudy. Power Plant, Eng., vol. 23, no. 14 & 15, July 15, & Aug. 1, 1919, pp. 617-622, & 671-675, 12 figs. Power received from 10,000-kw. steam-generating station. Article deals particularly with efficiency features of steam plant. Turbines and condensing equipment.

Waste Wood, Steam Generation. Electrical Equipment of Clear Lake Lumber Mills, W. A. Scott. Elec. Rev., vol. 74, no. 26, June 28, 1919, pp. 1065-1680, 6 figs. Refuse furnishes steam for dry kilns and turbo-generators.

Water Softening. Water Softening and Purifying Processes, C. E. Stromeyer. Power House, vol. 12, no. 11, July 19, 1919, pp. 300-302, 2 figs. Description of purifying processes used.

POWER TRANSMISSION

Belting. Scientific Methods to Prolong Life of Belting, vs. Careless Methods That Destroy, Edward E. Marbaker. Belting, vol. 15, no. 2, July 20, 1919, pp. 17-20. Tallow-cod oil recommended as best belt lubricant.

Steel-Mill Auxiliaries, Drives for. Hydraulic vs. Electric Drive for Steel Mill Auxiliaries, R. B. Gerhardt. Jl. Engrs. Club of Philadelphia, vol. 36, no. 177, August 1919, pp. 303-308, 5 figs. Also Blast Furnace & Steel Plant, vol. 7, no. 7, July 1919, pp. 330-334. Comparison between hydraulic and electric drive for door, hoists, furnace, covers, elevators, manipulators, lifting tables, middle roll balance, shears and intensifiers. Paper read before Assn. Iron & Steel Elec. Engrs.

PRODUCER GAS

Tar Disposal. Tar Disposal in Ford Producer-Gas Plants. Power, vol. 50, no. 2, July 8, 1919, pp. 66-67, 1 fig. Method for returning tar to, and vaporizing it in producer.

PUMPS

Air-Lift Pumping. Air-Lift Pumping, John Oliphant. Can. Engr., vol. 37, no. 2, July 10, 1919, pp. 121-124, 8 figs. Compressor handling single well pumping at rate of 700 gal. per min. with lift of over 300 ft. Details of operation.

Centrifugal Pumps. Rees Roturbo Centrifugal Pumps. Can. Manufacturer, vol. 39, no. 7, July 1919, pp. 33-38, 10 figs. Single and multiple stage-types illustrated. Venturi principle embodied in shaped contraction in water pipe having a brunt nozzle where water enters contraction, and gradually expanding taper piece after water has passed contraction.

Costs. Calculating oil Conduits. Zentralblatt der Bauverwaltung, vol. 39, no. 19, Mar. 1, 1919, pp. 101-102, 1 fig. Cost of pumping plant, maintenance, fuel.

Pumping Engine Tests. Pumping Engine Tests. Fire and Water Eng., vol. 66, no. 2, July 9, 1919, pp. 66-69, 7 figs. Record of tests at Electric Park, Kansas City, Mo., during convention of International Assn. of Fire Engrs.

REFRACTORIES

Cements. Patching Oven Jamb Leaks, R. L. Fletcher. Gas Rec., vol. 15, no. 12, June 25, 1919, pp. 401-402, 4 figs. Closing cracks between fire-clay jamb bricks and silica shapes by means of Hytempite dissolved in warm water.

Firebrick. Constitution and Microstructure of Silica Brick and Changes Involved Through Repeated Burnings at High Temperatures. Herbert Insley and A. A. Klein. Techn. Papers Bur. Stand., no. 124, July 11, 1919, 31 pp., 20 figs. Petrographic microscopic examinations of commercial silica brick and those which have received repeated burnings by use in kilns, alleged to show three main constitutents—quartz, cristobalite, and tridymite. In addition, small amounts of pseudowollastonite and glass are said to be present.

See also Refractory Material Committee Report.

Refractory Material Committee Report. Report of the Refractory Material Committee on the Crushing Strength of Firebrocks, W. Emery and J. W. Mellor. Gas Jl., vol. 146, no. 2925, June 3, 1919, pp. 619-620, 3 figs. Results interpreted as having indicated that present strength is reduced by increasing grain size of grog when proportion of grog is constant; and also by increasing proportion of grog when grain size is constant. Presented before Instn. of Gas Engrs.

REFRIGERATION

Ammonia Receivers. Watch the Ammonia Receiver, John E. Starr. Power, vol. 50, no. 4, July 22, 1919, pp. 142-143, 2 figs. Advises feeding only liquid to expansion coils, and warns against estimating conditions of feeding by sound made in expansion valve.

Brewery. Remodeling Suction Gas Mains, Anheuser-Busch Brewery, Robert H. Karl. Power, vol. 50, no. 2, July 8, 1919, pp. 48-54, 13 figs. Refrigerating system of brewery occupies 70 city blocks. During growth multiplicity of ammonia-compressor piping demanded remodeling so as to provide means to facilitate operation and to effect greater economy especially by better insulating the piping. Article tells how this was done.

Carbon-Dioxide Machines. The design of CO^2 machines, John E. Starr. Refrigerating World, vol. 54, no. 7, July 1919, pp. 11-12 & 20, 1 fig. Plate illustrating what writer terms disagreement on data of chief properties of carbonic acid gas as given by different authorities.

Code for the Regulation of Refrigerating Machines and Refrigerants. Ice & Refrigeration, vol. 57, no. 1, July 1919, pp. 6-8, 2 figs. Prepared by Commission on Municipal and State Regulations of Am. Soc. of Refrigerating Engrs.

Ice Plants. Re-Modeled Ice Plant, Columbus, Ohio. Ice & Refrigeration, vol. 57, no. 1, July 1919, pp. 10-15, 11 figs. Rated capacity is 250 tons daily, all distilled-water ice. In the transformation effected, about 20 steam-driven pumps and small steam engines have been replaced by electric-motor-driven apparatus.

Largest Ice Plant in the West, Victor J. Azbe. Power, vol. 50, no. 5, July 29, 1919, pp. 168-170, 5 figs. Plant of 350 ton capacity. Features are drum-type copper steam condensers, ammonia condensers made up of 8-in. pipe and ice-making system employing 800-lb. cans.

Shipboard Insulation. Refrigerating Installations on Board Large Steamships (Les installations frigorifiques à bords des grands paquebots). Genie Civil, vol. 74, no. 26, June 28, 1919, pp. 521-525, 1 fig. Assembly plan of installations as laid out in French steamer of 15,000 tons.

Storage, Cold. Cold Storage Accommodation. Surveyor, vol. 55, no. 1432, June 27, 1919, pp. 479-480, 6 figs. Design for building of 120-ton capacity.

RESEARCH

Forest Products Laboratory. Production in Industrial Research, Samuel Moreell. Indus. Management, vol. 58, no. 2, Aug. 1919, pp. 95-99, 5 figs. Management methods applied to Forest Products Laboratory to increase output of results.

INDUSTRIAL LABORATORIES. The Organization of an Industrial Laboratory, A. D. Little and H. E. Howe. Mech. Eng., vol. 41, no. 8, August, 1919, pp. 663-666, 3 figs. Divisions of laboratory are enumerated and discussed, laboratories of A. D. Little being taken as type. Methods of management, rating or reports and commercial organization are also discussed.

Industrial Research Laboratory Organization, K. C. Mees. Mech. Eng., vol. 41, no. 8, August 1919, pp. 667-668, 4 figs. Diagrams illustrating functions of industrial research laboratory.

The Scope of the Works Laboratory. Eng. & Indus. Management, vol. 1, no. 19, June 19, 1919, pp. 581-582. Success of a laboratory said to depend on (1) possession of proper equipment which includes ample number of properly trained scientific workers, (2) mutual existence of right attitude of mind between works and the laboratory, (3) complete confidence and sympathetic assistance of management.

INDUSTRIAL RESEARCH. Industrial Research and National Progress, Frank D. Adams. Min. & Eng. Rec., vol. 24, no. 10 & 11, June 1919, pp. 142-146. With notes on the work being done by governments of United States and Great Britain.

LAUSANNE UNIVERSITY LABORATORY. Mechanical, Physical and Chemical Laboratory of the Engineering School of Lausanne University (Le laboratoire d'essais mécaniques, physiques et chimiques de l'école d'ingénieurs de l'Université à Lausanne). Bulletin Technique de la Suisse Romande, vol. 45, nos. 11, 12 & 13, May 31, June 14 and June 28, 1919, pp. 99-102, 114-116, and 127-129, 13 figs. Martens apparatus for measuring small elastic deformations; machine used to measure tensile and compressive strength of wires, sheets, springs, etc. Charpy apparatus for measuring resilience.

LYNITE LABORATORIES. Evolution of the Lynite Laboratories. Iron Age, vol. 104, no. 3, July 17, 1919, pp. 149-154, 9 figs. General organization of laboratories is laid out to include research along purely scientific lines in the arts of alloying and fabricating non-ferrous metals, the adaptation of this scientific knowledge by means of experiments and development methods and scientific control of foundry practice to secure desired results.

NATIONAL PHYSICAL LABORATORY. The National Physical Laboratory. Engineering, vol. 107, no. 2791, June 27, 1919, pp. 846-848, 2 figs. Worm-gear testing machine. (To be continued).

RESEARCH OUTLOOK. The Outlook for Research, Nevil Monroe Hopkins. Jl. Engrs. Club of Philadelphia, vol. 36, no. 177, August 1919, pp. 309-316. Present status and economic possibilities of research in America and in European countries.

The condition of Research in the United States, Arthur H. Green. Mech. Eng., vol. 41, no. 7, July 1919, pp. 587-592, 13 figs. Writer discusses research in its relation to technical schools and engineering experiment stations, its value when comparatively conducted and as undertaken by various government activities.

WORKS LABORATORY. *See Industrial Laboratories.*

SPECIFICATIONS

MALLEABLE CASTINGS. Technical Specification for the Delivery of Malleable Castings (Spécification technique pour la fourniture des pièces en fonte malléable). Fonderie Moderne, no. 2, Feb. 1919, pp. 43-45. Concerning malleable castings as adopted by railroad companies.

MOTOR TRUCKS. Motor Truck Specifications. Power Wagon, no. 176, July 1919, pp. 49-64. List of major specifications of internal-combustion and electric trucks, grouped according to load rating and arranged alphabetically by brand name.

STANDARDS AND STANDARDIZATION

ENAMELS. *See Lacquers.*

ENGINEERING STANDARDS COMMITTEE. American Engineering Standards Committee, C. B. LePage. Jl. Engrs. Club of Philadelphia, vol. 36, no. 177, August 1919, pp. 321-322. Statement of reorganization activities during period January 1 to June 1, 1919.

HOLLAND. Standardization in Holland (Ontwerp-Standaardvormen der Hoofdcommissie voor de Normalisatie in Nederland). Ingenieur, vol. 34, no. 25, June 21, 1919, pp. 476-477. New Standardization rules of Standardization Committee of the Netherlands.

JAPANS. *See Lacquers.*

LACQUERS. Lacquers, Shellacs, Enamels and Japans. Safety Eng., vol. 38, no. 1, July 1919, pp. 15-22, 2 figs. Tentative safety standards prepared by the State of New Jersey.

PUMPS, LIQUID MEASURING. Specifications and Tolerances for Liquid Measuring Pumps, Tentatively Adopted by the Twelfth Annual Conference of Weights and Measures, May 1919, Scale Jl., vol. 5, no. 10, July 10, 1919, pp. 11-12. Covering definition of liquid-measuring pump, permanence, constancy of delivery, position of stop mechanism, etc.

SHELLACS. *See Lacquers.*

WOOD SCREWS. New Standards for Wood Screws (Neue Einheitsmasse für Holzschrauben). Metall-Technik, vol. 45, no. 7-8, Feb. 22, 1919, p. 29. New uniform measures for wood screws issued by the Standardization Committee of German Industries.

STEAM ENGINEERING

BOILERS. Standard Boilers, Gt. Western Railway. Ry. Engr., vol. 40, no. 474, July 1919, pp. 138-141, 4 figs. Leading particulars of four standard sizes having lengths of 14-ft. 10 in., 11-ft., 10-ft. 3-in., and 11 ft. Details of joints are particularly dealt with.

Design and Construction of Marine Boilers, A. E. Seaton. Mar. Engr. & Naval Architect, vol. 41, no. 502, July 1919, pp. 307-309 Work done by British Marine Eng., Design and Construction Committee. (Concluded). Paper read before Instn. Naval Architects.

Tests of High Efficiency Pre-heater Type Boilers, Josiah H. Rohrer. Universal Engr., vol. 29, no. 7, July 1919, pp. 39-45, 2 figs. Experiences at Ford Motor Company.

NEYCOMEN ENGINES. Two Neycomen Engines. Engr., vol. 127, no. 3313, June 27, 1919, pp. 621-623, and 632, 22 figs. Particulars regarding two engines, one dating back to 1787 and another to 1823, both of which are said to be still working satisfactorily.

TURBINES, BLADE FASTENINGS. Turbine Blade Fastenings—III. Mechanical World, vol. 65, no. 1694, June 20, 1919, p. 294, 8 figs. Methods used on running wheels of Westinghouse Rateau turbine. (Continuation of serial.)

TURBINES, BUCKET EFFICIENCY. Bucker Efficiency of Impulse and Reaction Steam Turbines (Om Skovelverkningsrader vid Aktions- och Reaktions angturbiner), Tore G. E. Lindmark. Teknisk Tidskrift, Mekanik, vol. 49, no. 24-3, Mar. 12 1919, pp. 37-41, 3 figs. Claims that it is frequently stated that the bucket efficiency in a reaction steam turbine must necessarily be lower than the corresponding efficiency in an impulse steam turbine, as long as the ratio between the peripheral velocity and heat drop for the reaction steam turbine does not exceed the most favorable values for the impulse steam turbine.

TURBINES FOR MECHANICAL DRIVES. Turbines for Mechanical Drives, R. R. Lewis. General Elec. Rev., vol. 22, no. 6, June 1919, pp. 438-442, 12 figs. Illustrates selection of standard parts to produce turbine best adapted to conditions of particular application.

TURBO-GENERATOR, 45,000-Kw. The 45,000-Kw. Tourbine-Generator set at Providence. Elec. Rev., vol. 75, no. 3, July 19, 1919, pp. 91-93. Cross-compound unit of Narragansett Electric Light Co., consisting of high- and low-pressure turbines, each connected with through flexible coupling to its own generator.

TURBO GENERATOR, 70,000-Kw. Interborough Rapid Transit Company's 70,000-Kw. Turbo-generator. Elec. Rev., vol. 75, no. 1, July 5, 1919, pp. 4-6, 4 figs. Methods of operating three elements of triple cross-compound turbine.

TURBINE GOVERNING. Turbine Governing for Present Types of Steam Turbines (Zur Regelung der Steuerung der gegenwärtigen Bauarten von Dampfturbinen), Ernst Blau. Zeitschrift des österr. Ingenieur- und Architekten-Vereins, vol. 70, nos. 43 & 45, Oct. 25 and Nov. 8, 1918, pp. 465-466, and 484-487, 10 figs. Throttle governors of the Bergmann steam turbine, oil-pressure valve gears of the Brown, Boveri & Co. turbines; Allegemeine Elektrizitats-Geselischaft system of automatic governing by cutting out nozzles. (To be concluded)

THERMODYNAMICS

EQUATION OF STATE FOR FLUIDS. Direct Determination of the Temperature Exponent in the Equation of State of Fluids (Détermination directe de l'exposant de la température dans l'équation d'état des fluides), E. Ariès. Comptes Rendus des séances de l'Académie des Sciences, vol. 168, no. 19, May 12, 1919, pp. 930-933. Equation solved for exponent of temperature and substitution of values of quantities in second side of equation effected for seven substances.

HEAT CONDUCTIVITY. Heat Conductivity, C. Edwards, A. Rigby and J. W. Mellor. Gas World, vol. 70, no. 1819, May 31, 1919, pp. 448-450, 3 figs., and Gas Jl., vol. 146, no. 2925, June 3, 1919, pp. 620-622, 3 figs. Theoretical. In computation conductivity of air is neglected, and it is assumed that conducitivity of solid does not vary with temperature and that no heat is conveyed across space by convection. Problem is taken up with reference to pore gap. Paper before Instn. of Gas Engrs.

JOULE-THOMSON EFFECT FOR AIR. The Joule-Thomson Effect for Air at Moderate Temperatures and Pressures, L. G. Hoxton. Physical Rev., vol. 13, no. 6, June 1919, pp. 438-439, 8 figs. Joule-Thomson coefficient was found in experiments to have a decreasing linear variation with increasing line pressures.

VARIA

ASTRONOMICAL INSTRUMENTS. An Evening's Journey among the Stars, Frank C. Jordan. Jl. Engrs. Club of Philadelphia, vol. 36, no. 176, July 1919, pp. 253-258, 7 figs. Development of astronomical instruments together with some of records obtained through their use.

CHEMICAL ASSOCIATIONS. Part of Chemical Associations in International Documentation (L'organisation de la Documentation internationale et le rôle des associations de chimie), Paul Otlet. Chimie & Industrie, vol. 2, no. 5, May 1919, pp. 547-554. Proposes that an international federation of chemical societies should be entrusted with documentation of all chemical literature. Discourse pronounced before Interallied Conference.

ENGINEERING PROFESSION, ORGANIZATION OF. A National Organization of the Engineering Profession, F. R. Ewart. Elec. News, vol. 28, no. 10, May 15, 1919, pp. 23-26, 1 fig. Referring to example of Great Britain where with development of various engineering sciences a single society of engineers formerly existing separated in spite of strenuous opposition into present organizations, it appears to writer that best realization of single-society idea would be in developing systematic scheme of cooperation which would leave most complete autonomy for technical purposes to all existing organisations. A system of co-ordinating councils for this purpose is presented.

ENGINEERS. The Engineer—His Opportunities and Responsibilities, John B. Fisken. Jl. of Electricity, vol. 43, no. 2, July 15, 1919, pp. 69-71. Calls attention to the fact that engineer is becoming a more and more important factor in modern would. Still, writer observes, in spite of vast opportunities for service which lie before him, his unnecessarily retiring temperament prevents him from taking the high place which is rightfully his.

PATENT SYSTEM. Proposed Changes in the American Patent System, Wesley G. Carr. Elec. Jl., vol. 16, no. 7, July 1919, pp. 299-300. Recommendations proposed by special committee appointed by Nat. Research Council.

Percentages. Checking Percentages by a Chart, William Wyer. Eng. & Contracting, vol. 52, no. 3, July 16, 1919, pp. 80-81, 1 fig. Methods of U. S. Railroad Administration.

WELDING

Acetylene Generating Plant. Acetylene Generating Plant for Large Welding Shops. Welding Engr., vol. 4, no. 7, July 1919, pp. 27-29, 3 figs. It consists of 7 generators, gas collector, moisture separator, 2 condensers, a gas-meter capable of storing 350 cu. ft. of gas, and 4 large purifiers provided with bypasses for working in pairs.

Acetylene Welding. Oxy-Acetylene Welding of Large Cylinders, L. M. Malcher. Min. & Sci. Press, vol. 119, no. 20, July 12, 1919, pp. 53 and 61-62. Repairing fractured left-hand low-pressure steam-cylinder, 70 in., in inside diameter, of Allis-Chalmers twin-tandem compound-reversing engine.

Arc Welding. Electric Arc Welding in Mines, John G. Kjellgren. Coal Age, vol. 16, no. 2, July 10, 1919, pp. 52-53, 2 figs. Illustrating weld on cast-iron hoisting sheave.

Blowpipes. Improvements in Blowpipes. Acetylene & Welding Jl., vol. 16, no. 189, June, 1919, pp. 121-122, 1 fig. Invention relating to blowpipes in which extension piece can be readily attached between nozzle and handle. Extension piece arranged so as to establish communication between oxygen nozzle and injector, and also between passage for combustible gas and annular space between injector and rear portion of tip.

Concrete Construction. Autogenous Welding in Reinforced-Concrete Construction (Die Flammenverschmelzung im Eisenbetonbau). Autogene Metallbearbeitung, vol. 12, no. 3, Mar. 1919, pp. 38-40, 10 figs. Describe concrete tanks and pipes as made by the Metallindustrie G.m.b.H. at Buhl, Baden. (Concluded.)

Electric Welding. Development of Electric Welding, Howard C. Forbes. Elec. Eng., vol. 53, no. 5, May 1919, pp. 222-223. Emphasized by quoting its application in preparation of depth and gas bombs, construction of Liberty motor, attachment of Otto gear to hulls of ships to protect them from mines, etc.
See also Arc Welding, Spot Welding.
Electric Welding: Its Theory, Practice, Application and Economics, H .S. Marquand. Elecn., vol. 82 & 83, nos. 2144, 2146 and 2147, June 20, July 4 & 11, 1919, pp. 705-707, 17-18, and 40-41, 7 figs. Deals with preparation of welds and then passes on to certain properties of iron and mild steels which have a marked bearing on methods adopted. Examples of various types of welding. (Continuation of serial.)

Firebox Welding. Fire Box Welding, B. K. Smith. Welding Engr., vol. 4, no. 7, July 1919, pp. 42-44, 5 figs. Work done by U. S. Welding Co.

Gas Torch. Modern Welding and Cutting—XVI, Ethan Viall. Am. Mach., vol. 51, no. 3, July 17, 1919, pp. 117-122, 13 figs. Rules for welding with gas torch.
Modern Welding and Cutting—XV, Ethan Viall. Am. Mach., vol. 51, no. 2, July 10, 1919, pp. 61-65, 13 figs. Gas-torch welding and cutting outfits.

Jigs. Welding Jigs and Methods of Overcoming Distortion, C. S. Milne. Welding Engr., vol. 4, no. 7, July 1919, pp. 21-27, 23 figs. Illustrating repair work.
Welding and Cutting, B. S. Milne. Can. Machy., vol. 22, no. 3, July 17, 1919, pp. 48-51, 18 figs. Examples of welding and methods of overcoming distortion. Paper presented before British Acetylene and Welding Assn. (Continued.)
Various Jigs as Applied to the Welding Trade, B. S. Milne. Can. Machy. vol. 22, no. 1. July 3, 1919, pp. 13-15, 17 figs. Illustrating methods for overcoming distortion.

Repair Work. *See Jigs.*

Rolling Mill Engine Repaired by Oxywelding, L. M. Malcher. Blast Furnace & Steel Plant, vol. 7, no. 7, July 1919, pp. 327-328, 5 figs. Repairing low-pressure steam-cylinder fracture on twin-tandem compound reversing engine at Farrell Works of Carnegie Steel Co.
Some Recent Striking Examples of Crankshaft Repairs. Reactions, 1919, vol. 12, no. 2, Second Quarter, pp. 31-36, 13 figs. Such as well made on extension to 20-in. blooming mill crankshaft.

Seam Stress. How the Seam is Stressed in Autogenous Welding (Wie wird beim Autogenschweissen die Schweissnaht beansurucht). Autogene Metallbearbeitung, vol. 12, no. 3, Mar. 1919, pp. 31-36, 18 figs. Heat expansion and upsetting in autogenous welding of mild-steel plates; suggestions for preventing stresses; welding circular seams on cylindrical bodies. (To be continued.)

Spot Welding. A Large Spot-Welding Machine. Engr., vol. 127, no. 3311, June 13, 1919, pp. 588-589, 5 figs. Design for spot welding of tubes 5 ft. long made of ¼-in. steel plates and having an internal diameter of 8-in.

Tank Welding. Tank Welding by the Oxy-Acetylene Process, Charles C. Phelps. Machy. (N. Y.), vol. 25, no. 11, July 1919, pp. 1071-1072, 2 figs. Illustrating application of oxy-acetylene method of welding to duplicate work required in large quantities.

Thermit. Correct and Incorrect Methods of Lining up Broken Crankshafts for Thermit Welding, J. H. Deppeler. Reactions, vol. 12, no. 2, Second Quarter, 1919, pp. 37-38, 2 figs. Placing riser between slabs to prevent shrinkage of thin ribs between heavier parallel members.
Recent Thermit Technique at the Rocky Mount Shops of the Atlantic Coast Line Railroad, D. C. Lewis Reactions, vol. 12, no. 2, Second Quarter, 1919, pp. 39-40, 5 figs. Welding of guide yoke, cast-iron driving wheel, and the like.

Truck Side Frames. Welding Truck Side Frames, Bolsters and Arch Bars. Welding Engr., vol. 4, no. 7, July 1919, pp. 48-50, and (discussion), pp. 50-52. Autogenous welding limits and regulations recommended by Welding Committee of Am. R. R. Assn.

WOOD

Drying Wood. The Phenomena of Drying Wood, Harry D. Tiemann. Jl. Franklin Inst., vol. 188, no. 1, July 1919, pp. 27-50, 8 figs. Analysis of Internal stresses which occur in wood during progress of drying, with discussion of physical properties which affect these stresses.
Kilndrying of Wood in the Airplane Industry, Myron A. Lee. Sibley Jl., vol. 33, no. 5, June 1919, pp 66-67, 3 figs. Results obtained with kiln of hot-air-blast, bake-oven type.

Plywood. The General Properties and Uses of Plywood, P. C. Boulton. Aerial Age, vol. 9, no. 17, July 7. 1919, pp. 813-815, 2 figs. Plywood strength tables. (Continuation of serial.)
See also Aeronautics. Materials of Construction (Plywood.)

Shrinkage. Shrinkage of Interior Trim: Its Cause and Prevention, Lawrence V. Teesdale. Am. Architect, vol. 116, no. 2275, July 30, 1919, pp. 143-145, 5 figs. Examples of shrinkage which occurs when insufficiently kiln-dried material is used. Writer advises obtaining material that has been kiln-dried to proper moisture content.
The Relation of the Shrinkage and Strength Properties of Wood to Its Specific Gravity, J. A. Newlin and T. R. Wilson. U. S. Dept. of Agriculture bul. no. 676, July 16, 1919, 35 pp., 9 figs., partly on supp. plates. Results of over 200,000 tests expressed in form to utilize them for estimating properties of any particular timber and for selecting timber for any given purpose.

Woodworking Industry. Installing Management Methods in the Woodworking Industry, Carle M. Bigelow. Indus. Management, vol. 58, no. 2, Aug. 1919, pp. 124-133, 29 figs. Information in regard to handling lumber, drying lumber, construction and operation of kilns, purchasing and storing; also time study leading up to payment of bonus.

MINING ENGINEERING

BASE MATERIALS

Sands. The Texture of Sands. Nature, vol. 103, no. 2590, June 19, 1919, pp. 315-317, 3 figs. Diameter obtained by plotting great sizes horizontally at distances proportional to their logarithms.

COAL AND COKE

Alaska. Methods for more efficiently utilizing our Fuel Resources—XXIX. The Coal Resources and Transportation Facilities in Alaska, F. P. Coffin. Gen. Elec. Rev., vol. 22, no. 7, July 1919, pp. 517-535, 7 figs. Alaskan coal fields contain the only accessible deposits of high-grade semi-bituminous coal on the shores of Pacific Ocean, as well as extensive deposits of lignite.

Bituminous Coal. A Chemical Investigation of Banded Bituminous Coal. Studies in the Composition of Coal, Frederick Vincent Tideswell and Richard Vernon Wheeler. Jl. Chem. Soc., vol. 115 and 116, no. 680, June 1919, pp. 619-636, 2 figs. In banded Hamstead coal investigated, it is claimed that ingredients show differences which grade them in fusain, durain, clarain and vitrain.
Preparation of Bituminous Coal—VII, Ernst Prochaska. Coal Age, vol. 16, no. 3, July 17, 1919, pp. 96-103, 7 figs. Considers advantageous to drive machines of washery in groups with larger units driven individually. It is noted that buildings should preferably be of steel, although wood and reinforced concrete are often employed.

Bunker Coal. A British System of Unloading, Stocking and Reclaiming Bunker Coal, H. Hubert. Coal Trade Jl., vol. 50, no. 29, July 16, 1919, pp. 865-866, 2 figs. System of bunkering with steam cranes described as being capable of handling 74 tons per hr.

Coal, Geology of. Résumé of Theories of the Origin of Coal, C. W. Hippard. Coal Age, vol. 16, no. 3, July 17, 1919, pp. 104-105. As some theories hold that beds now rest where vegetable matter, from which they were formed originally, grew, while others believe that beds are result of drift, writer, who finds arguments advanced in support of either hypothesis of value, concludes that it is quite probable that all coals were not formed by identical process.
Research on the Constitution and Origin of Coal, A. C. Fieldner. Gas Age, vol. 44, no. 2, July 15, 1919, pp. 45-49, 18 figs. Microphotographs taken at Pittsburgh Bur. of Mines, Research Laboratory, with notes on practical investigation of microcopical examination.
The Formation of Coal, J. D. Kendall. Can. Min. Inst. Bul., no. 87, July 1919, pp. 761-778, 13 figs. Geology of English coal fields. (Continuation of serial.)

Coal Industry Commission. The Coal Industry Commission. Reports on Nationalism. Colliery Guardian, vol. 117, no. 3052, June 27, 1919, pp. 1541-1546. Quoting reasons for State ownership of coal royalties, suggested method of purchase and carrying account of coal mines, and proposed scheme for local administration.

Coal Mining and Rock Structure. The Effect of Coal Mining on the Overlying Rocks and on the Surface, W. D. Lloyd. Tran. Instn., Min. Engrs., vol. 57, part 2, May 1919, pp. 74-95, and (discussion) pp. 95-100. Summary of theories which have been put forward and of opinions which have been expressed by various investigators.

Coke from Illinois Coal. Metallurgical Coke from Illinois Coal, R. S. McBride and W. A. Selvig. Iron Age, vol. 104, no. 5, July 31, 1919, pp. 283-286, 4 figs. Operating test at St. Paul plant of Minnesota By-Product Coke Co. conducted by Bureaus of Standards and Mines.

Coke Ovens. Coke Ovens (Koksöfen), E. Lococq and J. Pieters. Feuerungstechnik, vol. 7, no. 12-13, Mar. 15, April 1, 1919, pp. 95-96 & 101-104, 2 figs. Heat required for distillation; by-product yield; calculation of distribution of gases on walls of coke oven. The development of the coke oven. (Concluded.)

COKE-PLANT EQUIPMENT. Clairton By-Product Coke Plant Equipment—II, Frank F. Manquard. Blast Furnace & Steel Plant, vol. 7, no. 7, July 1919, pp. 340-342 & 358, 1 fig., also Coal Industry, vol. 2, no. 7, July 1919, pp. 284-287, 1 fig. Chart showing operating organization of coke works.

COKING CAPACITY. The Coking Capacity of Coals, A. Meurice. Colliery Guardian, vol. 117, no. 3052, June 27, 1919, pp. 1559-1560, 1 fig. Practical commercial tests said to have proven that value of coking coals is directly proportional to their index limit of agglutination. From Annales des Mines de Belgique.

DEPRECIATION. Depletion and Depreciation of Coal-Mining Properties, D. C. Burdick. Coal Age, vol. 16, no. 5, July 31, 1919, pp. 185-187. Writer's opinion is that charges should be graduated and of such amount that total investment may be extinguished when property is worked out.

FRANCE. The French Coke Problem, N. C. Bercthelot. Colliery Guardian, vol. 117, no. 3050, June 13, 1919, pp. 1415-1416. Suggests as model specification for coking plant attached to works comprising blast furnaces, that surplus gas from the later be used to heat the coke ovens, while coke-oven gas of 4000 calories be utilized in metallurgical furnaces. Translated from Chimie et Industrie.

GAS EXHAUSTERS. Gas Exhauster in Coke-Oven Plants (Gassauger in Koksofenanlagen), B. Shapira. Feuarungstechnik, vol. 7, no. 12, Mar. 15, 1919, pp. 93-94. Special reference is made to the Brown-Boveri and C. H. Jaeger types turbo-gas exhauster and also to the fan gas exhauster of the Berlin-Anhaltische Maschinenbau Gesellschaft.

GAS FROM BROKEN COAL. Effect of Breaking of Coal on the Emission of Gas, Robert Dunn. Coal Age, vol.16, no. 1, July 3, 1919, p. 20. Daily sampling and analysis of mine air at Crow's Nest Pass Mine said to have shown that amount of gas in mine air changes but little and seems to bear no relation whatever to mining operations.

IMPURITIES. Impurities in Raw Coal and Their Removal. Coal Age, vol. 16, no. 4, July 24, 1919, pp. 150-151. Limitations of three methods for removing impurities—hand-picking, mechanical shale pickers and coal washers.

PREPARATION. Preparation of Bituminous Coal—VI, Ernst Prochaska. Coal Age, vol. 16, no. 1, July 3, 1919, pp. 9-15, 5 figs. How, after coal has been washed, it must be freed from adhering moisture before it can be shipped. Draining bins, elevators, conveyors and centrifugal dryers as means for this purpose.

PYRITES. Valuable Pyrite in Illinois Coal Beds, G. H. Cady. Coal Age, vol. 16, no. 4, July 24, 1919, pp. 136-140, 9 figs. Defines various types of pyrite and their modes of occurrence, and shows in what beds and sections these types may be most generally found.

SAAR BASIN. Problem of the Great Saar Coal Basin, Wilhur Greely Burroughs. Coal Industry, vol. 2, no. 7, July 1919, pp. 268-274, 1 fig. With reference to its political, economical and geological value.

SHAFT MINE. Modern Shaft Mine at Amsterdam, Ohio, Jack L. Ball. Coal Age, vol. 10, no. 2, July 10, 1919, pp. 46-47, 2 figs. Coal mine. Capacity of mine is 800 tons a day.

SPLITTING OF COAL-SEAMS. On the Splitting of Coal-Seams, by Partings of Dirt—I, Percy Fry Kendall. Proc. Midland Inst., Min., Civil & Mech. Engrs., vol. 24, no. 4, 1918, pp. 104-119, and (discussion) pp. 119-123, 10 figs., partly on supp. plate. Evidence in support of theory that linear splits in coal-seams that rejoin are erosion phenomena and not, as Bowman supposed, tectonic in origin.

STRIPPING. Operating a Coal-Stripping Plant in Ohio, S. B. Creamer. Coal Age, vol. 16, no. 4, July 24, 1919, pp. 134-135, 3 figs. Overburden handled by shovel entirely. Suggestions are made for stripping by this method.

THICKENER, DORR. Use of the Dorr Thickener and Classifier in Coal Preparation, John Griffen. Coal Age, vol. 16, no. 4, July 24, 1919, pp. 146-148, 2 figs. Principles of construction and operation. Door continuous thickener is used for collection and dewatering of fine solids mixed or suspended in liquid.

WASHING. The Examination of Coal in Relation to Coal Washing, M. Wynter Blyth L. T. O'Shea. Iron & Coal Trades Rev., vol. 98, no. 2677, June 20, 1919. pp. 852-853. Suggests that purity of washed coal to be used for coking should be judged by its ash content as determined by incineration.

WASHINGTON (STATE). The Coal Fields of Southwestern Washington, Harold E. Culver. Wash. Geol. Survey, bul. no. 19, Jan. 2, 1919, 155 pp., 36 figs., partly on supp. plates. General geological features; details of various areas and remarks on utilization of coals.

COPPER

MILLING, LAKE SUPERIOR. Developments in Lake Superior Milling, C. H. Benedict. Eng. & Min. Jl., vol. 108, no. 1, July 5, 1919, pp. 5-10. 8 figs. Two types of copper ore are mined in region—congomeratic ore which is hard, close-grained rhyolite, characteristically composed of pebbles with copper as cementing material, and amygdaloidal ore, in which copper occurs in more massive form. Methods of dressing and leaching as required by these two types are described.

EXPLOSIVES

BLASTING EQUIPMENT. Electric Blasting Equipment, L. D. Rowen. Eng. & Min. Jl., vol. 108, no. 2, July 12, 1919, pp. 45-46, 1 fig. Dependability and conditions under which electric detonating cap can be used.

Electric Priming in Mines (Note sur le tir électrique), MM. Taffanel, Dautriche, Durr and Perrin. Annales des Mines, vol. 7, no. 11, Apr. 1919, pp. 6-124, 13 figs. Composition and properties of powders used for inflammation and electrical features of inflammator. (To be continued.)

PERMISSIBLE EXPLOSIVES. Tests and Comparisons of Various Types of Permissible Explosives, Joseph C. Thompson. Coal Age, vol. 16, no. 3, July 17, 1919, pp. 94-95. Notes tests used by Bureau of Mines to establish permissible explosives. Comparison is made of black powder and some permissible explosives and several classes of permissibles are discussed.

PRIMING. *See Blasting Equipment.*

STORAGE. Regulations Governing Storage of Explosives (Réglementation des dépôts de substances explosives). Comité Central des Houillères de France et Chambre Syndicale Français des Mines Métalliques. Notes Techniques, no. 384, June 1, 1919, pp. 19-63. With provisions in regard to sales and importation of dynamite and other nitroglycerine explosives.

Storing and Handling High Explosives During the War, G. C. Munoz. Eng. News-Rec., vol. 82, no. 26, June 26, 1919, pp. 1242-1246, 9 figs. Methods developed by Ordnance Department.

TNT. TNT as a Blasting Explosive, Charles E. Munroe and Spencer P. Howell. Can. Engr., vol. 37, no. 4, July 24, 1919, pp. 170-172 and 174. Industrial use, general characteristics, solubility and hygroscopicity grade of determination, precaution in packing, and remarks on practical field demonstrations.

GEOLOGY AND MINES

AMBER. Amber and Its Origin, George F. Black. Am. Mineralogist, vol. 4, no. 7 July 1919, pp. 83-85. Geology of Samland peninsula, East Prussia. (To be continued.)

BARITE, STALACTITIC. Stalactite Barite from Madoc, Ontario, T. L. Walker. Am. Mineralogist, vol. 4, no. 7, July 1919, pp. 79-80, 1 fig. on supp. plate. Outer surface formed by projecting ends of small crystals arranged in radial fashion with macro-axis of tiny crystals approximately parallel to axis of aggregate.

COLORADO ROCKIES. The Building of the Colorado Rockies—II, Rollin T. Chamberlin. Jl. Geology, vol. 27, no. 4, May-June 1919, pp. 225-251, 10 figs. System is characterized by open, gentle folding, moderate crystal shortening affecting a zone several scores of miles in depth in its deeper portions by strong uplifting and by extrusion of much lava.

EARTHQUAKES. Surface Reflexion of Earthquake Waves, George W. Walker. Phil. Tran. Roy. Soc. Lond., Series A 567, vol. 218, June 12, 1919, pp. 373-393, 8 figs. partly on two supp. plates. Investigation undertaken to study sharp impulses noted on seismograms, which in Wichert's opinion represent arrival of waves that have undergone one or more reflexions at earth's surface.

FLORIDA. Geology in Florida, E. H. Sellards. Jl. Geology, vol. 27, no. 4, May-June 1919, pp. 286-302, 3 figs. partly on supp. plate. General structural conditions.

FOLIATION AND METAMORPHISM. Foliation and Metamorphism in Rocks, T. G. Bonney. Geological Mag., vol. 6, no. 6, June 1919, pp. 246-250. Pressure-modified gneisses and schists. (Concluded.)

MANGANOTANTALITE. Magannotanalite from Amelia, Virgina, O. Ivan Lee and Edgar T. Wherry. Am. Mineralogist, vol. 4, no. 7, July 1919, pp. 80-83, 1 fig. Physical properties of deep red columbite containing magnese in excess over iron and tantalum slightly in excess over columbium.

METAMORPHISM. *See Foliation and Metamorphism.*

MUD VOLCANOES. Mud Volcanoes in Colombia, South America, Stanley C. Herold. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1025-1027, 2 figs. Their occurrence in faulted localities used as basis of explanation of their origin.

PRECAMBRIAN. Some Stratigraphic and Structural Features of the Pre-Cambrian of Northern Quebec—III, H. C. Cooke. Jl. Geology, vol. 27, no. 4, May-June, 1919, pp. 263-275. Petrographical similarities, geological successions, deformations and relation to older and younger formations as criterion for correlation.

Some Problems of the Adirondack Precambrian, Harold L. Alling. Am. Jl. Sci., vol. 48, no. 283, July 1919, pp. 47-68, 3 figs. Following are some of points brought out as consequence of investigation: That Grenville strata have been isoclinally extensively folded; that individual phases of Saranac serie smay be some one or other of well recognized rock units, and establishment of metagabbro closely following instrusion of Laurentian granite.

ROCK COMPOSITION DETERMINATION. A Planimeter Method for the Determination of the Percentage Compositions of Rocks, Albert Johannsen. Jl. Geology, vol. 27, no. 4, May-June, 1919, pp. 276-285, 6 figs. Based on claimed proportionality of surface measurements to volumes in any uniform, non-banded rock, irrespective of shape of individual components.

IRON

GREAT BRITAIN. Recent Iron-Ore Developments in the United Kingdom, F. H. Hatch. Iron & Coal Trades Rev., vol. 98, no. 2676, June 13, 1919, pp. 795-796, 2 figs. Working of low-grade iron-ore deposits as influencing industrial recuperation. From lecture delivered at Roy. School of Mines.

NOVA SCOTIA. The Iron and Coal Industry in Nova Scotia, F. W. Gray. Iron & Steel of Can., vol. 2, no. 7, July 1919, pp. 152-153. Economical conditions. Paper read before Montreal Metallurgical Assn.

LEAD, ZINC. TIN

LEAD AND VANADIUM. Treatment of Vanadinite for the Recovery of Lead and Vanadium Metallurgically, J. E. Conley. Metal Industry, vol. 14, no. 26, June 27, 1919, pp. 521-524, 2 figs. Results of methods which are said to have proven successful in recovering lead from vanadinite and fusion with caustic soda and soda ash; recovery by solution.

SPELTER. The Spelter Industry in Australia and Britain, F. A. Govett. Steel & Metal Digest, vol. 9, no. 7, July 1919, pp. 344-346. Statistics and account of projected increases of various plants.

VANADIUM. *See Lead and Vanadium*

ZINC. War's Influence on the Zinc Industry, Pope Yeatman. Eng. & Min. Jl., vol. 108. no. 1, July 5, 1919, pp. 19-21. Development of new uses of zinc; cooperation between miner and smelter. See also Spelter.

MAJOR INDUSTRIAL MATERIALS

MANGANESE. Manganese Deposits of the West Foot of the Blue Ridge, Virginia, G. W. Stone, H. D. Miser, F. J. Katz and D. F. Hewett. Virginia Geological Survey, Univ. of Va., Bul. no. 17. 1919, 166 pp., 38 figs. Based on examination of mines and prospects and studies of physiographic and stratigraphic conditions under which manganese deposits of region were formed, and of application of hypothesis proposed by D. F. Hewett for discovery of new ore deposits.
Preparation of Manganese Ore, W. R. Crane. Dept. Interior, Bur. of Mines, Minerals Investigations Series, no. 17, May 1919, 16 pp. Including summary of conditions affecting concentration.

NICKEL. Treatment of Low-Grade Nickel Ores, C. W. Davis. Jl. Indus. & Eng. Chem, vol. 11, no. 7, July 1, 1919, pp. 644-648. No satisfactory concentration of ores was obtained by sizing tests, panning, tabling, magnetic concentration, or flotation. Magnetic treatment of reduced North Carolina ore brought concentration of nickel from 0.97 per cent to 3.6 per cent, recovery being 45 per cent.

MINES AND MINING

APEX LAW. A Phase of the Apex Law, Chas. E. Dutton. Eng. & Min. Jl., vol. 108, no. 4, July 26, 1919, pp. 146-147. Examples quoted in support of contention that its application has operated to thwart development.

CONCENTRATION, MAGNETIC. Treatment of Low-Grade Iron Minerals by Magnetic Concentration (Le traitement des minérais de fer pauvres par concentration magnétique), Henry Louis. Chimie & Industrie, vol. 2, no. 5, May 1919, pp. 511-524, 20 figs. Description of process with illustration of machines employed and diagrammatic sketch indicating order of procedure in successive operations. Paper read before Interallied Conference of Chemistry.

COSTS, MINING. Excerpts from Reports of Mineral Investigations of the Bureau of Mines for June, 1919. Dept. of Interior, Bur. of Mines, 1919, 50 pp., 1 fig. Covering production and cost data and mining situation in regard to labor and mining methods in various industries.

DIAMOND DRILL EXPLORATION. Progress in Methods of Exploration, Hugh M. Roberts. Min. & Sci. Press, vol. 119, no. 20, July 12. 1919, pp. 55-57. Tracing particular claim in increasing effectiveness of diamond-drill as exploring instrument.

FRANCE, MINING LAW. New French Mining Law. Colliery Guardian, vol. 98, no. 3053, July 4, 1919, pp. 29. Provides profit-sharing scheme.

HYDRAULIC MINING. Hydraulic Mining in California With Special Reference to the You Bet Mine, F. A. Goodale. Colo. School Mines Mag., vol. 9, no. 7, July 1919, pp. 167-173, 2 figs. Including example of calculations involved in determining size and grade of sluice.

MILL, BALL AND TUBE DRIVES. Ball and Tube-Mill Drives at the Rochester Combined Mill, K. Freitag. Min. & Sci. Press, vol. 119, no. 1, July 5, 1919, pp. 7-8, 1 fig. Arrangement in two units, each composed of one 6 ft. by 4 ft. 6 in. ball mill and one 7 by 12 ft. tube-mill.

MINE EXAMINATION. Proper and Lawful Examination of a Mine by the Mine Examiner. Steve Gosnell. Coal Age, vol. 16, no. 1, July 3, 1919, pp. 18-19. Calls attention to the fact that an inspection may be entirely legal but not adequate and recommends that examiner while making his daily inspection, should not confine his activities to a perfunctory accomplishment of legal prescriptions.

NEVADA PACKARD. Description of Nevada Packard Mine and Mill, Herbert C. Thomson. Salt Lake Min. Rev., vol. 21, no. 6, June 30, 1919, pp. 21-24, 4 figs. Said to consist of series of rhyolite flows, with several intercalated beds of rhyolite stuff, the latter deposited in water, and grading imperceptibly into true shales; they are probably of Jurassic age.

POWER TRANSMISSION. Electrical Transmission of Power in and About Coal Mines, S. W. Farnham. Coal Age, vol. 16, no. 2, July 10, 1919, pp. 48-51. Types of mine loads to be considered and survey of practice in regard to methods of transmission. Paper read before Ill. Min. Inst.

ROCK DRILLS. Pneumatic-Electric Rock Drill and Some of the Tools Used in Its Construction—I, Frank A. Stanley. Am. Mach., vol. 51, no. 3, July 17, 1919, pp. 107-110, 10 figs. Machine which is claimed to provide for air cushion for minimizing shock on electrical apparatus.

SEALING UP. Sealing Up Old or Abandoned Workings, Joseph C. Thompson. Coal Industry, vol. 2, no. 7, July 1919, pp. 259-260. Suggests method of procedure. Paper presented before annual meeting of Ill. Min. Inst.

SHAFTING SINKING. Sinking and Concreting Deep Mine Shaft. Contract Rec., vol. 33, no. 28, July 9, 1919, pp. 674-677, 4 figs. Lining and walls of four compartment shaft, 936 ft. deep, concreted simultaneously with excavation operations.

MINOR INDUSTRIAL MATERIALS

GRAPHITE. The Graphite Situation, Hugh S. Spence. Can. Chem. Jl., vol. 3, no. 7, July 1919, pp. 213-216. Summary of situation as faced by Canadian producers with review of development of present process of recovery and discussion of market conditions.
Graphite Mining and Milling in Alabama, H. P. H. Brumell. Eng. & Min. Jl., vol. 108, no. 1, July 5, 1919, pp. 17-18. Flotation methods reported as successful.

MAGNESIUM AND SODIUM SALTS. Natural Deposits of Salts of Magnesium and Sodium Near Clinton, British Columbia, L. Reinecke. Can. Chem. Jl., vol. 3, no. 7, July 1919, pp. 209-213, 5 figs. Descriptive and historical. (Continued).

SODIUM. *See Magnesium and Sodium.*

OIL AND GAS

APPALACHIAN. Depletion of Natural Gas in the Applachian Field, J. A. Bownocker. Gas Age, vol. 44, no. 2, July 15, 1919, pp. 57-60, 8 figs. Situation is seen fairly satisfactory for present but is considered as uncertain for future.

CONDUCTING. Irevine Oil District, Kentucky, Stuart St. Clair. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1079-1089, 1 fig. Calls attention to probability that area of production from Irevine sand in eastern Knetucky is a function of the distance from the outcrop of the oil formation and from the major faults.

DRILLING. Percussion Plant for Oil Well Drillings. Eng., vol. 108, no. 2792, July 4, 1919, pp. 830-833, 15 figs. Differences in various systems—American, standard or Californian and Canadian. Paper presented to Inst. of Petroleum Technologists.

GREAT BRITAIN. The Search for Subterranean "Oil-pools" in the British Isles, V. C. Illing. Geological Mag., vol. 6, no. 7, July 1919, pp. 290-301, 1 fig. on supplement plate. Evidence brought forward in favor of possible occurrence of oil pools in Great Britain studied in its geological aspect. Conclusions are generalized in regard to possibility of ascertaining existence of oil in a locality from knowledge of geological formation.
Sections of English Oil Wells. Petroleum World, vol. 16, no. 226, July 1919, pp. 293, 2 figs. Hardstoft where oil is flowing and Brimington where next strike for oil is expected.

OIL ACCUMULATION. Notes on Principles of Oil Accumulation, Alex. W. McCoy. Jl. Geology, vol. 27, no. 4, May-June 1919, pp. 252-262, 6 figs. Experiments are offered to substantiate conclusion that bituminous shales are in close relationship with producing sand of oil field. It is asserted that this bituminous material is in solid form and is only changed to petroleum in local areas of differential movement, accumulation of oil in commercial pools being accomplished by capillary water after such a change is made.

PETROLEUM REFINING. Petroleum Refining, R. W. Cunningham. Jl. Soc. Automotive Engrs., vol. 5, no. 1, July 1919, pp. 78-82 and (discussion) pp. 82-84, 4 figs. Charts showing products obtained in running distallation of oil for petroleum coke and for cylinder stock with notes on oil testing instruments.

WATER SEALING. Sealing Water in California Oil Fields, Seth S. Langley. Eng. & Min. Jl., vol. 108, no. 1, July 5, 1919, pp. 11-16, 4 figs. Formation and cement shut-off methods.

WATER SEPARATION. Separating Water from Petrol. Petroleum World, vol. 16, no. 226, July 1919, pp. 304-305, 2 figs. Device which is said to be more particularly applicable to (1) buried gasoline storage tanks, and (2) portable tanks.

PRECIOUS MINERALS

CARIBOO. Cariboo Placers and Lodes, J. A. Macpherson. Min. & Eng. Rec., vol. 24, nos. 8 & 9, May 1919, pp. 125-129, 9 figs. Concerning conditions, ore treatment and transportation costs.

GOLD. Operations of Round Mountain Mining Company, Charles F. Spilman. Salt Lake Min. Rev., vol. 21, no. 7, July 15, 1919, pp. 23-26, 5 figs. Gold deposits.

OREGON. Placer Mining in Oregon, A. E. Kellogg. Eng. & Min. Jl., vol. 108, no. 3, July 19, 1919, pp. 90-91, 1 fig. Geology of Waldo district.

PLATINUM. The Platinum Situation, James M. Hill, Eng. & Min. Jl., vol. 108, no. 4, July 26, 1919, pp. 131-137, 4 figs. Uses of platinum and possibilities for maintaining supplies. Shortage in platinum and platinum group of metals attributed to disturbances of normal production created by war.

SILVER. Silver Spur Mine, Lionel C. Ball. Queensland Dept. of Mines, Geological Survey, No. 264, 1918, 36 pp., 13 figs. Recent developments and future prospecting.
Silver Volatilization in Smelting, Frederic P. Dewey. Eng. & Min. Jl., vol. 108, no. 3, July 19, 1919, pp. 87-89. Distinguished between volatilization and dusting and points out that mechanical loss due to ebullition has nothing to do with the vapor pressure, or true volatilization.

SAFETY ENGINEERING

FIRES. Use of Inert Gas to Extinguish Mine Fire, Joseph J. Walsh. Coal Industry, vol. 2, no. 7, July 1919, pp. 266-267, 1 fig. Applicability in extinguishing crop fires or those at inaccesible points.

BELGIUM. Underground Transportation (Les transports souterrains), F. Defize. Revue Universelle des Mines & de la Métallurgie, vol. 1, no. 1, Jan. 1919, pp. 70-117, 6 figs. Comparative examination of various systems referring to conditions prevalling in Belgium mines.

QUARRIES. Transportation in Quarries. Daniel J. Hauer. Cement, Mill and Quarry, vol. 15, no. 2, July 20, 1919, pp. 19-20, 3 figs. Illustrating track layouts for inclines in pit quarries that are worked in two or more lifts.

RAILS, MINE, BONDING. Importance of roper Bonding of Mine Rails, C. C. Beck. Coal Age, vol. 16, no. 3, July 17, 1919, pp. 90-93, 22 figs. Type of bond employing terminals welded to rail ends recommended.

VARIA

GERMANY. Economical Situation of the Basic Steel Works in Germany, Belgium and France (Situation économiques des aciéries au convertisseur basique en Allemagne, en Belgique et en France), Fernand Tordeur. Revue Universelle des Mines & de la Métallurgie, vol. 1, no. 1, Jan. 1919, pp. 1-69. Discusses application of modern methods as economical factor for developing industry.

PUBLIC CONTROL. State Versus Private Control of Mines and Minerals. Can. Min. Inst. Bul., no. 87, July 1919, pp. 697-701. Based on evidence presented before British Coal Industry Commission.

MUNITIONS AND MILITARY ENGINEERING

CABLES. Military Uses of Cables (Etude sur l'emploi des cahles aux armées), G. Linekugel le Cocq. Génie Civil, vol. 74, no. 24 & 25, June 14 & 21, 1919, pp. 477-481 and 497-504, 95 figs. partly on supp. plates. Mechanical details and technical study of semi-permanent Gisclard bridges; aerial transport cable and its use in rapid reconstruction of masonry piles and railroad heds. (Concluded).

CAMOUFLAGE. Memoranda on the Camouflage Service of United States Army, Evarts Tracy. Prof. Memoirs, Corps Engrs. U. S. Army & Engr. Dept., vol. 11, no. 56, Mar.-Apr. 1919, pp. 175-184. Including discussion of qualifications of a field camoufleur.

The Principles of Camouflage, M. Luckiesb, Tran. Illum. Eng. Soc., vol. 14, no. 5, July 21, 1919, pp. 234-255. Particularly in reference to marine practice and applicability of art to airplanes.

Camouflage Harold Van Buskirk. Tran. Illum. Eng. Soc., vol. 14, no. 5, July 21, 1919, pp. 225-233, 8 figs. on six separate plates. Outline of progress made inUnited States before and after Navy Dept. took over and organized its camouflage section.

Painting Battleships for Low Visibility, Everett L. Warner. Tran. Illum. Eng. Soc., vol. 14, no. 5, July 21, 1919, pp. 220-224, 2 figs. on four supp. plates. Standard navy gray considered as most suitable shade.

The Science of Marine Camouflage Design, Everett L. Warner. Tran. Illum. Engr. Soc., vol. 14, no. 5, July 21, 1919, pp. 215-219, 10 figs. on four supp. plates. Showing various designs witb reference to principles involved. Paper presented before N. Y. Section Illum. Eng. Soc.

CAMPS. Construction of Camp Meade, R. F. Proctor. Cornell Civil Engr., vol. 27, no. 5, June 1919, pp. 159-167. Camp provides housing for 41,500 men.

CONSTRUCTION DIVISION, U. S. A. Expediting the Engineering Work of the Construction Division of the Army, A. B. McDaniel. Eng. & Contracting, vol. 52, no. 3, July 16, 1919, pp. 77-79, 3 figs. Outlining method for routing work and coordination of various departments.

DESTROYERS. Notes on Handling Destroyers, C. C. Slayton. U. S. Naval Inst. Proc., vol. 45, no. 7, July 1919, pp. 1201-1219, 6 figs. Suggestions to captains.

ENGINEERING IN THE NAVY. The Importance of Engineering to the Navy, Josephus Daniels. Jl. Engrs. Club of Philadelphia, vol. 36, no. 177, August 1919, pp. 299-300. From address at opening exercises of Post-Graduate School at Anapolis.

GERMAN FLEET, SINKING OF. The Sinking of tbe German Fleet at Scapa-Flow (Le Coulage de la flotte allemande a Scapa-Flow), A. Poildoué. Génie Civil, vol. 75, no. 1, July 5, 1919, pp. 1-7, 22 figs. Technical notes on relative values of British and German fleets. Structural features of ships which participated in Jutland battle.

GUN-MOUNT CONSTRUCTION. Building 5-inch Gun Mounts at Brantford, J. H. Moore. Can. Machy., vol. 22, no. 4, July 24, 1919, pp. 65-68, 9 figs. Dealing practically with machine-tool equipment. (To be concluded).

GUN MOUNTS, NAVAL. Making Naval Gun Mounts. Machinery (Lond.), vol. 14, no. 351, June 19, 1919, pp. 349-353, 11 figs. Tools, gages and fixtures used in operations. (Continued).

How the Navy Designed and Built tbe World's Heaviest Field Piece, C. L. McCrea. U. S. Naval Inst. Proc., vol. 45, no. 7, July 1919, pp. 1159-1169, 2 figs. Seven-inch caterpillar mount.

Mounts for Naval Anti-Aircraft Guns, Fred H. Colvin. Am. Mach., vol. 51, no. 2, July 10, 1919, pp. 79-83, 14 figs. Carriage and hall races. First article.

MINES. Bringing in tbe Sheaves, Clarence Nelson Hinkamp. U. S. Naval Inst. Proc., vol. 45, no. 7, July 1919, pp. 1117-1133, 11 figs. Structural details of German mines. Account of mine sweeping.

ORDNANCE BASE. Tbe Ordnance Base of the American Expeditionary Forces. Stone & Webster Jl., vol. 25, no. 1, July 1919, pp. 10-22, 14 figs., on supp. plates. Describes Mebun plant, which was laid out to serve army of two million men in france.

ORDNANCE MATERIALS. Tbe Manufacture of Steel for Ordnance Materials in England and in France, F. F. McIntosb. Proc. Engrs. Soc. Western Pa., vol. 35, no. 3, April 1919, pp. 140-163, and (discussion) pp. 164-170. Observation and impression obtained on inspection of steel mills tbrougb England and France. The method of etching for macrostructure of steel as developed by Mr. J. C. W. Humphreys, Chief Chemist in charge of Naval Inspector of Steels Lahoratory at Sheffied, England, is presented.

PARAVANES. Paravanes, George L. Catlin. U. S. Naval Inst. Proc., vol. 45, no. 7, July 1919, pp. 1135-1157, 8 figs. Types used, manner of applying them, and description of operation.

ZEEBRUGGE ATTACK. Destruction of the Flanders Triangle. Z. W. Wicks. U. S. Naval Inst. Proc., vol. 45, no. 7, July 1919, pp. 1093-1116, 3 figs. Technical consideration involved in planning the Zeebrugge attack.

INDUSTRIAL TECHNOLOGY

ALCOHOL. Etbyl Alcohol from Waste Sulphite Liquor, E. C. Sherrard and Galo W. Blanco. Paper, vol. 24, no. 17, July 2, 1919, pp. 15-21, and 26. Experiments conducted hoth commercially and experimentally said to bave shown production ranging from 0.70 to 1.15 per cent on a lahoratory scale and from 0.53 to 0.79 per cent on a large scale production.

AMMONIA. Manufacture of Ammonia hy .... of Electric Arc. Study of the Influence of a Partial Vacuum (Formation de l'ammoniaque au moyen de l'arc électrique. Etude spéciale de l'influence de la dépression), E. Briner and A. Baerfuss. Jl. Chimie Pbysique, vol. 17, no. 1, March 31, 1919, pp. 71-140, 3 figs. Experiments at chemical lahoratory of Geneva University. The best results obtained were mixture of one to tbree parts of nitrogen and hydrogen respectively.

The Manufacture of Ammonia and Ammonium Compounds, M. Rind, South Africa Jl. of Industries, vol. 2, no. 5, May 1919, pp. 463-466. Sources of production and uses.

BENZENE. Chlorination of Benzene. Analysis of Mixtures of Benzene, Chlorobenzene and Dichlorohenzene, etc., Percy F. Frankland, S. Raymond Carter and Dorothy Webster. Jl. Soc. Chem. Indus., vol. 38, no. 12, June 30, 1919, pp. 153T-155T, 1 fig. Three fractions obtained by interrupting distillation from Engler flask under uniform conditions at 122 deg. cent and again at 142 deg. cent. Percentages of henzene and chlorohenzene obtained from graph constructed from experiments with mixtures of know composition.

CARBON, ARTIFICIAL. The Manufacture of Artificial Carbon in Norway (Herstellung künstlicher Kohle in Norwegen), Sander. Dinglers Polytechnisches Journal, vol. 6, no. 334, Mar. 22, 1919, p. 63. The raw material used for this purpose is the lye drained off in the manufacture of cellulose, this lye heing rich in organic matter. The product obtained can he used either wet of dried.

CAUSTIC SODA. *See Chlorine.*

CHLORINE-CAUSTIC SODA. The United States Government Chlorine-Caustic Soda Plant at Edgewood Arsenal, Edgewood, Maryland, Samuel M. Green. Chem. & Metallurgical Eng., vol. 21, no. 1, July 1, 1919, pp. 17-24, 9 figs. Historical and descriptive account.

CLAYS. Some Properties of Bond Clays for Graphite Crucihles, M. C. Booze. Jl. Am. Ceramic Soc., vol. 2, no. 6, June 1919, pp. 461-476, 6 figs. Result of tests with nineteen domestic clays, one Englisb, and one German clay.

CRUCIBLES. *See Clays.*

The Effect of Electrolytes on the Properties of Graphite Crucible Bodies, H. G. Schurecht, Jl. Am. Ceramic Soc., vol. 2, no. 6, June 1919, pp. 443-450, 5 figs. Addition of NaOH to graphite-crucible hodies containing Dorset bond clay spoiled working properties of hodies, which offect of same electrolyte on on bodies containing Mississippi hond clay was observed to he improvement of their moldability. HCI claimed to have opposite effect.

CYANAMID. Warrior Extension Station for U. S. Nitrate Plant No. 2. Southern Engr., vol. 31, no. 5, July 1919, pp. 36-40, 7 figs. Plant uses cyanamid process.

Notes and Data on Fixed Nitrogen Plants. Chem. & Metallurgical Eng., vol. 21, no. 2, July 15, 1919, pp. 66-67. Cost figures obtained at Government's cyanamide process nitrate plant at Muscle Shoals as presented before Committee on Military Affairs of House of Representatives.

DUST PRECIPITATION. Electrical Cleaning of Blast Furnace Gas, W. H. Gellert. Blast Furnace & Steel Plant, vol. 7, no. 7, July 1919, pp. 334-339, 2 figs. Data concerning electrical precipitation.

DYES. Gas in the Dye Industry, Gilbert Colville Shadwell. Gas Rec., vol. 16, no.2, July 23, 1919, pp. 17-21, 10 figs. Points out possible utilization. (To be concluded).

FERTILIZERS. The World's Supply of Nitrogeneous Fertilizers, George W. Anderson. Gas Jl., vol. 146, no. 2926, June 10, 1919, pp. 695-696. As production of nitrogeneous products in Germany has heen greatly promoted during the war, writer helieves that a strong competition may be expected now that demand for munitions having ceased Germany will not he ahle to absorh total production herself.

GLASS. Glass-Making Before and During the War, Harry J. Powell. Jl. Roy. Soc. Arts, vol. 67, no. 3473, June 13, 1919, pp. 485-493, and (discussion) pp. 493-495. Descriptive account of progress made hy glass industry in England during the war.

Use of Optical Pyrometers for Control of Optical Glass Furnaces, Clarence N. Fenner. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1001-1011, 2 figs. Investigations at the Geophysical Lahoratory, Carnegie Instn. of Washington, and account of results obtained in actual practice.

Glass, with Special Reference to Its Production in South Africa, Percy A. Wagner, South Afriean Jl. of Industries, vol. 2, no. 5, May 1919, pp. 436-449, 2 figs. On selection of sands. (To he concluded).

Procedures in the Manufacture of Optical Glass, W. S. Williams and C. C. Rand. Jl. Am. Ceramic Soc., vol. 2, no. 6, June 1919, pp. 422-442, 6 figs. Account of investigations made by Bur. of Standards.

GREASE EXTRACTION. Extraction of Grease from Sewage Sludge at Morley, F. Turner. Surveyor, vol. 55, no. 1428, May 30, 1919, pp. 401-403. Including cost of operation. Paper read hefore Instn. Mun. and County Engrs.

HELIUM. Bibliography of Helium Literature, E. R. Weaver. Jl. Indus. & Eng. Chem., vol. 11, no. 7, July 1, 1919, pp. 682-688. Articles published in scientific magazines up to January 1, 1919.

HYDROGEN. *See Oxygen.*

LIME. Lime Calcination (Calcinacion de cal), W. D. Mount. Indenieria Internacional, vol. 1, no. 3, June 1919, pp. 154-155, 1 fig. Suggestions in regard to securing economy in production.

OIL, LINSEED. Effect of Exposure on Raw Linseed Oil, E. J. Shepard. Jl. Indus. & Eng. Chem., vol. 11, no. 7, July 1, 1919, pp. 637-639, 3 figs. Thickness of exposed layer thought to affect only rate of change in constants. For any gain in weight over range covered hy experiments described. changes occurring in constants were found to he independent of rate of gain in weight.

OPACIFIERS. Note on the Use of Magnesia as an Opacifier, V. S. Schory. Jl. Am. Ceramic Soc., vol. 2, no. 6, June 1919, pp. 477-480. Experiments to determine whether additions of small amounts of barium and zinc would result in increases transparency of glaze.

OXYGEN. Automatic Electrolytic-Oxy-Hydrogen Plant, Fred. H. Woodhull. Jl. Engrs. Club of Pbiladelphia, vol. 36, no. 176, July 1919, pp. 271-274, 1 fig. Features in connection with electrical operation and control of compressor set. Paper read hefore Assn. Iron & Steel Elec. Engrs.

Paints. Paint Pigments: Their History and Development, S. J. Cook. Chem. Indus., vol. 38, no. 11, June 16, 1919, pp. 137T-139T. With reference to Church's and Toch's methods of classification.

Paper. Waste Paper for Papermaking, Henry Aldous Bromley. Paper, vol. 24, no. 18, July 9, 1919, pp. 18-21. Researches on printing ink in relation to its destructibility.

Porcelain. An American Procelain Containing no Free Silica, Arthur S. Watts. Jl. Am. Ceramic Soc., vol. 2, no. 6, June 1919, pp. 488-489. It is claimed that by clacining or semi-fusing fluxes and flint prior to incorporation in procelain body maturing point can be lowered approximately two cones, color vastly improved, and resistanee to sudden temperature changes improved approximately 200 per cent.

Potash. Non-German Sources of Potash, Arthur Holmes. Geological Mag., vol. 6, no. 6, June 1919, pp. 251-254, 1 fig. Deposits in Alcace, Spain, and Abyssinia, where beds of potassium are associated in workable quantities with saline formations. (To be continued).

Rubber. Prices of Rubber Products, Isador Lubin. India Rubber World, vol. 60, no. 5, Aug. 1, 1919, pp. 614-620, 7 figs. From War Industries Board, Press Bulletin no. 30.

Recent Improvements in Rubber Compounds for Solid and Pneumatic Tires. India-Rubber Jl., vol. 58, no. 1, July 5, 1919, pp. 1-2 & 5. Advantages claimed for using carbon gas black in rubher compounds.

Soap. Colloid Chemical Studies of Soap—I. Martin H. Fisher. Chem. Engr., vol. 27, no. 7, July 1919, pp. 155-162, 8 figs. Hydration capacity of some pure soaps.

Sugar. Better Results by Better Management, L. W. Alwyn-Schmidt. Sugar, vol. 21, no. 7, July 1919, pp. 350-353. Quotes instance in which it is said installation of suitable equipment in sugar factory increased amount of sugar obtained from same quantity of raw material.

The Color of Sugar Cane Products and Decolorization in Factory Practice F. W. Zerban and E. C. Freeland. Sugar, vol. 21, no. 7, July 1919, pp. 354-359b, 2 figs. Results obtained in experiments at laboratory of Louisiana State University said to show that combination of ferric iron and polyphenols plays a very important part in the color of sugar-house products.

ORGANIZATION AND MANAGEMENT

ACCOUNTING, FINANCE AND COSTS

Building Factors in Costs. Fixing Building Factors in Costs, M. H. Potter. Iron Trade Rev., vol. 65, no. 2, July 10, 1919, pp. 97-98. How building and associated factors are apportioned in fixing indirect costs, Fourth article.

Chemical Manufactures. Cost Analysis in Chemical Manufacture—II, Jl. Soc. Chm. Indust., vol. 38, no. 12, June 30, 1919, pp. 224R-226R. Costs and efficiencies of pitric and sulphuric phuric acid production. Based on official reports of English foundries.

Coal-Production Costs. The Cost of Coal Production as Influenced by the Balancing of the Working Organization, F. W. Gray. Iron & Steel of Can., vol. 2, no. 7, July 1919, pp. 159-160. Cost increase since 1913. Unbalanced condition of working forces at collieries due to requirements of military service is quoted as prominent among reasons for increased expenditure required to produce coal.

Manufacturing Costs. A Graphical Analysis of Manufacturing Costs, E. L. Ackerman and L. F. Merritt. Am. Industries, vol. 19, no. 12, July 1919, pp. 20-21, 1 fig. Illustrates with hypothetical case graphical analysis of manufacturing costs of a given contract cancelled prior to completion.

Finding Costs of Manufacture, Clifford E. Lynn. Iron Trade Rev., vol. 65, no. 1, July 3, 1919, pp. 23-25, 5 figs. Recommended forms for keeping record. Fifth article.

Public Utilities. Organization and Methods of Puhlic Utilities Accounting, C. P. Staal. Nat. Elec. Light Assn. bul., vol. 6, no. 7, July 1919, pp. 392-397, 2 figs. Diagrams showing accounting department organization of Southern California Edison Co.

EDUCATION

Accident Prevention. How to Give Illustrated Lectures on Accident Prevention to Workmen, Roy S. Vonsih. U. S. Dept. Labor, Working Conditions Service, 1919, 13 pp. Believes that most effective way to prevent accidents is through lectures with slides and moving pictures, showing reuslts of accidents rather than how to avoid them.

Arc Welders. Training Operators for Arc Welding, E. Wanamaker and H. R. Pennington. Ry. Elec. Engr., vol. 10, no. 7, July 1919, pp. 226-231, 14 figs. Outlining methods said to have been used successfully.

See also Disabled Soldiers.

Colleges. *See Engineering Students.*

Disabled Soldiers. Electrical Occupations for Disabled Soldiers. Universal Engr., vol. 29, no. 6, June 1919, pp. 41-45. In construction, repair, and maintenance work.

Teaching Autogenous Welding to Disabled Soldiers (Lehrwerkstätte des Verhandes für autogene Metallbearbeitung an der staatlichen Maschinenbauschule zu Cöln). Acetylen in Wissenschaft und Industrie, vol. 22, nos. 3-4, Feb. 1919, pp. 15-18, 7 figs. Showing appliances used for various forms of disability.

Engineering Students. Broader Education for Engineers, George B. Pegran. Jl. Engrs. Club of Philadelphia, vol. 36, no. 176, July 1919, pp. 274-277. Preparing students to come into professional engineering course with fair general education on ordinary subjects and definite amount of preparation in fundamental sciences.

"Case System" Changes in Engineering Curricula, and Business Training for Engineers. Eng. News-Rec., vol. 83, no. 4, July 24, 1919, pp. 183-187. Result at Army Engineer School at Camp A. A. Humphreys in applying definite problem method. Radical reorganization in methods of instruction effected at Tufts College and Yale University.

Hawthorne Training Schools. Training Men and Women at Hawthorne, F. W. Willard. Western Elec. News, vol. 8, no. 5, July 1919, pp. 2-6. Theoretical as well as practical instruction.

Higher Positions. Choosing and Training the Man for the High Position, Julian McGill. Jl. Electricity, vol. 43, no. 1, July 1, 1919, pp. 11-12. Suggests rules governing training of men.

Miners. Educational Methods at the Copper Queen, Chas. F. Willis. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1099-1106, 1 fig. Course designed for education of miners to shift-boss position.

Upgrading in Training Department. Upgrading in the Training Department, M. R. Lott. Indus. Management, vol. 58, no. 2, Aug. 1919, pp. 100-104, 4 figs. Method of Sperry Gyroscope Co.

Tin-Plate Mills. Education a Plant Efficiency Factor, J. K. Lamoree. Iron Age, vol. 104, no. 5, July 31, 1919, pp. 296-297. Application in tin-plate mill.

Training. Preparing Industry for Reconstruction Demands, C. T. Clayton. Am. Mach., vol. 51, no. 1, July 3, 1919, pp. 19-22, 2 figs. Points out advantages of training men in manufacturing industry.

Vocational Education. Vocational Education Under the Smith-Hughes Act. Metal Trades, vol. 10, no. 7, July 1919, pp. 297-300. Provisions of the Act as far as industrial education is concerned.

FACTORY MANAGEMENT

Bonus Systems. Bonus System Reduces Coal Consumption at Denver, W. E. Casey and E. Weber. Power, vol. 50, no. 5, July 29, 1919, pp. 174-179, 7 figs, By installation of new turbine and introduction of bonus system, Denver tramway system claims to have reduced coal consumption to less than 2.5 lb. per kw-hr., with saving in operating expenses of about $150,000 per year.

Construction Records. Mastering Service Problems with a Master Sheet—II. Motor Age, vol. 36, no. 3, July 17, 1919, pp. 22-25, 7 figs. Service records for indicating rapair jobs through shop proves a time saver.

Progressive Cards for Shipyards Shipbuilding and Shipping Record, vol. 14, no. 2, July 10, 1919, pp. 41-42, 1 fig. Suggests system of checking progress of construction.

Drawing Office. The Principles of Drawing Office Organization, N. Gerard Smith. Eng. & Indus. Management, vol. 2, no. 1, July 3, 1919, pp. 13-15, 1 fig. Functions of office are believed to be (1) to design product and manufacturing plant and processes. (2) to collect ideas wherever they may be found, and to utilize them to best advantage. (3) to experiment with and demonstrate all new product and processes. (4) to deal with time study, (5) to record all data.

Employment Management. Employment, A. Rowland Entwistle. Eng. & Indus. Management vol. 1, no. 19, vol. 2, nos. 1 and 2, June 19, July 3, and 10, 1919, pp. 590-593, 6-10, 38-41, 1 fig. June 19: Object, scope and functions of the employment manager. July 3: Construction details of employment department. July 10: Qualifications of employment manager.

Physical Examination Previous to Employment, Chas. F. Willis. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 151, July 1919, pp. 1013-1020 Advocated not for the purpose of eliminating the unfit, but for measuring physical fitness and placing men where they can do the best for themselves, for their follow-workers and the company.

Gage Making. *See Management Methods.*

Garment Trades. *See Management Methods.*

Industrical Cooperation. Anti-Social, Militant Methods Condemned, Walter Gordon Merritt. Iron Age, vol. 104, no. 1, July 3, 1919, pp. 9-12. Cooperation of different companies through representatives chosen by employer and employees suggested.

Industrial Democracy—The Leitch Plan. Min. & Oil Bul., vol. 5, no. 7, June 1919, pp. 395-396 and p. 411. Co-operation between executive and operating individuals by means of an industrial democracy house of representatives.

Successful Industrial Democracy, Dale Wolf. Indus. Management, vol. 58, no. 1, Juy 1919, pp. 67-71, 2 figs. Participation board plan of Miller Lock Company.

Industrial Co-operation, W. R. Ingalls. Min. & Sci. Press, vol. 118, no. 26, June 28, 1919, pp. 877-884. Economical aspect. Paper read before Can. Min. Inst.

Industrial Democracy in Operation, B. C. Forbes. Iron Age, vol. 104, no. 4, July 24, 1919, pp. 239-240. Representative plan which has been adopted by a numher of companies.

Industrial Personnel Relations, Arthur H. Young. Mech. Eng., vol. 41, no. 7, July 1919, pp. 581-586. Human factor in organization system intended to promote safety; also account of International Harvester Co.'s plan of employees' representation.

Interchangeable Manufacture. Principles of Interchangeable Manufacturing, Earl Buckingham. Machinery, vol. 25, no. 11, July 1919, pp. 1024-1029. Factors which make possible, or permanent, interchangeable manufacture of mechanical products.

Labor Labels. Organizing an Industrial Republic, A. J. Hain. Iron Trade Rev., vol. 65, no. 4, July 24, 1919, pp. 21-26. Commercial possibilities of label or trade-mark bearing words "Made in an Industrial Democracy," or similar phrase to denote that product originated in factory where labor is given voice in management.

MANAGEMENT METHODS. Installing Management Methods in the Woodworking Industry, Carle M. Bigelow. Indus. Management, vol. 58, no. 1, July 1919, pp. 1-8, 6 figs. Necessity of establishing engineering department in woodworking industry emphasized by reference to writer's experience in several of these plants where lack of this department permitted conditions which encouraged waste and inefficiency. Basis for organizing such department is suggested.

How We Increased Output 1000 Per Cent in an Already Crowded Plant. Factory, vol. 23, no. 1, July 1919, pp. 40-42. Improvements performed in various departments such as giving better tempering to cutting in screw machine that was found to dull quickly. From experiences of Gillette Safety Razor Co.

Efficiency in the Gage-Making Department, C. B. Cole. Machinery, vol. 25. no. 11, July 1919, pp. 1056-1057. Operation and management of gage-making department on time, and money-saving basis.

Scientific Management in Road Construction, A. W. Campbell. Contract Rec., vol. 33, no. 26, June 25, 1919, pp. 634-635. System of cost-keeping for securing greatest possible performance for given outlay.

Modern Management Methods. Applied to Construction, Mean Higher Efficiency, Daniel J. Hauer. Contract Rec., vol. 33, no. 26, June 25, 1919, pp. 585-589. How scientific scheme of planning and organization opens way to greater and more certain profits.

Factory Management in Garment Trades, Mack Gordon. Indus. Management, vol. 58, no. 1 and 2, July and August, 1919, pp. 12-16, and 140-145, 10 figs. July: Functions and methods of planning department. August: Time studies and instructions.

Managing for Maximum Production, L. V. Estes. Indus. Management, vol. 58, no. 1 and 2, July and August 1919, pp. 54-61 and 134-138, 10 figs. July: V—Use of standards and instructions. August: VI—Emphasis is laid upon needed fostering spirit of co-operation, training some one to perpetuate and carry forward betterment work and making an occasional management audit.

Organizing for Work, H. L. Gantt. Indus. Management, vol. 58, no. 2, Aug. 1919, pp. 89-93, 3 figs. Machine-record charts, progress charts and man-record charts.

Organization and Management of a Machine-Tool Plant—II. Machy. (Lond.), vol. 14, no. 353, July 3, 1919, pp. 408-411, 10 figs. Work of planning department in relation to time study and rate setting in medium-sized plant making single line of machines.

System in the Small Works. Eng. Rev., vol. 32, no. 12, June 16, 1919, pp. 340-341. Points out that general shops need have very little fear of total extinction.

ORDERS. The Production Planning System of Heald Machine Company, W. S. Pratt. Am. Mach., vol. 51, no. 5. July 31, 1919, pp. 203-208, 9 figs. General system and writing of orders. (First article.)

PAYROLL COMPUTING. The Periodograph. A Decimal Time-Keeping Machine, J. V. Hunter. Am. Mach., vol. 51, no. 2, July 10, 1919, pp. 49-54, 20 figs. Division of hour into ten parts for purpose of simplifying work of payroll computer. Manufacturing operations at Periodograph shop.

PERIODOGRAPH. *See Payroll Computing.*

PLANNING DEPARTMENT. The Planning Department in Scientific Management—II, James F. Whiteford. Eng. & Indus. Management, vol. 1 & 2, no. 20 & 1, June 26 and July 3, 1919, pp. 632-636 and 23-24. Discussion following reading of paper of that title read before Indus. Reconstruction Council.

PLANT CONSTRUCTION. Planning the Industrial Plant—II, Hugh M. Wharton. Indus. Management, vol. 58, no. 1, July 1919, pp. 47-50, 11 figs. Application for standard types of construction. (To be continued.)

PLANT LAYOUT. Doubles Steelmaking Capacity, G. H. Manlove. Iron Trade Rev., vol. 65, no. 2, July 10, 1919, pp. 87-95, 13 figs. Works of Inland Steel Co., with reference especially to mill equipment and layout for routing of material.

Planning a Progress Department—III, W. J. Hiscox. Eng. & Indus. Management, vol. 1, no. 20, June 26 1919, pp. 621-622, 3 figs. Suggestions in regard to selecting location so as to permit efficient handling of materials and to prevent confusion and overlapping.

PRODUCTION. Increase Production to Reduce Prices. Contract Record, vol. 33, no. 30, July 23, 1919, pp. 713-715. Greater physical production considered as only solution of present industrial difficulties.

RATE SETTING. Time Study and Rate Setting in a Machine Tool Plant, Erik Oberg. Machinery, vol. 25, no. 11, July 1919, pp. 1051-1055, 8 figs. System consists of determining, by actual experiments or performance of work in shop, accurate estimate of time in which it can be done. Bonus time is a certain amount less than "standard" time so determined.

RATING WORKERS. Dangers in Rating Employees, Roy Willmarth Kelly. Indus. Management, vol. 58, no. 1, July 1919, pp. 35-42, 13 figs. Methods used by representative American firms in rating workers for salary advances and promotions. It is recommended that rating divisions be few and questions to be answered precise.

SCIENTIFIC MANAGEMENT. Scientific Management (Wissenschaftliche Betriebführung), Victor Frey. Schweizerische Bauzeitung, vol. 73, no. 21, May 24, 1919, pp. 237-240. With reference to systems of Taylor, Gilbreth-Ross and Gantt.

SHOP COMMITTEES. Shop Committees as Lubricants in Management, William Leavitt Stoddard. Factory, vol. 23, no. 1, July 1919, pp. 37-40, 2 figs. System of representation ordered by War Labor Board at Lynn works of General Electric Co. following strike of workers during June-July 1918.

Representative Shop Committees, Willard G. Aborn and William L. Shafer. Indus. Management, vol. 58, no. 1, July 1919, pp. 29-32. Discusses basis of representation method of election, election procedure, eligibility requirements, committee procedure, relations with labor unions and personnel of shop committees.

How Far Should Shop Committees Go? William Leavitt Stoddard. Indus. Management, vol. 58, no. 2, Aug. 1919, pp. 121-123. Observes that spirit of compromise must prevail else no good can be accomplished.

SMALL SHOP. *See Management Methods.*

SYMBOLIZATION, MNEMONIC. Factory "Nicknames" That Save Time, Henry H. Farquhar. Factory, vol. 23, no. 1, July 1919, pp. 50-53. Basis of mnemonic symbolization.

TAYLOR SYSTEM. An Object Lesson in Efficiency, Wilfred Lewis. Eng. & Indus. Management, vol. 1, no 19, June 19, 1919, pp. 594-596. Illustration of what has been accomplished along lines laid down by F. W. Taylor by the Tabor Mfg.

TOOL STORES. The Model Tool Stores—II & III, Herbert C. Armitage. Eng. & Indus. Management, vol. 1 & 2, no. 20 & 22, June 26 & July 10, 1919, pp. 615-617 and 35-37, 8 figs. Their functions as independent stores investigated chiefly in regard to maintenance of effective stocks of alwearing tools. Arrangement, organization, construction and equipment. (Continuation of serial.)

WAGE SYSTEMS. My Objection to the Piece Rate Method of Wage Payment—II. Harrington Emerson. Indus. Management, vol. 58, no. I, July 1919, pp. 17-20. Lays down physiological laws of work, and discusses manner of estimating task and preparing standard schedule.

See also Bonus Systems, Rate Setting.

WELFARE BUILDINGS. Design and Construction of Factories—17, Arthur F. Wickenden. Eng. & Indus. Management, vol. 1, no. 20, June 26, 1919, pp. 618-619. Welfare buildings.

WELFARE WORK. Co-operation Between Management and Employees, E. O. Davis, Textile World Jl., vol. 56, no. 3, July 19, 1919, pp. 49-51, 5 figs. Emphasizes need of welfare and educational work as means of increasing production and improving quality of manufactured products.

WOODWORKING INDUSTRY. *See Management Methods.*

WORK RECORDS. Machine Repair Records, John A. Davenport. Machy. (Lond.), vol. 14, no. 352, June 26 1919, pp. 365-367, 6 figs. Forms for keeping record of all repair work completed and in progress.

LABOR

FOREMEN. Who Make the Best Foremen? Factory, vol. 23, no. I, July 1919, pp. 63-67, 5 figs. Personnel record forms of Service Motor Truck Co.

GREAT BRITAIN. What I Found the British Employer Thinking About, Samuel Crowther. Factory, vol. 23, no. 1, July 1919, pp. 57-61. Position trade unions held at the beginning of the war; how women workers were affected by close of war.

Royal Commission on Industrial Relations Reports Its Findings on Labor Situation. Contract Rec., vol. 33, no. 28, July 9, 1919, pp. 667-668. Recommends, among other things, establishment by legislation of eight-hour day and recognition of greater rights of workers in control of industry.

INTELLIGENCE TESTS. Intelligence Tests in Industry, J. P. Lamb. Indus. Management, vol. 58, no. 1, July 1919, pp. 21-23, 1 fig. Experience in industrial plant where such tests have been used for three years believed to indicate advisability of conducting them.

INTERNATIONAL LABOR STANDARDS. Enforcement in U. S. of International Labor Standards, George W. Wickersham. Am. Industries, vol. 19, no. 12, July 1919, pp. 11-16 and p. 42. Conclusion derived by writer from analysis of labor program as outlined in recent conferences in Europe and the U. S. A.

LABOR UNREST. Prepare for Labor Unrest While Labor is Content, Harry Tipper. Automotive Indus., vol. 41, no. 2, July10, 1919, pp. 77-79. Points out that even during prosperity and industrial peace and contentment radicals never let their printing presses or propaganda machine lie idle. This, it is said, is lesson for American employees.

LIVING CONDITIONS. Making the Workman's Dollar Bigger, Emerson P. Harris. Indus. Management, vol. 58, no. 2, Aug. 1919, pp. 111-112. By insuring economy and real competition in the purveying of household supplies.

PROFIT SHARING. Fallacy of the Employees' Profit-Sharing as a Reward for Labor, P. L. Buckhard. Indus. Management, vol. 58, no. 1, July 1919, pp. 42-45. It is emphasized as fundamental fact that no profit sharing scheme can be substituted for a proper wage-payment system whereby adequate wages are paid to workers. It is pointed out that profit sharing must always be secondary to a fair, suitable reward for labor.

WOMEN. Women's Work in Engineering and Shipbuilding During the War, Lady Parsons. Engineering, vol. 108, no. 2793, July 11, 1919, p. 62. Statistical data obtained from report of War Cabinet Committee on Women in Industry. Paper read before North-East Coast Inst. of Engrs. and Shipbuilders.

Women in Industry (Die weibliche Hilfskraft im Fabrikbetriebe), Karl Benecke. Dinglers polytechnisches Journal, vol. 334, no. 1, Jan. 11, 1919, pp. 4-6, 3 figs. Writer believes that when properly selected, the number of women suitable for ordinary factory work will be found larger than generally supposed. He also considers training course, as introduced by many large plants in Germany, as best method for selection.

LEGAL

ACCIDENT LEGISLATION. Legislation and the Coal Trade, E. T. Good. Eng. & Indus. Management, vol. 2, no. 2, July 10, 1919, pp. 56-57. How accidents have been reduced.

DEPENDENCY. The Riddle of Dependency—II & III. Chesla C. Sherlock. Am. Mach., vol. 51, no. 1 & 2, July 3 & 10, 1919, pp. 10-12 and 70-72. Effects of desertion, bigamy, divorce and common-law marriages on the making of compensation awards. Question of disposing of compensation in case of death of workman's widow.

DISEASE AND ACCIDENT LIABILITY. Disease and Accident Liability, Chesla C. Sherlock. Iron Trade Rev., vol. 65, no. 3, July 17, 1919, pp. 168-169. It is noted that courts hold employer must pay damages when disease results from injury and when injury hastens fatal consequence of disease.

Explosion of Chemicals. The Explosion of Chemicals—I. Common Law Liability, Chesla C. Sherlock. Chem. & Metallurgical Eng., vol. 21, no. 2, July 15, 1919. pp. 83-84. With reference to court decisions bearing on the subject.

RECONSTRUCTION

Reconstruction Problems, F. R. Todd. Gas Engine, vol. 21, no. 7, July 1919, pp. 213-216. Expresses optimism in viewing readjustment during period of reconstruction.

The Industrial Situation, E. Garcke. Eng. Rev., vol. 32, no. 12, June 16, 1919, pp. 337-339. Pleads for readjustment of economic system in order to repair ravages of war, to inaugurate industrial peace and to prevent famine of capital a few years hence.

Foreign Countries. Readjustment and Reconstruction Activities in Foreign Countries, Grosvenor B. Clarkson. U. S. Council of Nat. Defense, Reconstruction Research Division, Washington, D.C., May 1, 1919, 188 pp. Extracts from and digests of article sconcerning readjustment and reconstruction activities in foreign countries, which have appeared in recent publications. Material selected consists of accounts of governmental activities in organization and administration of readjustment and reconstruction work, and of similar activities of important national industrial, commercial, and welfare organizations.

Great Britain. British Engineers' Reconstruction Problems, E. J. Elford. Good Roads, vol. 56, no. 3, July 16, 1919, pp. 23-35. Development of labor-saving machinery and methods of dealing with labor situation considered as chief problem of municipal engineers. Paper prepared for meeting of Instn. of Mun. & County Engrs.

International Competition. Applying Industrial Efficiency to Readjustment, Charles E. Bedaux. Am. Contractor, vol. 40, no. 29, July 19, 1919, pp. 21-22. Forecasts that future competition will require at least 33 per cent reduction in production costs to meet foreign labor costs.

Machine-Tool Reappraisal. How War Department will Revalue Used Machine Tools. Automotive Indus., vol. 41, no. 2, July 10, 1919, p. 67, 2 figs. Chart for use in appraisal of standard machine tools to determine service value.

Markets. Principle for Stabilizing Prosperity, G. Sumner Small. Indus. Management, vol. 58, no. 1, July 1919, pp. 24-28. Suggests utilization of reserve purchasing power of Government to sustain market, providing employment for idle labor on government work, and equalizing rate of purchase of materials with rate of consumption through governmental regulations.

SAFETY ENGINEERING

Acetylene Apparatus Explosions. Explosions in Acetylene Apparatus (Explosionen von Acetylen-Apparaten). Acetylen in Wissenschaff und Industrie vol. 22, nos. 1-2, Jan. 1919, pp. 4-5. New regulations for cleaning and handling apparatus.

Apparatus Failure. Accidents Due to Structural Defects of Apparatus or Injury to Apparatus, D. Dale Logan. Iron & Coal Trades Rev., vol. 98, no. 2677, June 20, 1919, pp. 850-851. Details of two fatal accidents which happened during rescue operations in France. Paper read before Instn. of Mining Engrs.

Breathing Apparatus. Development and Improvement of Breathing Apparatus, H. H. Sanderson. Can. Min. Inst. Bul., no. 87, July 1919, pp. 730-736. Particularly Gibbs and Paul apparatus.

Electrical Apparatus. Safety Rules for Men Handling Electrical Circuits or Apparatus. General Elec. Rev., vol. 22, no. 6, June 1919, pp. 484-486. Based on experience acquired in electrical field by General Electric Co.

Gas Poisoning. Protection Afforded by Army Gas Masks Against Various Industrial Gases, A. C. Fieldner, M. C. Teague and J. H. Yoe. Jl. Indus. & Eng. Chem., vol. 11, no. 7, July 1, 1919, pp. 622-623. Results of tests against various gases

Kerosene-Lamp Explosions. Kerosene Lamp Explosions, C. E. Worthington. Safety Eng., vol. 38. no. 1, July 1919, pp. 1-13, 9 figs. Lamp explosions are believed to be more properly termed flares. Conclusions are derived in regard to causes producing such explosions and remedies are suggested.

National Electric Safety Code. Is the National Electric Safety Code Suitable for California? Edward B. Rosa. Jl. of Electricity, vol. 43, no. 2, July 15, 1919, pp. 57-59. Standpoint of Bur. of Standards in regard to safety code and institution of code of ethics.

The National Electrical Safety Code, Geo. E. Quinan. Jl. of Electricity, vol. 43, no. 2, July 15, 1919, pp. 54-57. Discussion of problems, aims and the building up of present national code. Paper read before joint meeting of Am. Inst. Elec. Engrs. and Nat. Elec. Light Assn.

Safeguards. Industrial Safety—I, R. J. Young. Power Plant Eng., vol. 23, no. 15, August 1, 1919, pp. 689-690, 1 fig. Design and construction of safeguards. Lecture delivered before Schools for Safety Engr. conducted by Nat. Safety Council.

Safety-First Instructions. Safety First Instruction Through Moving Pictures, Ernest A. Dench. Jl. Electricity, vol. 43, no. 1, July 1, 1919, pp. 15-16. Pictures available and how to obtain them.

Sprinkler Protection. Automotic Sprinkler Protection a Necessity, C. G. Sherman. Contract Rec., vol. 33, no. 27, July 2, 1919, pp. 644-646. Claims that sprinkler have been proved 95 per cent efficient and that consequently they give a guarantee against fire loss that is needed when wastage is so high.

SALVAGE

Warring on Waste. XIII, Johnson Heywood. Factory, vol. 23, no. 1, July 1919, pp. 44-47, 2 figs. Instances showing how material has been saved in factories.

TRANSPORTATION

Industrial Electric Trucks. Use of Industrial Electric Trucks and Tractors by Railroads, Bernard J. Dillon. Elec. Rev., vol. 74, no. 26, June 28, 1919, pp. 1069-1073, 5 figs. Methods of application in handling of freight and baggage.

Motor Transportation. Motor Transportation, J. M. Ritchie. Jl. Engrs. Club of Philadelphia, vol. 36, no. 176, July 1919, pp. 281-282. Its relation to national highway development.

Hauling Over the Highways with Motor Trucks. Good Roads, vol. 18, no. 4, July 23, 1919, pp. 46-49, 14 figs. Examples of services performed by motor vehicles in rural motor express and intercity hauling. Cost data.

Rail and Truck Transportation Compared. The Relative Economy of Freight Transport by Railway and by Motor Truck, Charles Whiting Baker. Eng. News-Rec., vol. 83, no. 2, July 10, 1919, pp. 52-67. Based on figures compiled by Motor Truck Assn. of America and statistical data of railway companies having freight traffic less than 20,000 ton-miles per annum per mile of line.

Refuse Collection. Cost of Motor Truck Operation for Refuse Collection. Eng. & Contracting, vol. 52, no. 1, July 2, 1919, pp. 11-13. Data given by Rochester Bur. of Municipal Research.

Trailers. Trailers and Trucks for Highway Hauling, Harry Wilkin Perry. Good Roads, vol. 18, no. 4, July 23, 1919, pp. 41-44, 7 figs. How trailer solves special hauling problems, reduces road repair and maintenance costs and cuts down cost of highway transportation.

EXPORT

The Future of Industry, F. J. Whiting, Stone & Webster Jl., vol. 24, no. 6, June 1919, pp. 474-484. Considerations on saturation of home markets in the face of present prospects of enlarging our foreign trade.

China. International Engineering Interests in China. Eng., vol. 108, no. 2792, July 4, 1919, pp. 827-829. Advocates reconstruction scheme which should include international supervision of all new loan expenditures and loan allotment and creation of an international railway service, which should control all railway policy.

See also Machine Tools in China.

Electrical Products. Export Conditions for Electrical Products. Elec. World, vol. 74, no. 2, July 12, 1919, pp. 64-65. Summary of information on South American countries emphasizes element of financing sales of manufactured materials for public-utility use and water-power possibilities.

Internal-Combustion Engines. Where is the Foreign Market for Internal Combustion Engines, Lynn W. Meekins. Gas Engine, vol. 21, no. 8, August 1919, pp. 249-252. Possibilities of exporting internal combustion engines. Paper read before Nat. Gas Engine Assn.

Latin America, Rolling Stock. Entering the Latin American Markets, Percy F. Martin. Eng. & Indus. Management, vol. 1 (New Series), no. 20, June 26, 1919, pp. 628 and 630. Opportunities for manufacture of rolling stock.

Machine Tools in China. The Machine Shops of China, Frank A. Foster. Am. Mach., vol. 51, no. 3, July 17, 1919, pp. 99-103, 12 figs. Opportunities of American machine-tool builder.

RAILROAD ENGINEERING

CONSTRUCTION

Gradient, Economical. Technical Study Preliminary to Projecting a Railway (El control têcnico en los proyectos y ahras ferroviarias), César A. Cipriani. Informaciones y Memorias de la Sociedad de Ingenieros del Peru, vol. 21, no. 5, May 1919, pp. 227-232. Formula for determining economical gradient.

Station Rebuilding. Union Station is Rebuilt Without Interrupting Traffic. Eng. News-Rec., vol. 83, no. 2, July 10, 1919, pp. 84-87, 6 figs. Erecting elevated trainshed and rearranging tracks while carrying 165 trains daily.

Track Construction. Constructing a Track Layout in Close Quarters, W. F. Rench. Ry. Maintenance Engr., vol. 15, no. 7, July 1919, pp. 232-234, 1 fig. Difficulties encountered especially because rail was of heaviest section and had to be unloaded and placed by hand.

ELECTRIC RAILROADS

Italy. Electric Traction in Italy (La grande trazione elettrica in Italia). Industria, vol. 33, no. 11, June 15, 1919, pp. 325-329, 3 figs. Features of installation in line of 50 miles.

ELECTRIFICATION

Possibilities of Steam Railroad Electrification, Calvert Townley. Power Plant Eng., vol. 23, no. 14, July 15, 1919, pp. 639-642, 2 figs. Survey of electrified sections of railways, pointing out what are considered as advantages which had been realized in both freight and passenger service.

France and Belgium. Railway Electrification in France and Belgium, Robert E. Thayer. Ry. Age, vol. 67, no. 3, July 18, 1919, pp. 93-94. Plan under consideration involves electrification of 5,220 miles in France, and 147 miles in Belgium.

Main-Line Railroads. Electrification of Main-Line Railroads, W. B. Potter. Street Ry. Bul. vol. 19, no. 7, July 1919. pp. 252-258, 7 figs. Statistical data on power demands for electrical operation of steam railroads in United States. Remarks on design of electric locomotives. Also abstracted in General Elec. Rev., vol. 22, no. 6, June 1919, pp. 430-437, 7 figs.

Single-Phase High-Tension Current. The Shortage of Coal and the Electrification of Railroads (Die Kohlennot und die Elektrisierung der Bahnen), Richard Baecker. Zeitschrift des österr. Ingenieur-und Architekten-Vereins, vol. 71, no. 1, Jan. 3, 1919, pp. 6-8. Writer considers high-tension single-phase alternating current as best suited for standard gage systems of European railroads.

Sweden. Extensive Electrification Proposed for Sweden. Ry. Age, vol. 67, no. 2, July 11, 1919, pp. 61-63, 5 figs. Findings of commission appointed to study question. Of estimated total of 5,000,000 water h.p. available, 1,000,000 has been developed.

Switzerland. Electrification of Federal Railways (Electrification des chemins de fer fédéraux). Bulletin Technique de la Suisse Romande, vol. 45, no. 13, June 28, 1919, pp. 121-122, 2 figs. Hoeter reinforced-concrete piles. (To be continued.)

EQUIPMENT

Standardization. Standardization of Railway Equipment, Frank McManamy. Ry. Rev., vol. 65, no. 1, July 5, 1919, pp. 7-9. What Railroad Administration planned to do and expected to accomplish.

FOREIGN

South America. Railways in the Americas (Ferrocarriles en las Américas), Perciva Ingenieria Internacional, vol. 2, no. 1, July 1919, pp. 1-5, 1 fig. Points out advantages of building trunk lines with easly slopes in diminishing cost of freight and for developing uncultivated and slightly populated sections.

Necessity of Railways for the Development of South America (Ferrocarriles necesarios para la animacion y desrrollo de la América del Sur), F. B. Morris. Ingenieria Internacional, vol. 2, no. 1, July 1919, pp. 7-8, 1 fig. Indicates thre lines which writer believes are necessary for rapid development of South American continent.

Speed, Train. European Train Speeds. Ry. Gaz., vol. 30, no. 24, June 13, 1919, pp. 958-961, 1 fig. Germany and Scandinavia. Survey of highest, longest, an fastest non-stop runs, speed of trains between two places and geographical distrihution of important series. (Continuation of serial.)

LABOR

Suitability Tests. Suitability Tests for Railway Men. Eng. & Indus. Management, vol. 2, no. 1, July 3, 1919, pp. 3-5, 5 figs. Illustrating what are believed to be imperfections in processes devised to test mechanically man's psychological conditions and activities.

LOCOMOTIVE

Design. Problems in the Construction and Operation of Locomotives (Probleme in Lokomotivbau und -betrich), R. Sanzin. Zeitschrift des Osterr. Ingenieur-und Architekten-Vereins, vol. 70, no. 1, Jan. 4, 1918, pp. 1-5, 3 figs. Compares various types and discusses complete utilization of their power.

Engine Calibration. Engine Calibration as Adjunct to Efficient Operation, B. B. Milner. Ry. Rev., vol. 64, no. 26, June 28, 1919, pp. 1000-1004, 8 figs. Tests performed to determine maximum drawbar pull developed at various speeds and similar characteristics, for the purpose of gaining knowledge as to manner in which behavior of locomotives was effected through manipulation of reverse lever.

Fuel Economy. Locomotive Fuel Economy. Ry. Rev., vol. 65. no. 1, July 5, 1919, pp. 27-30, 2 figs. From report of committee on Fuel Economy and Smoke Prevention read at annual convention of Am. R. R. Assn.

Gasoline Locomotive. A New Petrol Shunting Locomotive. Ry. Gaz., vol. 31, no. 1, July 4, 1919, pp. 25-26, 1 fig. Engine is a 40-b. hp. internal-combustion motor having four water-jacketed cylinders working on 4-stroke principle.

Grand Trunk. Grand Trunk 0-6-0 Type Switching Locomotives. Ry. Age. vol. 67, no. 1, July 4, 1919, pp. 7-8, 1 fig. Tractive effort 36,700 lb.; weight in working order 168,000 lb.

Mallet. Simple Mallet Locomotive Pennsylvania R.R. Ry. Rev., vol. 65, no. 3, July 19, 1919, pp. 81-89, 14 figs. Among special features to which particular attention is called are design of firebox and combustion chamber, superheater, float system for water-level indication and multiple stack and exhaust nozzle arrangement. Also in Ry. & Locomotive Eng., vol. 32, no. 7, July 1919, pp. 193-194, 2 figs.

Standard. Standard Light Mountain Type. Ry. Mech. Engr., vol. 93, no. 7, July 1919, pp. 431-437, 9 figs. Total weight, 327,000 lb.; tractive effort, 53,900 lb.

Standardization of Parts. The Standardization of Parts for Half-Inch Scale Model Locomotives, Henry Greenly. Model Engr. & Elecn., vol. 40, nos. 945, 946 and 948, June 5, 12 and 26, 1919, pp. 448-453, 470-473 and 519-522, 18 figs. June 5 and 12: Schemes for types writer classifies into outside-cylinder and inside-cylinder machines. June 26: Method of building up a machine.

Front Ends, Grates and Ash Pans. Ry. Jl., vol. 25, no. 7, July 1919, pp. 19-21. Committee report before International Ry. Fuel Assn.

Stoking, Mechanical. Mechanical Stoking of Locomotives an Economy, W. S. Bartholomew. Ry. Age, vol. 67, no. 4, July 25, 1919, pp. 163-167, 7 figs. Factors determining necessity of applying stokers; operating results secured by stoker firing. Paper presented before Western Ry. Club.

Switching. C.C.C. & St. L. 0-8-0 Switchers, R. W. Retterer. Ry. Mech. Engr., vol. 93, no. 7, July 1919, pp. 411-414, 5 figs. Consolidation type converted with special features to adapt engines for switching service.

MAINTENANCE

Permanent Way. Maintenance of Permanent Way—I. Ry. Engr., vol. 40, no. 474, July 1919, pp. 141-143. Comparison of British and American methods of management. (To be continued.)

OPERATION AND MANAGEMENT

Accounting. Calculating Machine in Railroad Accounting, C. O. Price. Ry. Rev., vol. 64, no. 26, June 28, 1919, pp. 972-976, 5 figs. Contrasting present methods with those of ten years ago.

Allocation of Cars. Rolling Stock Distribution on the Midland Railway. Ry. Gaz., vol. 31, no. 1, July 4, 1919, pp. 9-16, 9 figs., partly on two supp. plates. Method of allocating vehicles which forms an essential part of the Company's train control system.

France. Brief Survey of the Road Organization in France, A. Forbes. Surveyor, vol. 55, no. 1430, June 13, 1919, pp. 439-441, 4 figs. Work done by British army in order to fit French road for war traffic. Paper read before Instn. Mun. & County Engrs.

Fuel Efficiency in Stationary Plants. Fuel Efficiency in Railroad Stationary Plants. Ry. Rev., vol. 65, no. 1, July 5, 1919, pp. 24-25, 1 fig. From report of committee on Fuel Economy and Smoke Prevention, read at annual convention of Am. R.R. Assn.

Interstate Commerce Law. A Comprehensive Revised Interstate Commerce Law. Ry. Age, vol. 67, no. 3, July 13, 1919, pp. 105-108. Suggestion for law which shall correlate laws passed since and including that of 1887.

Transfer Roads. How Operating Capacity Can Be Increased, E. H. Lee. Ry. Age, vol. 67, no. 1, July 4, 1919, pp. 34-36. Suggestions for improving intermediate transfer roads: from an appendix to preliminary report of Yards and Terminals Committee of Am. Ry. Eng. Assn.

PERMANENT WAY AND BUILDINGS

Grade-Separation Work. Extensive Grade Separation Work at Indianapolis. Ry. Age, vol. 67, no. 3, July 18, 1919, pp. 95-101, 16 figs. Improvements embrace a four-track high-level line and additional station facilities.

Track Support, Concrete. Concrete Railway Track Support. Eng. & Contracting, vol. 52, no. 3, July 16, 1919, pp. 65-67. 9 figs. Illustrating types constructed on various American railways. Paper read before Am. Concrete Inst. Also in Ry. Rev., vol. 65, no. 3, July 19, 1919, pp. 92-99, 20 figs.

Water Troughs. New Water Troughs at Langley. Great Northern Railway. Ry. Gaz., vol. 30, no. 25, June 20, 1919, pp. 997-999, 5 figs. Total length is 1,800 ft. of which 1,500 ft. is on level, the ramps at each end being 150 ft. long, graded to correspond with rails.

PUBLIC REGULATION

Government Operation. A New Advocate of Government Operation, Joseph B. Eastman. Ry. Age, vol. 67, no. 2, July 11, 1919, pp. 57-58. Letter to Congress suggesting that modifications pronosed in the Cummins bill be continued "for an appropriate period of time," in order that uncertaintly as to immediate future may be ended and sufficient time gained for deliberate and constructive consideration of entire problem.

RAILS

Electric-Railway Rails. . Notes on the History and Development of Electric Railway Rails, R. C. Cram. Elec. Ry. Jl., vol. 54, no. 3, July 19, pp. 106-112, 11 figs. Takes up practical and theoretical considerations which aregradually leading to rail standardization and simplification.

ROLLING STOCK

Box Cars. Box Cars for Chilean Railway. Ry. Mech. Engr., vol. 93, no. 7, July 1919, pp. 417-420, 5 figs. Steel construction of American type for meter-gage line, including M.C.B. couplers and trucks.

See also Express Cars.

Express Cars. Utility Express Car of the Pennsylvania Railroad. Ry. Rev., vol. 65, no. 1, July 5, 1919, pp. 1-5, 6 figs. Box car fitted with heating and axle lighting equipment, and "semi-passenger" design of trucks to permit of its being run in fast trains.

Hopper and Gondola Cars. High Capacity Hopper and Gondola Cars, Pennsylvania Railroad. Ry. Rev., vol. 65, no. 2, July 12, 1919,pp. 45-50, 11 figs. Bodies fabricated from plates and pressed-steel shapes. Underframe is composed of center sills, consisting of two 10-in. channels, weighing 30 lb. per ft. and two side sills, for which 4 x 6 x ¾-in. angles are used.

Lighting. Report on Train Lighting and Equipment. Ry. Elec. Engr., vol. 10, no. 7, July 1919, pp. 233-240, 9 figs. Relating particularly work done by committee to develop standard ratings for axle generators. Paper presented at Ann. Conv. of Am. RR. Assn.

Vibration. On the Vibration of Railway Cars, N. Fukushima. (In Japanese.) Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 56, Feb. 1919.

SAFETY AND SIGNALING SYSTEMS

Explosives, Transportation of. The Baltimore Tunnel Disaster, Frank H. Kneeland. Coal Age, vol. 16, no. 2, July 10, 1919, pp. 55-58, 3 figs. Judicial inquiry into causes which led to explosion of blasting powder which was being carried in same mined car with workmen.

Fire Prevention. Fire Prevention on Railroads, W. H. Hoyt. Bul. Affiliated Eng. Societies of Minnesota, vol. 4, no. 5, May 1919, pp. 89-94. Methods of reducing fire loss grouped under three heads—(1)fireproof construction, (2) fire-prevention and fire-fighting equipment, and (3) inspection and education. Applicability and value of each of these to fire prevention on railroads is discussed.

Locomotive Failures. Personal Injuries Due to Locomotive Failures, John L. Mohun. Ry. Age, vol. 67, no. 3, July 18, 1919, pp. 113-118, 2 figs. Suggestions for their reduction based on review of Interstate Commerce Commission locomotive inspection reports.

Safety-Signal Repetition. Safety in Operation of Railroads (La sécurité de la circulation des trains de chemin de fer), J. Carlier. Société belge des Electriciens, vol. 33, April-June 1919, pp. 99-132, 3 figs. "Cesar" apparatus installed in locomotives for repeating safety signals.

Switch Machines. The Use of Low Voltage Switch Machines, A. R. Whitehorn. Ry. Signal Engr., vol. 12, no. 7, July 1919, pp. 241-242, 2 figs. Describing why such apparatus has been introduced and the main requirements to be met.

SHOPS

Chile. New Shops of the Chilean State Railways, Ernesto Gusman Donoso. Ry. Rev., vol. 64, no. 26, June 28, 1919, pp. 967-972, 8 figs. Reinforced-concrete sanitary repair plant.

Smoke Jack. An Unusual Form of Roundhouse Smoke Jack. Ry. Age, vol. 67, no. 4, July 25, 1919, pp. 155-157, 7 figs. Smoke jacks that cover entire length of stalls, special form of door construction and reinforced-gypsum roof mentioned as features in roundhouse of Pittsburgh & Lake Erie at Haselton, Ohio.

SPECIAL LINES

Light Railways. Light Railways (Ferrocarriles livianos), Charles F. Lang. Ingenieria internacional, vol. 2, no. 1, July 1919, pp. 9-11, 5 figs. Economic advantages.

Construction and Operation of Light Railways in France, J. H. McKnight. Annual Report of Assn. of Dominion Land Surveyors, January 29, 30 and 31, 1919, pp. 136-139, 1 fig. Types used for military purpose.

A Technical Description of the British Light Railways in France, B. W. Guppy. Prof Memoirs, Corps Engrs. U. S. Army & Engr. Dept., vol. 11, no. 56, March April 1919, pp. 185-216. System was designed to connect broad-gage railways with front. Operating rules and signals are given.

STREET RAILWAYS

. New Cars for Liverpool Corporation Tramways. Tramway & Railway World, vol. 45, no. 30, June 19, 1919, pp. 307-308, 4 figs. Single-truck car with reversed stairway and canopy top.

One-Man Car Operation, S. W. Greenland. Elec. Traction, vol. 15, no. 7, July 1919, pp. 421-423. Types, service, and data secured from their operation. Paper read before Central Elec. Ry. Assn.

.veland. Cleveland Rapid Transit Report. Elec. Ry. Jl., vol. 54, no. 2, July 12, 1919, pp. 71-74, 5 figs. Report of Rapid Transit Commission of the city suggesting means of relief for present congestion and plans for development of rapid transit system.

.pan. Practices and Tendencies In Japanese Electric Railway Transportation, Shiro Sano. Elec. Ry. Jl., vol. 54, no. 1, July 5, 1919, pp. 4-6, 7 figs. Both double and single trolley are used, track gages are far from standard and people seem to lean toward public ownership.

Moving Platforms. Continuous Trains for Forty-Second Street Transit, Henry B. Seaman. Eng. News-Rec., vol. 82, no. 26, June 26, 1919, pp. 1248-1250, 3 figs. Moving platforms recommended. Operation illustrated.

Passenger Traffic, Analysis of. Methods of Observing and Analyzing Passenger Traffic, R. H. Horton. Elec. Ry. Jl., vol. 54, no. 2, July 12, 1919, pp. 75-78, 3 figs. Merits of various methods of obtaining data are pointed out and suggestions are offered in regard to using traffic study data.

Rail Hardening. The Sandberg "In Situ" Rail Hardening Process, Robt. B. Holt. Tramway & Railway World, vol. 45, no. 30, June 19, 1919, pp. 314-315, 1 fig. Experiments carried out by operating a car on an upgradient on a length of track a portion of which had been treated by the "in situ" process, with the front motor cut out and brakes applied to front wheels.

Track Construction. Latest British Street-Railway Track Construction. Eng. News-Rec., vol. 83, no. 2, July 10, 1919, p. 83, 2 figs. Ties generally omitted; bituminous granite chip packing under rails used; standard welding and rail hardening in place.

Bonds for Temporary and Permanent Track Construction, G. H. McKelway. Elec. Ry. Jl., vol. 54, no. 3, July 19, 1919, pp. 114-117, 14 figs. Advantages and disadvantages of various types are discussed from practical standpoint.

Zone Fares. The Zone Fare in Practice, Walter Jackson. Elec. Ry. Jl., vol. 54, nos. 1, 2 and 4, July 5, 12 and 26, 1919; pp. 7-12, 56-61 and 154-157, 27 figs. July 5: Comparative bus and trolley statistics obtained at Leeds, England. July 12: Despite higher fares and cut in service, traffic is said to have fallen off only 3.4 per cent and revenue increased 23.3 per cent. July 26: How British Elec. Traction Co. stimulated riding as close to destination as possible by introducing halp-penny stages on top of maximum penny ride.

TERMINALS

Chicago. Proposed New Passenger Terminal in Chicago. Ry. Rev., vol. 65 no. 2. July 12, 1919, pp. 57-61, 6 figs. Plans of Illinois Central which also involves electrification for all types of service and lake front developments.

Illinois Central Will Build New Chicago Terminal. Ry. Age, vol. 67, no. 2, July 11, 1919, pp. 51-54, 3 figs. Electrification project embracing terminal capable of development to accommodate all railroads at present entering passenger stations east of Chicago River.

Pennsylvania. Engine Terminal Imrpovements: Pennsylvania Lines West. Eng. News-Rec., vol. 83, no. 1, July 3, 1919, pp. 24-28, 5 figs. Heavy travelling crane, circular crane runway, parking tracks with transfer table and turntable and mechanical ashpits.

Northwest Pennsylvania's Newest Station, J. B. Scott. Elec. World, vol. 74, no. 2, July 12, 1919, pp. 60-63, 5 figs. Power house built on unit principle. It is expected that installation will eventually be rated at 120,000 kw.

GENERAL SCIENCE

CHEMISTRY

Air Analysis. A Simple Form of Apparatus for Estimating the Oxygen Content of Air from the Upper Atmosphere, Francis William Aston. Jl. Chem. Soc., vols. 115-116, no. 679, May 1919, pp. 472-475, 1 fig. Watson apparatus modified by measuring difference only in oxygen content between sample and normal air.

Apparatus for the Rapid Analysis of Confined Air and Unhealthy Atmospheres (Appareil pour l'analyse rapide de l'air confiné et des atmosphères insalubres). Génie Civil, vol. 74, no. 24, June 14, 1919, p. 490, 1 fig. Air drawn in through independent Clocz flasks by running water out of large zinc cylinder. Apparatus permits simultaneous examination of various atmospheres.

Allotropy. Theory of Allotropy; Allotropes and Allotropoids, Maurice Copisarow. Chem. News, vol. 118, no. 3086, June 6, 1919, pp. 265-266, Regaros allotropy as function of valency and defines it as "capacity of an element to exist in forms, differing in the mode of their ultra-molecular linkage."

Analysis, Electrochemical. New and Rapid Apparatus for Electrochemical Analyses, J. T. King, Chem. & Metallurgical Eng., vol. 21, no. 1, July 1, 1919, pp. 25-29, 7 figs. Stirring effected by rotating containing beaker. Table showing results of experiments on three different brasses, obtained by this and other methods of stirring and carried out by different operators, is included.
See also under names of materials analyzed.

Analysis, Chemical. Quantitative Analysis of Nickel in Ferro-Nickels and Steels (Dosage du nickel dans les ferro-nickels et les aciers), Paul Nicolardot and Goerges Gourmain. Bul. Société Chimique de France, vol. 25-27, no. 6, June 1919, pp. 338-344. Preference is given to eletrolytic method, which is said to be most exact.

Asphalt Precipitation. Quick Method for Determination of Hard Asphalt (Schnellmethode zur Bestimmung von Hartasphalt), J. Tausz and A. Luttgen. Petroleum, vol. 14, no. 14, Apr. 15, 1919, pp. 653-654, 1 fig. Principal features of method are: Hard asphalt is precipitated with benzine in special small centrifugal containers which may be weighed on the micro scale, and is immediately put into the centrifugal apparatus, where it is said to be completely separated within 10 min.

Calcium Determination. *See Zinc and Calcium Determination.*

Clay Analysis. A Simplified Apparatus for the Determination of Air in Clay, H. Spurrier. Jl. Am. Ceramic Soc., vol. 2, no. 6, June 1919, pp. 490-493, 2 figs. Disengaging gases occluded in clay by use of air-free and nearly boiling water, introduced as simplification in process given as accurate in connection with apparatus described in Jl. Am. Ceramic Soc., 1, 710-715, 1918.

Cyanide Reactions. The Sensitiveness of Some Cyanide Reactions, John B. Ekeley and Icie C. Macy. Proc. Colorado Sci. Soc., vol. 11, June 1919, pp. 269-274, 1 fig. Experiments lead to recommendation that Schonbein tests should be carried out in closed vessels in dark to get trust-worthy results.

Distillation. New Laboratory Alembic and Measure of its Efficiency (Sur une nouvelle colonne à distiller, pour laboratoire et sur la mesure de son efficacité), M. H. Robert. Comptes rendus des séances de l'Académir des Sciences, vol. 168, no. 20, May 1919, pp. 998-1001, 2 figs. For fractional distillation.

Elements. New Periodic Classification of the Chemical Elements (Sur une nouvelle classification périodique des éléments chimiques), Marc Chauvierre. Bul. Société Chimique de France, vol. 25-26, no. 6, June 1919, pp. 297-305, 1 fig. Based on periodicity resulting from atomic weights and presented as applicable to theories of organic evolution and believed to suggest hypotheses ezplaning origin of radioactive phenomenon.

Explosive Reactions, Temperature. Temperature Obtained in Explosive Reactions (Sur la détermination des températures atteintes dans les réactions explosives), Henri Muraour. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 20, May 19, 1919, pp. 995-997. Experiments are said to have proved that the greater part of methane contained in the products of combustion of powders is formed during period of cooling.

Gas Analysis. Computation Tables for Flue and Chimney Gas Analyses (Rechentafeln zur Rauchgas und Auspuffanalyse), Wa. Ostwald. Feuerungstechnik, vol. 7, no. 7, Jan. 1, 1919, pp. 53-57, 12 figs., partly on supp. plate. Endeavors to show the state of dependence to each other of the following variations: (1) proportion of mixture or surplus of air or air factor of exhaust mixture, (2) completeness of combustion or percentage of carbon monoxide, (3) percentage of carbonic acid in flue gases, (4) percentage of free oxygen in flue gases.

Lead Sulphide. The Chemical Equilibrium between Sulphide of Lead and Its Roasting Products (Ueber die chemischen Gleichgewichte zwischen Bleisulfid und seinen Röstprodukten), Rudolf Schenk and Agnès Albers. Zeitschrift für anorganische und allgemeine Chemie, vol. 105, no. 4, Apr. 3, 1919, pp. 145-146, 6 figs. Purpose of Experiments was to determine nature of tension curves and to deduce from these the condition of existence of the various solid phases.

PETROLEUM ANALYSIS. Estimation of Benzene and Toluene in Petroleum, F. B. Thole. Chem. Indus. vol. 38, no. 4, Feb. 28, 1919, pp. 39T-43T, 2 figs. Comparative examination of various methods.

PHOSPHATES, ACID. On Various Properties of Acid Phosphates (Sur quelques propriétés des phosphates acides), A. Joannis. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 24, June 16, 1919, pp. 1202-1203. Experiments said to confirm Berthelot's conclusions in regard to the different values he obtained for the three acid functions of phosphoric acid.

ROCK ANALYSIS. The Determination of Combustible Matter in Silicate and Carbonate Rocks, A. C. Fieldner, W. A. Selvig and G. B. Taylor. Bur. of Mines technical paper no. 212, April 1919, 22 pp., 1 fig. Lissner's method of determining organic carbon and hydrogen found to give abnormally high results for organic hydrogen in rocks containing small amounts of combustible matter.

SCHONBEIN TEST. *See Cyanide Reactions.*

SOIL ANALYSIS. A Simplified Wet Combustion Method for the Determination of Carbon in Soils, D. D. Waynick. Jl. Indus. & Eng. Chem., vol. 11, no. 7, July 1, 1919, pp. 634-637, 1 fig. Said to require about 25 min. total time for determination.

SOLUBILITY. Solubility—III. Relative Values of Internal Pressures and their Practical Application, Joel H. Hildebrand. Jl. Am. Chem. Soc., vol. 41, no. 7, July 1919, pp. 1067-1080. Various methods for calculating solubility of liquids are reviewed and though the values they yield differ considerably, arguments are presented to show that they are closely parallel.

STEEL ANALYSIS. The Determination of Vanadium in Steels by Electrometric Titration. The Selective Oxidation of Vanadyl Salts by Nitric Acid in the Presence of Chromic Salts, G. L. Kelley, J. A. Wiley, R. T. Bohn and W. C. Wright. Jl. Indus. & Eng. Chem., vol. 11, no. 7, July 1, 1919, pp. 632-634. With illustration of application of methods to analysis of synthetic steels.

ZINC AND CALCIUM DETERMINATION. Determination of Zinc and Calcium in the Presence of Lead, Ernest Nyman. Can. Chem. Jl., vol. 3, no. 7, July 1919, pp. 217-218. Based on solubility of lead ferrocyanide and lead oxalate in ammi acetate solution and titration of zinc in ammoniacal solution by using uranylacetate weakly acidified with hydrochloric acid as outside i nicator.

ZIRCONIUM ANALYSIS. Analysis of Zirconium Ores and Alloys. A. Travers. Metal Industry, vol. 14, no. 22, May 30, 1919, pp. 441-444. Chancel's method of separating ZrO_2 and Fe_2O_3 by means of sodium hyposulphite considered as best.

MATHEMATICS

DETERMINANTS. Notes on the Determinant of the Primary Minors of a Special Set of $(n1)$ — by n Arrays, Thomas Muir. Proc Roy. Soc. of Edinburgh, vol. 39, part 1, Session 1918-19, pp. 35-40. Cases in which determinant vanishes.

EQUATIONS. Two-dimensional Solutions of Poisson's and Laplace's Equations, Leonard Bairstow and Arthur Berry. Proc. Ry. Soc., Series A, vol. 95, no. A 672, June 4, 1919, pp. 457-475, 2 figs. Based on theorem stating that "any irrotational acyclic fluid motion can be reproduced by an appropriate choice of simple sources round the fied boundaries." Strength of sources corresponding with given boundaries is determined by solution of an integral equation; in case of double boudaries simultaneous integral equations are solved.

Application of Gibbs-Helmholtz Equation to Monovariant Systems (Sur l'application de l'équation de Gibbs-Helmholtz, aux systèmes monovariants), A. Boutaric. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 19, May 12, 1919, pp. 939-942. Suggests modification in form adapted by Nernst for extending above equation to such systems.

Numerical Integration of Differential Equations, F. R. Moulton. Jl. U. S. Artillery, vol. 51, no. 1, July 1919, pp. 40-55, 1 fig. Examples illustrating application of Picard's method.

On the Numerical Integration of Differential Equations, H. T. H. Piaggio. Lond., Edingburgh and Dublin, Phil. Mag., vol. 37, no. 222, June ,1919, pp. 596-600, 1 fig. Formula for computing order of magnitude of error in final result when Runge's formula (Math. Ann., vol. 46, 1895) is used.

ISOTHERMAL SURFACES. On Isothermal Surfaces (Sur les surfaces isothermiques), C. Guichard. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 24, June 16, 1919, pp. 1185-1188. Solution of equation of system formed by lines of curvature, which is satisfied by the solutions of Laplace, of an equation having equal invariants such that the sum of their equares equals zero.

POLYNOMIALS. Development of Jacobi's Polynomials (Sur les développements de Jacobi), Erwand Kogbetliantz. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 20, May 19, 1919, pp. 992-994. Limiting cases of summation.

RULED SURFACES. On a Certain Class of Rational Ruled Surfaces, Arnold Emch. Proc. Nat. Acad. Sciences, vol. 5, no. 6, June 15, 1919, pp. 222-224. Surfaces considered are those obtained by generatrix moving in such a manner that a fixed point of it moves uniformly along circle, while generatrix in every position passes through directrix line.

SERIES. Summation of Divergent Series (Sur la sommation des séries divergentes), Erwand Kogbetliantz. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 22, June 2, 1919, pp. 1090-1092. Theorem concerning application of method $(R, \bar{n}, y)$ by Riesz typical mean function.

TRIGONOMETRIC SERIES. Trigonometric Series (Sur les séries trigonométriques), Erwand Kognetliantz. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 24, June 16, 1919, pp. 1193-1194. Problem summation $(C, \delta < o)$.

VECTOR ALGEBRA. Further Contributions to Non-Metrical Vector Algebra, L. Silberstein. Lond, Edingurgh, and Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 115-143, 6 figs. Theory of vector multiplication.

PHYSICS

ACOUSTICS. The Resonance Theory of Audition subjected to Experiments, E. H. Barton and H. M. Browning. Loud., Edinburgh, and Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 164-173, I fig. Reviewing position of resonance theory about audition, writer acknowledges subject to be controversial, but endeavors to throw sidelight upon it by trial of a graduated set of pendulums.

The Function of Phase Difference in the Binaural Location of Pure Tones, R. V. L. Hartley. Physical Rev., vol. 13, no. 6, June 1919, pp. 373-385, 5 figs. In expressing sound images observed when pure tones of same frequency and intensity but of different phase are applied to the two ears, use is made of theoretical curves calculated by Stewart and Fry, giving relation between the position of actual source and the resulting phase difference of sound at the two ears.

The Absolute Measurement of the Intensity of Sound, Arthur Gordon Webster. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 7, July 1919, pp. 889-900, 8 figs. on two supp. plates. Theory of operation of phone (used for measuring output of sound in watts of energy), phonometer (for measuring a sound in absolute units), and phonotrope (designed and used to find direction of a source of sound). A list of various technical papers on sound is apprended.

COLLOID WEIGHING. A New Method of Weighing Colloidal Particles, E. F. Burton. Proc. Roy. Soc., Series A, vol. 95, no. A 672, June 4, 1919, pp. 480-483, 1 fig. Method described as artificial production of settling due to gravitation by superimposing motion produced in electrical field maintained in liquid medium up that due to gravitation.

COLORS. The Persistence of Vision of Colours of Varying Intensity, Frank Allen. Lond., Edinburgh & Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 81-89, 5 figs. Method of critical frequency of flicker applied to investigating phenomena of color vision.

CRYSTAL FORMATION. A Method of Growing Large Perfect Crystals from Solution, R. W. More. Jl. Am. Chem. Soc., vol. 41, no. 7, July 1919, pp. 1060-1066, 3 figs. It consists of placing small seed crystals or several in nearly saturated solution of salt, cooling solution until it is very slightly supersaturated, and maintaining a sate of slighy supersaturation by slowly colling solution, with the temperature regulated within very narrow limits.

ELECTRON DISCHARGES. Determining the Velocity of Electron Discharge (Ueber die Bestimmung von Elektronen-Austrittsgeschwindigkeiten), A. Becker. Annalen der Physik, vol. 58, no. 5, 1919, pp. 393-473, 17 figs. Theories: homogeneous field; Cosine law of radiation; practical derivations; special applications.

FLUID FLOW. Flow of Gasoline Vapor (Sur l'écoulement de la vapeur de pétrole). Jean Rey. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 22, June 2, 1919, pp. 1092-1095. Further discussion of equations presented in Comptes Rendus, vol. 168, 1919, p. 509.

FLUIDS. The Spreading of Fluids on Glass—III, W. B. Hardy. Lond., Edinburgh, and Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 49-55. Evidence offered in confirmation of Lord Rayleigh's suggestion that complicated secondary composite surface are due to chemical heterogeneity of surface layer.

GRAVITATION. On a Possible Limit to Gravitation, Frank W. Very. Am. Jl. Sci. vol. 48, no. 283, July 1919, pp. 33-46. Conclusion reached in argument is that gravitational vibrations are probably confined within definite volume of universal medium, or magnetic aura and are limited outwardly by form, motion and peculiar properties of this medium exercises general control on all gravitative phenomena.

HEAT MEASUREMENT. The Measurement of Heat and the Scope of Carnot's Principle, Arthur C. Lunn. Physical Rev., vol. 14, no. 1, July 1919, pp. 1-19. What is termed symmetric form of exposition of principle of thermodyanmics is developed through recognizing on a parity from the outset the two kinds of conservation naturally called after Black and Carnot which lead to energy and entropy scales of measurement of heat.

HEAT, MECHANICAL, EQUIVALENT OF. Value of the Mechanical Equivalent of Heat (Ueber den Wert des mechanischen Warme-aquivalents), W. Jaeger and H. von Steinwehr. Annalen der Physik, vol. 58, no. 5, 1919, pp. 487-488. Discussion of value found by Carlton Sutton and table of equivalents obtained in research work of twelve other scientists, during period extending from 1843 to 1915.

LIQUIDS. Vapor Pressure of Thin Liquid films (Pression de vapeur des liquides en lames minces), Felix Michaud. Comptes rendus des séances de l'Academie des Sciences, vol. 168, no. 23 June 10, 1919, pp. 1155-57. Concluded analytically vapor from each films exerts pressure considerably below normal corresponding to conditions of saturation.

The Rotational Oscillation of a Cylinder in a Viscouous Liquod. D. Coster. Lond., Edinhurgh and Dublin Phil. Mag., vol 37, no. 222, June 1919, pp. 587-594, 1 fig. Following method used by Professor Verschaffel in analogous case of sphere. (Comm. Leiden, p. 22.)

MICHELSON'S EXPERIMENT. *See Relativity.*

OPTICS. Scattering of Light by Solid Substances, R. J. Strutt. Proc. Roy. Soc., Series A, vol. 95, no. A 672, June 4, 1919, pp. 476-479, 4 figs., on separate plate. Comparison between . . . . of vibration, (1) parallel to direction of primary beam, and (2) perpendicular to primary beam. Former is given as percentage of meter. Result for Chance's crown glass given as 8 per cent and for ordinary plate glass as 3 per cent.

Velocity of Light in Turbid Media (Sur la vitesse de la lumière dans les milieux troubles), Charles Cheneveau and René Audubert. Comptes Rendus des séances de l'Académie des Sciences, vol. 168, no. 19, May 12, 1919, pp. 957-959. Reflective character of optical phenomena presented by media containing large particles in suspension.

OSMOTIC PRESSURES. On Osmotic Pressures Derived from Vapour-Pressure Measurements: Aqueous Solutions of Cane Sugar and Methyl Glucoside, E. G. J. Hartley and C. V. Burton. Phil. Tran. Roy. Soc. Lond., Series A 565, vol. 218, May 20, 1919, pp. 295-349, 6 figs. Investigations to determine best conditions for making method described in Roy. Soc. Proc., A, vol. 77, 1906, and in Phil. Trans., A, vol. 209, both accurate and of general applicability, and to obtain data for construction of suitable apparatus for determination of absolute vapour denisty of liquids in air or other gas.

Photographic Rendering of Contrast. The Fundamental Law for the true Photographic-Rendering of Contrast, Alfred W. Porter and R. E. Slade. Lond., Edinburgh, and Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 187-197, 9 figs. Examination of technical principles assumed in method of treating photographic plates devolved after researches of F. Hurter and V. C. Driffield. (See Jl. Sic. Chem. Industry, May 31, 1890.)

Radioactivity. On the Relation between the K Series and the L Series of X-Rays, William Duane and Takeo Shimizu. Physical Rev., vol. 14, no. 1, July 1919, pp. 67-73, 2 figs. Experiments with tungsten. Graphs are given representing ionization currents as functions of the crystal table angle.

Radioactive Bricks, H. J. Knollman. Jl. Am. Ceramic Soc., vol. 2, no. 6 June 1919, pp. 451-460. Method of manufacturing radioactive clay bricks.

Relativity. Michelson's Experiment and its Interpretation (L'Esperienza di Michelson e la sua interpretazione). Aukusto Righi. Nuovo Cimiento, vol. 16, no. 6, Nov.-Dec. 1918, pp. 213-242, 7 figs. With reference to theory of relativity.

Soap Films. Soap Bubbles and Films, J. Perrin. Sci. Am. Supp., vol. 88, no. 2273, July 26, 1919, pp. 50-51. Examination of black spots which appear just before rupture of bubbles or films of soap. Translated from the French.

Spectra. Modifications in Spectrum of a Spark Obtained Between Two Electrodes of a Given Metal Due to the Nature of the Gas in which Spark is Produced (Sur les modifications apportées au spectre d'étincelle de differénts métaux par le milieu ambiant), M. Bouchetal de la Roche. Bul. Société Chimique de France, vol. 25-27, no. 6, June 1919, pp. 305-309. Experiments with iron, tungsten, molybdenum, nickel, antimony, lead, tin, copper and gold in air, hydrogen andilluminating gas.

The Ultra-Violet Band of Ammonia, and Its Occurrence in the Solar Spectrum. A. Fowler and C. C. L. Gregory. Phil. Tran. Roy. Soc. Lond., Series A 566, vol. 218, June 5, 1919, pp. 351-372, 6 figs., partly on supp. plates. Spectrographs of high resolving power claimed to have established that ammonia band is certainly represented in solar spectrum, and that it accounts for a considerable number of faint lines for which no other origins have been suggested. Attempt is also made to elucidate chief features of structure of this band.

On the Discovery of Four Transition Points in the Spectrum and the Primary Colour Sensations, Frank Allen. Lond., Edinburgh, and Dublin Phil. Mag., vol. 38, no. 223, July 1919, pp. 55-81, 24 figs. Experimental confirmation of existence of only three color sensations which are primarily excited by hues that lie between limits set by four transition points.

Spectrum of Neon (Zur Kenntnis des Neonspektrums), K. W. Meissner. Annalender Physik, vol. 58, no. 4, 1919, pp. 333-374, 5 figs. Fabry's and Perot's interferometric methods were used for determining wave lengths of new lines.

Precision Measurements in the X-Ray Spectra, Manne Siegahn. Lond., Edinburgh, and Dublin Phil. Mag., vol. 37, no. 222, June 1919, pp. 601-6' Angle of reflected rays determined as angle through which same photographic plate has to be turned in order to receive impressions of nth order reflection on both sides of direct ray.

On the X-Ray Absorption Wave-Lengths of Lead Isotopes, William Duane and Takeo Shihizu. Proc. Nat. Acad. Sciences, vol. 5, no. 6, June 15, 1919, pp. 198-200, 1 fig. Experiments with X-ray spectrometer described in Physical Rev., Dec., 1917, p. 624.

The Effect of an Electric Field on the Spectrum Lines of Hydrogen—III, Toshio Takamine and Nohoru Kobuhu. Memoirs of College of Sci., Kyoto Imperial University, vol. 3, no. 9, Mar. 1919, pp. 271-273, 5 figs. on two separate plates. In earlier communications (Mem. Coll. of Sci., Kyoto, 2,137,321, 1917) writers reported on Stark effect on hydrogen lines examined by Lo Surdo's method. Present note gives results found in similar experiments obtained by arrangement in which tantalum cathode was used instead of one of aluminum.

The Effect of an Electric Field on the Spectrum Lines of Helium—III, Toshio Takamine and Nohoru Kokubu. Memoirs of College of Scii. Kyoto Imperial University, vol. 3, no. 9, Mar. 1919, pp. 275-280, 13 figs. on supp. plates. Lines about which report for examination is made in present note are 6678, 5876, 4713, 3889 and 3188.

The Effect of an Electric Field on the Spectrum Lines of Argon. Toshio Takamine and Noboru Kokubu. Memoirs of College of Sci., Kyoto Imperial University, vol. 3, no. 9, Mar. 1919, pp. 281-285, 4 figs. on supp. plates. Employing Lo Surdo's method for examining Stark effect, 16 lines were found to be slightly displaced toward the red in strong electric field.

Structure of Matter. The Size and Shape of the Elecktron, Arthur H. Compton. Physical Rev., vol. 14, no. 1, July 1919, pp. 20-43, 7 figs. Attention is called to what are termed outstanding differences between experiment and theory of scattering of high-frequency radiation based upon hypothesis of a point charge electron.

The Law of Attraction for Molecular Force, Herbert Chatley. Soc. Engrs., vol. 10, no. 5, 1919, pp. 192-197. Claims that at very close proximity molecular forces vary as inverse fifty power of the distance and with appreciable separation they vary as the inverse fourth power.

The Arrangement of Electrons in Atoms and Molecules—I, Irving Langmuir. Gen. Elec. Rev., vol. 22 no. 7, July 1919, pp. 505-516. 1 fig. (To be continued.)

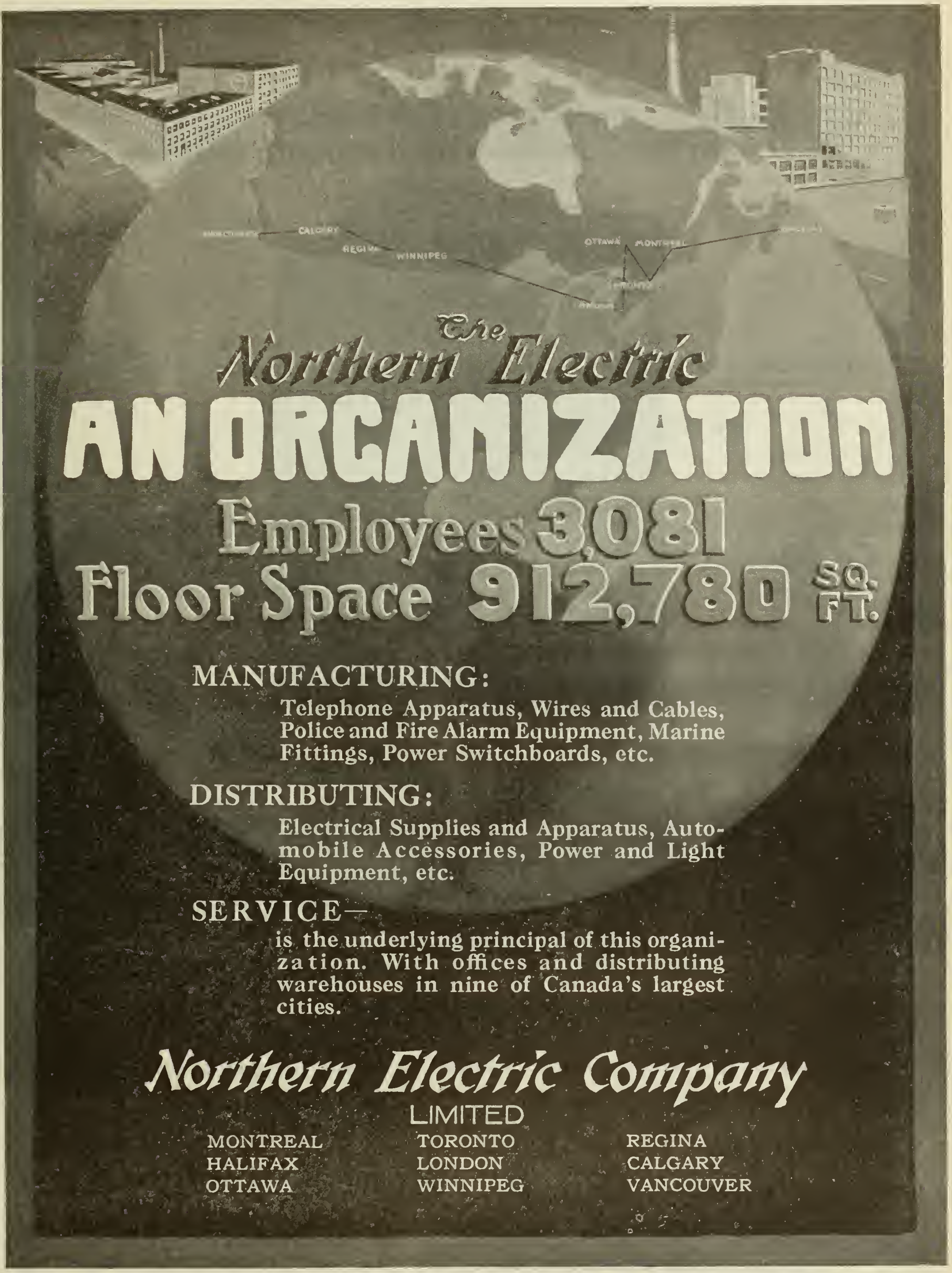
An Extension of the Electron Theory of Metals—I. Thermoelectricity and Metallic Conduction, A. E. Caswell. Physical Rev., vol. 13, no. 6, June 1919, pp. 386-403. Based on fundamental assumptions (1) that number of free electrons in a metal changes with the temperature, (2) that number of positive centers with which electrons collide, wether these centers are atoms, molecules or clusters of molecules, also changes with temperature, and (3) that these positive centers take part in the conduction of heat but not ofelectricity.

The Langmuir Postulates. Ellwood Hendrick. Chem. & Metallurgical Eng., vol. 21, no. 2, July 15, 1919, pp. 73-81, 13 figs. Method of determining physical qualities of chemical compounds from their atomic, ionic and molecular structure. Presented as introduction to theory of chemical reactions developed by Dr. Irving Langmuir.

Sulphur Vapor. The Constitution of Sulphur Vapour, James J. Dobbie. Proc. Roy. Soc., Series A, vol. 95, no. A 672, June 4, 1919, pp. 484-492, 5 figs., partly on two separate plates. Experiment performed by enclosing quantity of metal in closed tube from which air was subsequently drawn out and nitrogen introduced. Sources of light employed were Nernst filament, ultraviolet, and cadmium arc.

Vortices. Vortices of a Fluid (Sur les tourbillons d'une veine fluide), L. Lecornu. Comptes Rendus des séances de l'Académie des Sciences, vol. 168, no. 19, May 12, 1919, pp. 923-926. On Beltrami's researches (Rendiconti del reale Instituto lombardo, 1889), as to whether in movement of fluid curves tangent to veolocities coincide with lines of vortex.

X-Rays. *Se Radioactivity.*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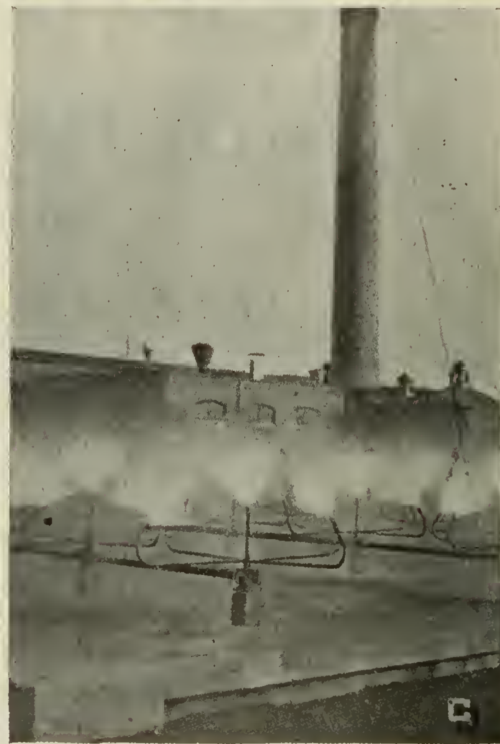
VANCOUVER

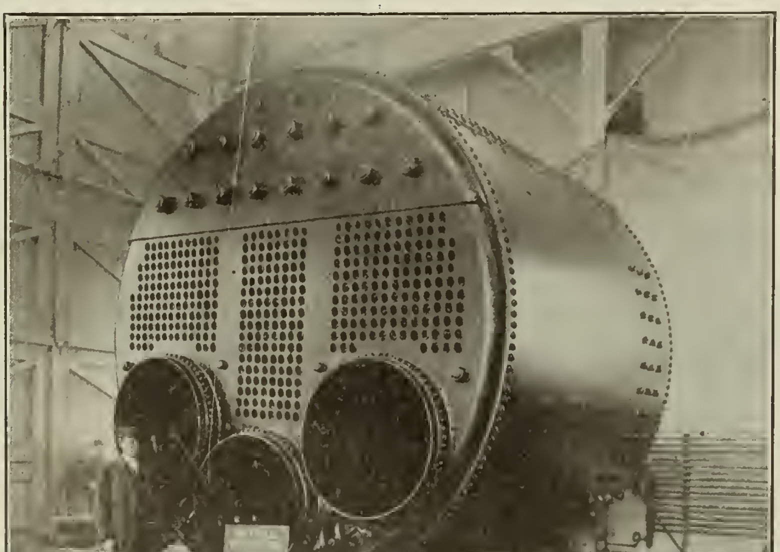
TOWER ROAD BRIDGE

144 foot span over cut which is 65 feet deep. Suspension Bridge also shown.

Continental Life Bldg.
Toronto

Confederation Life Bldg.
Toronto





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TOWERS—Transmission Poles and Towers, etc.

Plate and Tank Construction
PLATE WORK—All kinds, Boilers Riveted and Pipe.
STEEL TANKS—All kinds; Water Supply Tanks and Towers, Steel Stand Pipes, Smoke Stacks, Penstocks, Bins and Hoppers, etc.

Forgings
Elevator and Power Transmission Machinery, Upset Rods
Recent installation of Hydraulic Upsetting Equipment capable of upsetting rods up to 4 in. diameter.

Equipment
MINING EQUIPMENT — Mine Cars, Buckets, Melting Pots, Screens, Coal and Coke Handling Equipment, etc.
RAILWAY EQUIPMENT — Turntables, Frogs and Switches, Snow Plows, etc.

Reinforcing Steels
Plain Rounds, Square and Twisted, Bent to Specifications for Beams, Stirrups, etc.

Shipbuilding
Ships' Bolts and Spikes, Plain and Galvanized, General Forgings, Tanks, Tail Shafts, Propellors, Fastenings, etc.

Contractors' Supplies, Castings
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Miscellaneous
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VOLUME II MONTREAL, OCTOBER 1919 NUMBER 10

Fifth General Professional Meeting

Maritime Gathering held in the City of St. John, September 10th, 11 and 12th, a great success.

Thanks to the courtesy of the Board of Trade of the City of St. John, the headquarters of the Fifth General Professional Meeting of *The Institute* were located at and the various sessions held in the rooms of the St. John Board of Trade.

In declaring the meeting open, C. C. Kirby, A.M.E.I.C., Chairman of the St. John Branch, announced that President R. W. Leonard would arrive at noon and would preside for the rest of the Convention. He called upon his Worship, Mayor R. T. Hayes, of St. John, to address the gathering.

Mayor Hayes said that it was with very much pleasure that he accepted the invitation of the local engineers to accompany them to Halifax a year ago to attend the professional meeting of *The Institute*. In company with Mr. Wetmore, Chairman of the Board of Trade, he had spent three enjoyable days in Halifax, where the people headed by Mr. Bowman and others extended their hospitality and gave them a splendid time. Since then he had followed the procedure of the engineers with interest. He spoke of the necessity of having engineers when anything was to be built or constructed in the city. A city needed a good fearless engineer. The experience of St. John was that they had just such men—men in whom they had the greatest confidence. Very much is expected of engineers and they had always maintained a very splendid standard. He referred to the possibilities of St. John and to the harbor which was yearly growing in importance and use. The city was second in amount of import and exports during recent years. It was contemplated that the harbor would be placed under a commission in the near future, and that it would become part of the great national transportation system of Canada. He was glad to welcome the engineers to St. John, stating that he felt sure the Board of Trade and the citizens of St. John would endeavor to return the compliment for the very splendid entertainment they had had in Halifax a year ago. Concluding he said—the city is yours while you are here and all the hospitality that we can offer to you is yours.

The Chairman thanked Mayor Hayes on behalf of the gathering for the very kind address of welcome and for the great interest he had shown and was showing in the welfare of *The Engineering Institute*. His visit to Halifax last year and also that of Mr. Wetmore had been a source of great pleasure to the members, and the interest he had shown was greatly appreciated. After making a few announcements he called on Alex. Gray, M.E.I.C., to read the first paper on the programme of the Fifth Professional Meeting, by E. T. P. Shewen, M.E.I.C. on The Usefulness of Vegetation in Maritime Engineering.

Usefulness of Vegetation in Maritime Engineering

"British engineers have perhaps been somewhat apt to disregard those transformations which are capable of being brought about by vegetation."

This remark is found in the preface to a book recently published, entitled: "Tidal Lands, A Study of Shore Problems" (1918). by A. E. Carey, M. Inst. C.E., F.R.G.S., etc., and F. W. Oliver, F.R.S., Professor of Botany in University College, London.

A convincing illustration of the value of vegetation as a protection against inroads of the sea, was given about ninety years ago in the maritime provinces by the destruction of a fine harbour at Port Hood on the west coast of Cape Breton. The shelter, two miles long and one and a quarter broad, was formed by the junction with the mainland of Smith's (or Port Hood) Island, which constituted the western barrier, presenting on the east a concave side. From Emerson Point, four miles below the harbour, to Dean Shoal abreast the middle of the island, the coast lies north and south, but then trends N.N.W. for a mile and a half to Isthmus Point, there turning due north to Cape Linzee, half a mile away. At Cape Linzee, the shore swings N.N.E., and continues in that direction almost in a straight line for some miles.

C. C. Kirby, M.E.I.C.
Chairman of the St. John Branch.

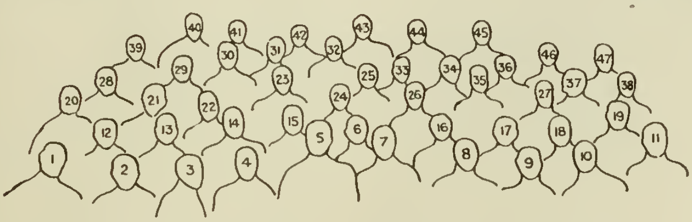
The connection was made by a sand beach or bar starting from the shore at Isthmus Point and running nearly three-quarters of a mile S.S.W. to the head of the Island. In respect to the littoral drift which made the isthmus, it is worth noting that the line of it, if produced N.N.E., practically coincides with the coast-line for ten miles from Cape Linzee. A deep and capacious haven was thus made between the island and the main, large enough to hold a fleet, and affording at best more than seven fathoms of water. Concerning the holding-ground, there is no present information, for the bottom was covered with sand, and the depth shoaled, when the isthmus was washed away. The harbour was open to the south alone, and in that quarter the fetch is only twenty-one miles to the Nova Scotian coast. The conditions of a good natural harbour were therefore fairly fulfilled.

The isthmus was covered with grass, so long, according to statements made a quarter of a century ago by some of the older people of the place, that the children who had to cross to reach the school, used to play hide-and-seek in it on the way. Unfortunately, cattle were turned out there to graze, and disaster followed. One of the eye-witnesses of the consequent destruction of the sand beach (and from his apparent age, one of the school-children mentioned), said that he considered the greater damage was done by the hoofs of the cattle in uprooting, and that the actual cropping was a minor evil. In any case, the grass was killed by the cattle, and the sand above high-water, no longer held in place by the roots or protected by the stalks, was blown away by the wind until the crest of the beach, formerly several feet above H.W. was soon lowered to that level. A breach, small at first, was shortly after made by the sea.

Seeing an opportunity for making an outlet for their boats, which would save a long sail round the tail of the island in reaching the northern waters, the fishermen enlarged the breach to a size sufficient for a boat-channel. The sea did the rest. Not long afterwards the whole isthmus was swept away, the harbour utterly destroyed, and only an open roadstead left in place of it. The grass which had preserved a harbour for an unknown period by holding the sand composing the northern bulwark was evidently a valuable and hardy species, consequently about twenty years ago search was made to find if any of it had survived in some sheltered nook lower down the shore, where the sand and roots must have been carried (part of the sand lodged on Dean Shoal) since the littoral drift follows that direction. In a cove filled with sand, some distance to the south, grass of the same kind was discovered in quantity, and on being sent to the Experimental Farm for examination, it was pronounced to be *calamagrostis arenaria.* It was then decided to plant some of it at Negro Point in order to stop the dry sand drift at that time being blown over the top of the work into the harbour of St. John, and also in order to assist the increase of the natural face on the weather side of the breakwater, pending the extension of it to Partridge Island. Transportation from Cape Breton did not become necessary, for the resemblance of the grass at the head of Courtenay Bay to the Port Hood specimens was observed, and they were found to be identical. Roots were accordingly transplanted from Courtenay Bay to Negro Point, and the desired effect was produced.

On the sandy eastern coast of New Brunswick, and on the shores of Nova Scotia and Prince Edward Island, opportunities occur for the use of this grass, and wherever accumulation of sand is observed to be taking place alongside a new work, it might be prudent, for the purpose of retarding the formation of dunes, to plant it as soon as the littoral drift collected rises a few feet above tide-level. If erection of the long piers at Cape Traverse in Prince Edward Island, and at Richibucto in this province, did not actually originate formation of the dunes at those

Group Photo St. John, N.B., Professional Meeting, September 10th, 1919.



Key to Group Picture of Members at St. John.

(1) G. G. Murdoch, (2) R. H. Cushing, (3) J. S. Armstrong, (4) F. A. Bowman, (5) Col. R. W. Leonard, (6) F. S. Keith, (7) C. C. Kirby, (8) A. R. Crookshank, (9) W. P. Morrison, (10) F. P. Vaughan, (11) A. O. Wolff, (12) Chas. W. West, (13) A. Gray, (14) J. R. Freeman, (15) J. A. Dryden, (16) H. N. Putnam, (17) C. O. Foss, (18) J. A. W. Waring, (19) G. N. Hatfield, (20) J. T. O'Brien, (21) Moses Burpee, (22) W. B. Mac-Kay, (23) F. G. Goodspeed, (24) G. Stead, (25) R. E. Armstrong, (26) C. St. J. Wilson, (27) G. S. Macdonald, (28) N. Wm. Golding, (29) C. Cornill, (30) R. J. Sandover Sly, (31) S. C. Webb, (32) W. T. Earl, (33) O. S. Cox, (34) R. A. Major, (35) G. E. Martin, (36) J. M. McC. Lamb. (37) F. W. Holt, (38) A. G. Tapley, (39) H. M. Hopper, (40) H. Jennings, (41) T. E. O'Leary, (42) C. McN. Steeves, (43) L. S. Benjamin (44) H. H. Wetmore, (45) A.V. F. Duffy, (46) S. A. Sewell, (47) C. G. Price.

places, it at least contributed to increase their size, because both works caused advance of the foreshore. According to the authors of "Tidal Lands," dunes can be formed as soon as the sand flats of the foreshore rises high enough to allow the surface to become sufficiently dried between tides for the wind to blow the thin dry layer landward.

At Cape Tormentine, on this side of Northumberland Strait, there are wide sand flats dry for a considerable period of each tide, but no dunes; because the prevailing strong wind blowing up the Bay of Fundy and across the low isthmus of Chignecto is off-shore from the New Brunswick coast. Dunes are however found at Cape Traverse on the opposite side of the strait, and nine miles distant, where the same wind is on-shore and where the sand flats as already mentioned, were enlarged by the construction of a long railway pier of solid cribwork. So rapid was the spread of the strand there, that the workmen said the sand came out to the end as soon as the pier was built. Quantities travelled round the end, and lodging under the lee went on, either to make or augment the dunes on the farther side of the cove. At Mabou, ten miles north of Port Hood and on the same coast, dunes have overwhelmed the land, killing the trees and all other vegetation. The dunes at Richibucto are formed on waste or inferior land, and in consequence have so far caused little damage.

In such places, *calamagrostis arenaria* might be cultivated with advantage. No doubt other varieties of shore plants, useful in greater or less degree for holding or protect ng by root or top the dry sand, might be discovered on the shores of these provinces.

The lessons taught by the catastrophe of Port Hood are evidently:—

(1) To preserve the useful shore grasses, in particular by the exclusion of live-stock from beaches.

(2) To plant *calamagrostis arenaria* betimes, when sand-spits or beaches are being denuded by wind action.

Wherever a breach in the numerous dry sand bars found in this region is being made, after restoring the beach to proper height for survival of the roots, the engineer would act wisely in planting bent-grass.

Movement of the dunes on the European and also on the Australian continent, is being prevented by systematically setting, according to prescribed rules, roots of grass as a first step, followed by cultivation of other suitable plants as the dunes become fixed. Botanical investigation of the sandy coasts of Canada, with the view of ascertaining the different kinds of indigenous plants capable of holding sand, which flourish best at varied elevation above H.W. (say from 10 to 60 feet) would furnish information useful to the maritime eng neer in hindering the development of sand dunes, or in arresting their movement when formed.

Discussion

Mr. Gray had provided a number of water color plates illustrating the grasses referred to in the paper he had just read. He mentioned that the plants brought from Port Hood to Negro Point were a different species to the grass at Courtenay Bay. He pointed out the difference in the two on the plates exhibited.

Geoffrey Stead, M.E.I.C., Engineer of Public Works, Chatham, N.B., stated that the same results from the removal of grass as mentioned by Mr. Shewen are in evidence at several of the North Shore points. At Tracadie there is a beach four miles long with a harbor of the same length and one or two miles wide. The inhabitants have been cutting hay on the beach and letting the cattle roam, which resulted in the destruction of the beach. The Department of Public Works had breastworks built of stakes and brush for about four miles, resulting in the beach being built up again. They were now at the stage where they were ready to plant beach grass to preserve the beach and further raise it. At another beach, Port Shubert, they had planted grass for its preservation. He had collected fully thirty species of marine plants native to the beaches. He considered the subject a very pertinent one as it involved an engineering problem to the engineers of the north and eastern shores of New Brunswick. F. G. Goodspeed, M.E.I.C., stated that his experience had been practically the same as Mr. Stead. He recently noted in an article on a harbor on the west coast of the United States which was delivered in 1894, that the author strongly recommended the use of artificial grasses. C. O. Foss, M.E.I.C., said that the paper indicated to his mind the necessity of the Canadian Government securing the ownership of the beaches in the different harbors. He thought it would be cheaper than constructing works to protect them after they had been destroyed. He asked Mr. Gray if he knew if anything had been done at Port Hood, who replied not as far as he knew. It would be a difficult proposition to purchase beaches extending over a distance of fifty miles cut up into hundreds of lots belonging to different owners. In different places the Government had purchased str ps of beaches which were threatened and which were the most necessary. It would have been better if they had never been granted to the people. The Chairman asked what were the common names of these grasses, and received the information from Mr. Stead that they were wild rye and beach grass. They made a poor quality of hay, but on the North Shore the people fed their cattle on it. J. S. Armstrong, M.E.I.C., dealt with the question raised in the paper as one which needed emphasis, because the Magdalen Islands would disappear altogether and the same was true of Sable Island. He believed it was a matter which the Government should take in hand. F. A. Bowman, M.E.I.C., Halifax, believed that the Dominion Government had been doing such work. He thought that one of the difficulties regarding Sable Island is to keep vegetation existing there on account of the severity of the weather. Continuing the discussion Mr. Armstrong was of the opinion that beach grass should be grown on Sable Island and later trees might be grown. In Europe after getting control of the beaches, large areas are planted with pine trees in different places, and considerab'e areas are now growing forests.

It was moved by Mr. Stead, seconded by Mr. Goodspeed that the thanks of the meeting be extended to Mr. Shewen. Carried unanimously.

In the absence of G. H. Prince, B.Sc. F., the author of the paper, who is Provincial Forester, his paper was read by H. C. Kinghorn, on Forestry in New Brunswick.

Forestry in New Brunswick

Forestry Conference of 1907, in Fredericton

The present marked development in forest administration in New Brunswick may be traced largely to a Canadian Forestry Convention held in Fredericton just twelve years ago. At that important gathering of practical and scientific men the many problems of Forestry including Proper Utilization, Fire Protection and Forest Conservation were fully discussed and many far-reaching resolutions were presented to the Government.

Forestry Course Established at University of New Brunswick

The most important and immediate result of that convention was the establishment of a four years' course in Forestry in the University of New Brunswick in the following year.

In all, twenty-nine foresters have since graduated from this university, a small number you will say, but well worth the effort when you consider the great part they have taken and are taking in the development of Forest Conservation in all parts of Canada.

Origin of Forest Survey

Before attempting to describe what the Provincial Government has done, let us consider the progress of Forestry with owners of Crown granted forest land. One company owning over one and one-half million acres of forest land in New Brunwick early started the surveying and cruising of their limits. This forest survey, a task that took over five years, furnished the company with accurate timber maps, timber estimates, reports on the conditions and growth of the timber, etc. This information has had much to do with shaping this company's policy in regard to the disposal of its timber towards an increased income and a perpetual supply. Quite extensive surveys have also been made by two other large owners of private lands in New Brunswick.

The Government of New Brunswick, no doubt realizing, as the private companies have done, that the best results in the management of its greatest resource, the forest, could not be obtained without a full knowledge of that asset, passed the Act which provided for the Forest Survey and classification of the seven and one-half million acres of public forest lands. This survey, commenced in 1916, has been continued as rapidly as possible, consistent with war conditions, and already over one-quarter of the total area has been surveyed and mapped, at a cost of approximately five cents per acre.

The objects of this Forest Survey as defined by the Act are, briefly:—

First—To report with as much detail as possible upon the character and quantity of the lumber, estimating the quantity of timber and reproducing capacity of the forest.

Second—To estimate as accurately as possible the annual growth of timber upon each area or tract. That is, the number of board feet produced each year.

Third—To report upon the accessibility of the timber on each section, estimating cost of logging on the different areas and cost of driving.

Fourth.—To report the location of lands deemed suitable for agriculture, distinguishing them from other lands that might be regarded as suitable for the growth of timber only.

In order to obtain the above information the most modern and scientific methods of timber estimating and mapping have been employed, and this survey is said to be the most extensive of any survey of its kind in regards to area in North America.

Method of Forest Survey

The method of carrying out the above work is technically known as the strip method. This is fully described in the 1917 Report, which may be obtained upon request. Briefly, the method of work is as follows:—

The forest land is held under licenses by our licensees, each division being known as a license or timber block, varying in area from 1000 acres to 12,000 acres. The average timber block contains 4000 acres, or 6 square miles, and is approximately 200 chains square.

Method of Surveying Block Lines

The first work in connection with the survey is the establishing of the boundaries of these timber blocks. In many cases old lines are retraced, while in others entirely new lines are run. The chief difficulty encountered is determining the location of lines between Crown land and granted lands. When these lines are completed it will relieve the stumpage scalers of any difficulty of determining whether the logs are subject to stumpage or not. In accordance with law these lines are run by qualified Provincial Land Surveyors, of which 5 crews have been employed during the present season and some 700 lineal miles of line run. The lines are being thoroughly blazed, stakes or trees being marked with chainage and block numbers every 20 chains and in addition posts are set wherever the lines cross portages, streams, lakes, etc., and marked with their chainage from the nearest corner and proper block numbers. This enables the lumbermen's cruisers, as well as the Government Rangers, to locate themselves quickly wherever they locate a post along a portage by referring to their plans. The lines are plotted and are required to close within a certain limit. All work is being done by compass.

After the lines have been established and quarter mile posts set, the area is cruised. A cruising party usually consists of about 13 men, made up of a chief, camp compiler, 3 cruisers, 3 compassmen, 3 calipermen, 1 teamster, 1 cook. The cruising is done by parties of 3 made up of a compassman, a cruiser, and a caliperman. This cruising crew travels from one quarter mile post across the block 200 chains to the post exactly opposite. The compassman directs the course and acts as head chainman. The caliperman acts as rear chainman and calipers the trees on one side of the chain for a distance of half a chain from it. The cruiser also calipers trees on the opposite side of the chain for the same distance and takes all the notes. No attemp is made to chain accurately on these so-called cruise lines, as the exact distance between the two block lines is known from the former survey. A cruising crew will cross a block twice, thus running 5 miles of cruise line a day or recording the timber standing on a strip 5 miles long and one chain wide or on 40 acres. The cruise lines are run parallel and 25 chains apart.

The types of timber, hardwood, softwood, burned land, etc., are recorded.

The cruiser also takes notes on all topographical features with which he comes in contact—slopes, brooks, streams, lakes, rivers, roads, portages, etc., with description of each, which are afterward compiled.

The notes are kept in loose leaf metal folders and turned in to the camp compiler each night and are plotted the following day, so that any errors or ommissions may be properly detected.

Method of Timber Estimating

Some of you may not understand just how the timber estimate is arrived at. The trees are calipered outside the bank 4½ feet from the ground in order to avoid the swell of the root. They are recorded by species and diameter, so that a tally sheet will show so many spruce trees 8, 10, 12, 14, 16, 18 inches in diameter on the number of acres calipered. All visible defects that can be observed in the standing tree are allowed for when calipering the tree. Hidden defects are covered by a deduction made from the estimate. The contents in board feet is arrived at by what is termed a volume table, which is prepared by following a logging operation and measuring a large number of trees of all diameters (at least 1000 trees in the locality where the work is to be done). The contents of a tree varies directly with its height and diameter, and the average contents of, say a 12 inch tree 80 feet high, may be accurately determined and the average contents of trees of all diameters are secured and compiled in what is known as a volume table. Multiple volume tables are then made up from which the contents in board feet of the trees on the area calipered can readily be determined and the average per acre is applied to the total area of the same class of timber land. In this manner 4 acres out of every hundred are measured, or in other words, the survey is known as a 4 per cent cruise. Check cruises are made after every cruiser twice a month, in addition to the above.

Purposes of Forest Survey

Notes are taken on the soil, rock and slope and other points affecting the possibility of using the land for agriculture. Small shovels are carried and the soil examined to a depth of at least 12 inches or deeper if necessary to determine the nature of the soil and sub-soil.

Results of Forest Survey

The method of carrying out the timber survey and soil examination has been largely the result of conferences and field directions given by experts employed by the Conservation Commission and loaned to the Provincial Government for a few weeks each year. These men visit the field parties and direct the work and initiate improvements in method.

Timber and Soil Maps Prepared

Two plans or maps are prepared, one showing all survey lines, posts, portages, lakes, etc., and the timber types, and one the soil conditions and topographical features. The plans are being prepared in blocks of 42,000 acres, each plan being given a distinctive number. When the work is completed there will be 477 of these plans.

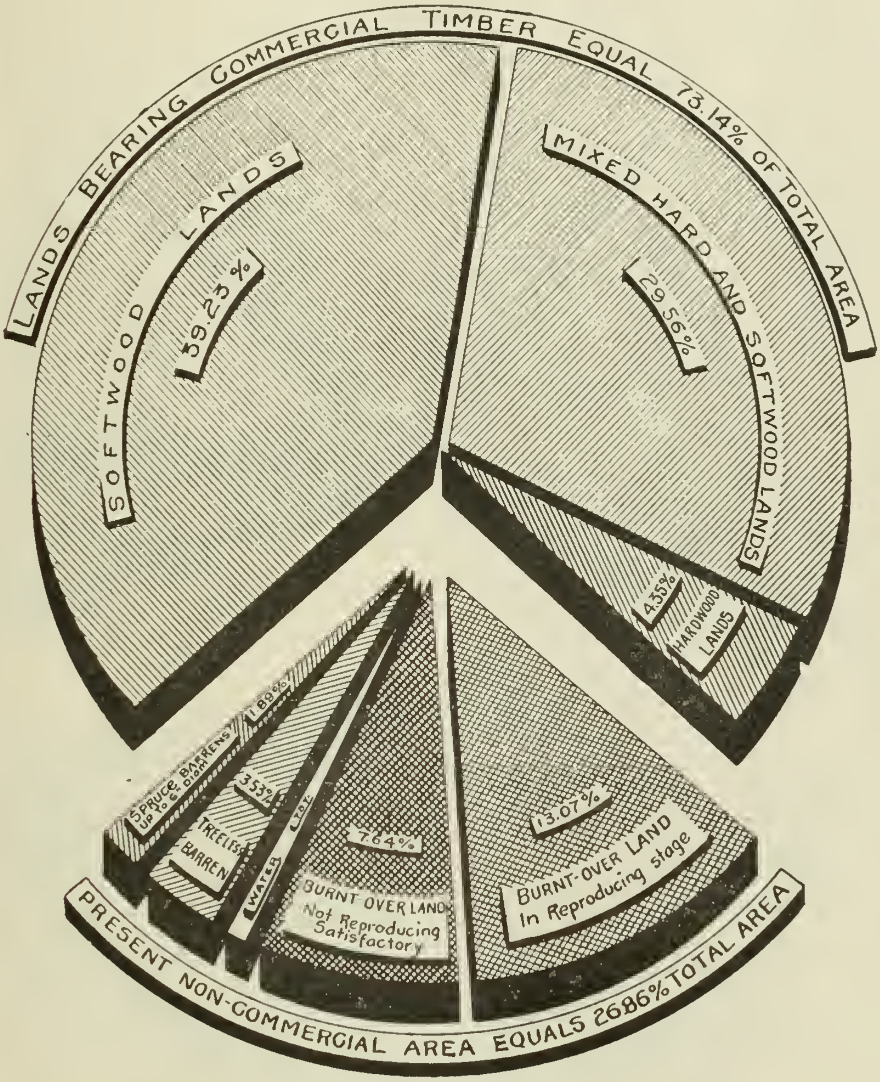
Establishing of Permanent Sample Plots

The permanent establishing and systematic marking of the timber block lines is already proving of much value to the lumbermen's cruisers, as well as to the Government Rangers. The same is true of the timber estimates. One large lumber company holding over 500 sq. miles is contributing half the cost of the survey in order to avail themselves of the maps, reports and notes. Another company owning over 150 sq. miles is also contributing in order to have the survey made this year so as to have the maps and figures with which to plan this season's logging operations. These facts are a clear indication of the value of the survey to the licensee as well as to the Government.

I feel sure that some of you who are connected with the lumbering or pulpwood industry will be interested in some of the figures secured by the tabulation of the timber estimates on 1,400,000 acres of the forests compiled in the 1918 Report. The following figures indicate the percentage of the total area covered by each forest type:—

(a)	Area covered by Softwood Timber..................	549,344	acres	or	39.23%
(b)	Area covered by Mixed hard and soft woods.....	413,878	"	"	29.56%
(c)	Area covered by Hardwood timber.............	60,838	"	"	4.35%
	Total area supporting merchantable timber suitable for saw logs.............	1,024,060	"	"	73.14%
(d)	Area of burnt over land on which there is sufficient reproduction to assure a future timber crop.......	183,411	"	"	13.07%
(e)	Area of burnt over land on which satisfactory reproduction is not yet established...................	107,738	"	"	7.64%
(f)	Area of barrens, treeless land, including caribou barrens, cranberry bogs, swamp areas not supporting commercial growth...	49,395	"	"	3.53%
(g)	Areas of black spruce and jack pine barrens, trees under 6″ in diameter.....	26,255	"	"	1.89%
(h)	Area of lakes and water...	5,505	"	"	.39%
(i)	Area of lands cleared or cultivated..............	4,560	"	"	.34%
	Total area not supporting merchantable timber.....	376,864	"	"	26.86%
	Grand Total of both Timber and Non-Timber Land	1,400,000	"	"	100.00%

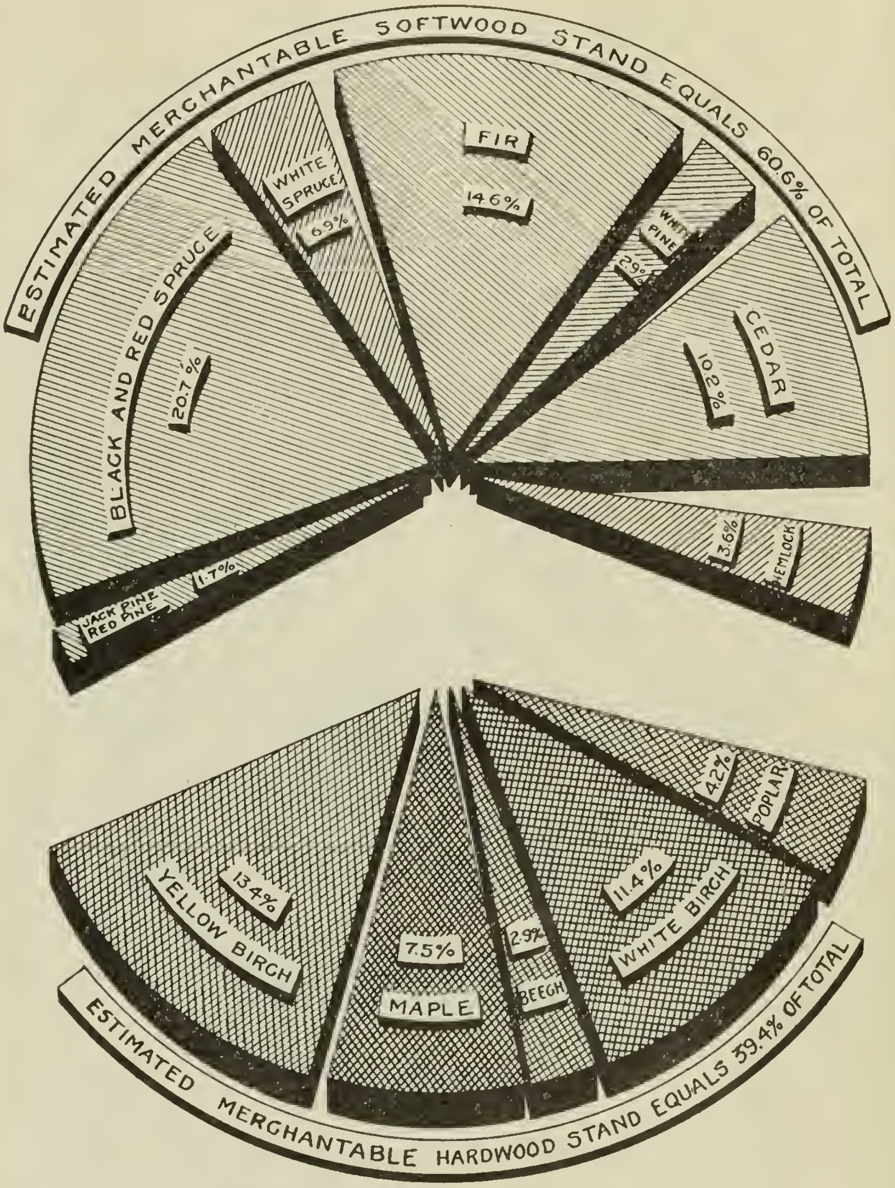
The above is very strikingly set forth on Plate No. 1 which divides the area graphically and from which you can gather at a glance the relative extent of each type of land. Note the very large proportion rendered unproductive by Forest Fires. Note also that the present nonproductive area forms over 26 per cent of the total area.



1,400,924 acres Crown Lands graphically divided into Forest Types.

Note the large area rendered unproductive by Forest Fires, during the last forty years.

J.B.M.



1615000 000 FEET OF MERCHANTABLE TIMBER GRAPHICALLY DIVIDED ACCORDING TO SPECIES. NOTE THE LARGE PROPORTION OF HARD WOODS AT PRESENT FORMING LESS THAN 2% OF THE ANNUAL CUT FROM CROWN LANDS.

B.M. ESTIMATE 1 024 060 Acres

Tabulation of commercial sized timber, that is, spruce over 12 inches and fir over 9 inches, estimated on 1,024,060 acres, showing amount of each species and percentage of the 1,615,000,000 feet occupied by each:—

(*a*) *Softwoods:*				
White Spruce......	111,000,000	ft. or	6.9%	of total
Black and Red Spruce..........	335,000,000	"	20.7%	"
Fir................	235,000,000	"	14.6%	"
White Pine........	46,000,000	"	2.9%	"
Red Pine..........	19,000,000	"	1.2%	"
Cedar.............	165,000,000	"	10.2%	"
Hemlock..........	59,000,000	"	3.6%	"
Jack Pine.........	5,000,000	"	.5%	"
Sub-Total Softwood Stand...........	979,000,000	"	60.6%	"
(*b*) *Hardwoods:*				
Yellow Birch.......	211,000,000	"	13.1%	"
Maple, hard.......	118,000,000	"	7.3%	"
Beech.............	43,000,000	"	2.6%	"
White Birch.......	186,000,000	"	11.4%	"
Poplar............	68,000,000	"	4.2%	"
Other hardwoods....	8,000,000	"	.8%	"
Sub-Total Hardwood Stand...........	636,000,000	"	39.4%	"
Grand Total estimated Soft and Hard woods on 1,024,000 acres of timbered land..............	1,615,000,000	"	100.%	"

or 1577 ft. per acre for the timbered area, 60.6% being softwood and 39.4% being hardwood.

Utilization of Hardwoods Encouraged

The above figures have been graphically shown on Plate No. 2, from which you will see the very large place occupied by hardwoods in our commercial stand. Our annual cut of these species does not amount to two per cent of the total cut and this shows very emphatically the need of further developing the hardwood industries. Something has been accomplished in this regard by one of our largest holders of Granted Forest Land as hardwoods represented 10 per cent of their total cut last year.

The utilization of White Birch and Poplar should be further extended in view of the large quantities of these species on the Crown Lands. A new hardwood industry is just being established in the centre of the Province which will manufacture each year 3 to 6 million feet of Yellow Birch and Maple into shoe lasts. It is expected that a further utilization of hardwood will be developed each year.

The N. B. Government is one of the first in Canada to establish permanent sample plots. Through co-operation with the Conservation Commission and the Bathurst Lumber Company a 600 acre lot will be laid out and various methods of cutting will be tried and measurements made of the results periodically during the next 25 years. The work is being directed by Dr. C. D. Howe for the Conservation Commission.

In order to form an approximate idea of the stand of growing timber, the undersized spruce and fir down to a minimum diameter of 8 inches has been estimated to be equivalent to 838,000,000 feet. Considerable of this is just on the border line between undersized and merchantable sized timber trees, and usually some of these trees are cut in the course of a logging operation, thus increasing to some extent the commercial estimate given above. Thus undersized material represents the growing stock for future timber crops.

The survey parties are also collecting data regarding the spruce bud worm injury in co-operation with the Federal Government Entomological Department, which has had the work in hand for the past 5 years. A comprehensive report will be issued this year.

You will ask of what use is the Forest Survey to New Brunswick. Briefly:—

(1) It will give definite information of the quantity, quality and value of the timber on any area, from which the stumpage value may be determined. It will show the quantity and quality of species now of little commercial importance because of lack of market demand, and possibly it may show that these species can be marketed profitably, or where quantity justifies it, to induce industries utilizing these inferior species to operate within the province, thus profitably utilizing material which is at present going to waste. Something has already been accomplished in the utilizing of hardwood.

(2) The estimate of the annual growth will determine whether or not the annual cut can be increased, or whether to perpetuate the industry and maintain our revenue restrictions should be placed on certain species to regulate the cut.

(3) The information on soils will permit of directing agricultural settlement to districts offering the greatest prospect of success, thus protecting both the future settler and the timber licensee.

(4) Any system of Forestry is useless without Fire Protection, and you are wondering in what way will this Forest Survey benefit Forest Fire Protection in New Brunswick.

Well, first of all we have an excellent base plan from which to build our Forest Protection plan. Our map will show all passable portages, all old portages and trails, all roads passable for wagons, and all roads passable for automobiles; it will show all telephone lines, all canoeable streams, all camps, the location of all green timber, burned areas, bad slashes, and dangerous points; possible look-out stations, area visible from them, possible observation points and areas visible from them. From the network of portages and canoeable streams we can plan an efficient system of control; we can see clearly where the tool caches are most needed, where look-outs will be most beneficial. When fires do occur it will show the Forest Ranger where the heavier timber is, and whether the fire is being blown towards timber, a swamp, a heavy slash, and many of the things he needs to know at once. The plans will also show the areas of most danger, where the most of the recent burns have occurred, etc. Our Chiefs of Party are instructed to collect all local knowledge available regarding all matters of fire protection, and to prepare a plan of patrol whether by auto, saddle horse, canoe or by foot as the case may be, showing the location of possible look-out towers, observation posts, tool caches, where fire permits will be necessary to protect the timber from settlers clearing fires, and where the public opinion is so far advanced as to give excellent fire protection at the present time without further development. Our reports will show where debris has accumulated near public highways, railroads and settlements, which should be burned in order to avoid a great fire risk to even human life as well as property. You will see from this that the Forest map of New Brunswick will undoubtedly be of greatest value in planning a comprehensive and efficient fire protection system.

Passing of Forest Act and Fire Law in 1918

The figures already compiled by the Forest Survey have shown an enormous loss to the Province of New Brunswick by forest fires. This startling fact, together with the active influence of the Canadian Forestry Association and the Commission of Conservation, resulted in the passing of the new Forest Fires law which was designed to assist in preventing the recurrence of so great a national disaster.

The Fire Permit system of regulating settlers burning slash as provided under the new fire law is recognized as one of the most important advances in Forest Protection and although this law was in force for only a short time in New Brunswick it has given excellent results.

The Provincial Government early recognized that without a permanent, properly disciplined and efficient field staff of Forest Rangers, unhampered by the influence of politics, very little could be accomplished by way of fire protection and Forest Conservation, consequently the 1918 Forest Act was passed, providing for a Forestry Advisory Commission of five members, consisting of the Minister of Lands and Mines, Deputy Minister, Provincial Forester and two others—one elected by the Crown Land licensees and one chosen by the Minister to represent the granted forest land owners.

Creation of New Brunswick Forest Service.

This Advisory Board has the power to make all permanent appointments and to supervise all matters in relation to the Forest Act, which includes the scaling of logs from Crown Land, the enforcing of logging regulations, the protection of game, and the protection of the forests from fire.

This Advisory Board has had several meetings and the results obtained have shown the wisdom of its creation. The practical contributions to the deliberations of this Board by the two representatives of the lumbermen of the Province has been invaluable.

Method of Appointment of Forest Rangers by Competitive Examination

Among the Board's first duties was the appointing of an examining committee to carry out the Act in relation to the appointment of rangers by competitive examination on a strictly merit basis.

The Board of Examiners was made up of three members, the Provincial Forester as Chairman, an expert scaler and a practical woodsman and lumberman.

Nature of Examination

The examination consisted of a written test on Woodscraft, Fire Protection, Game Protection and Scaling, an oral test and, most important, an actual scale of a large number of logs by the applicant. The examination was modeled after the U. S. Forest Service Examination, through the kindness of the U. S. Civil Service Commissioners.

Promotion in Forest Service by Merit

It is very interesting to note that of the 179 men examined only 99 qualified. The large number that failed to qualify was due to the fact that many men lacked sufficient experience as scalers. The Government of this Province is entitled to great credit in view of the fact that the appointment of the Forest Rangers and Inspectors is being practically completed from the pass lists on a strictly merit basis, irrespective of any other influence.

The new act, by providing for the consolidation under one staff the work of Game Protection, Scaling and Fire Protection, made possible the employment of men continuously the year round. This renders possible proper disciplining of the staff, which was seldom possible where the men were annually appointed through the patronage system, which system is being rapidly abandoned by all up-to-date organizations in Canada and appointments and promotions are being made strictly on a basis of merit.

It is inevitable that, in spite of a most rigid examination, in appointing a large number of men a few undesirable appointments may be made. This is provided for in the Act by making permanent appointments only after six months of satisfactory service. The Province has been divided into thirty-six districts, each under a Forest Ranger who has one or several assistants during the fire season, as deemed necessary. Five inspectors are employed, who devote their whole time to the supervising and checking of the work of the Rangers. During the scaling season each Ranger will have one or more assistants to assist in the counting and scaling of the logs. In order to give the staff a greater sense of responsibility, they have been placed under bond for the proper performance of their duty. The whole staff coming under the supervision of the Provincial Forester, Chief Scaler and Chief Game Warden. It is hoped to improve the personnel of the Forest Service by weeding out those who fail to measure up to the proper standard of efficiency and by the appointment of more energetic and competent men to fill their places. Of the first 43 men appointed the appointments of 13 were not confirmed and recently another Ranger has been dismissed.

Vacancies to be filled by Returned Men only

It is the policy of the Department to fill all vacancies with returned soldiers, 16 returned men having qualified in the recent examinations.

Furthermore, it is the expressed aim of the Minister of Lands and Mines to keep the administration of the Forest Service entirely free from the influence of politics and to build up a permanent organization on a strict basis of merit alone. He has won the support and approval of deep-thinking men for his adoption of a policy so vital to the success of any business organization.

Fire Protection Needed and Developed

Through the continued co-operation of the New Brunswick Government with the Railway Commission of Canada, the work of fire protection along railway right of ways was continued with beneficial results, and it is worthy to note that last year was the first year that systematic inspection of the fire protective appliances on locomotives was carried out by the Provincial Inspectors in New Brunswick.

The co-operation between the New Brunswick Government and the Canadian National Railways in regard to fire prevention has been considerably extended. The concession of the General Manager of this Railway to the New Brunswick Government's inspectors to examine their locomotives for fire protective appliances, and the issuing of a circular by the General Manager to all employees of the C.N.R., outlining their duties in regard to forest fires along practically the same lines as railways do under the Railway Commission, resulted in considerable improvement in the fire situation; nevertheless it is felt that much better results can be obtained if the Canadian National Railways were placed under the jurisdiction of the Railway Commission of Canada. Considerable improvement in fire protection along private railways in New Brunswick has been secured by close inspection and considerable pressure brought to bear on their managers. Last season one railroad was forbidden to operate trains until engines were properly equipped and fire patrol established.

The necessity of this work and its great importance will be seen when it is stated that a very large percentage of the locomotives examined had serious defects in their fire protective appliances, which were immediately remedied at the request of our Inspector. The seriousness of the forest fire hazard along railroads is easily realized when it is stated that over 770 fires occurring from the smokestacks or ashpans of locomotives operating through the forests were extinguished by our patrolmen during the 1918 fire season.

Considerable improvement in general fire protection throughout the province and a greater interest by the public has been noted, due to a considerable extent to the educative propaganda recently adopted. Over 15,000 attractive and warning posters were placed throughout the Province. The Press was used to a large extent. Through co-operation with the Board of Education, circulars on fire protection were read in 1500 country schools by the teachers, and the children urged to be careful with fire in the woods. Fire protection posters were placed in railway smoking cars through the permission of the railroads. Five thousand circulars on slash burning were distributed. Over 100 various interesting slides on fire protection were distributed and shown in many of the forty motion picture houses in the Province. Envelopes for all correspondence carried fire protection data during the fire season; several thousand pocket whetstones carrying fire protection information were distributed to woodsmen, hunters and fishermen; a course of ten lectures on the Crown lands and Fire Protection was given to the Provincial Normal School students last year. Practical Fire Protection talks were given by the Rangers to 100 Boy Scouts in Camp. 2000 copies of the Fire Act were distributed—the whole tending to create a healthy sentiment regarding the importance of fire protection.

Summary of Fires and Damage of 1918

The need of all this publicity is fully justified when the following brief summary of the fires reported in 1918 is considered:—

Railroads.....	771 fires	......93.5¾	of total
Fishermen.... Campers..... Hunters...... Smokers......	29 "	...... 3.5%	"
Settlers burning slash....	15 "	...... 1.5%	"
Unknown.....	9 "	...... 1. %	"
Industrial operations...	5 "	...... .5%	"
Total......	829 "	......100. %	"

The following statement shows comparatively the amount of damage resulting from fires through each cause:—

Fishermen.... Campers..... Hunters...... Smokers......	$56,100	.....68. %	of damage.
Railroads.....	20,000	.....24.5%	"
Settlers burning slash....	2,100	..... 2.6%	"
Unknown causes......	2,000	..... 2.5%	"
Industrial uses of fire......	1,800	..... 2.4%	"
	$82,000	.....100. %	"

The above tabulations show that over 90 per cent of the damage done was caused by the carelessness of fishermen, campers, hunters and smokers neglecting their camp fires or throwing away burning matches, and by the railroads through defects in the fire protective appliances on their locomotives.

It is, therefore, absolutely essential that carefulness with fire, and a proper appreciation of this our greatest national resource, should be so impressed on the minds of our citizens, especially those whose business or pleasure takes them within the forests, that in the near future the neglected camp fire will become unknown, and forest fires will no longer destroy the people's heritage.

Method of Log Scaling for Collection of Stumpage

One of the main duties of the Forest Service is to secure a correct return of the logs cut from Crown Lands and when it is stated that usually there are 700 or 800 camps and the cut exceeds 200 millions and 500,000 ties, it is seen that it is considerable of a task.

Each Ranger is furnished with complete plans of the Crown Land in the district assigned to him, and he is held responsible for a proper count, scale and return of all material cut from these lands each year. He is furnished with an assistant or counter who assists him during the scaling season. About 5,000,000 feet is considered sufficient work for any one scaler. Each camp is visited every two weeks and the yards of logs counted and scaled, marked and numbered. A report is furnished the Crown Land Office every two weeks on the logs scaled and counted at each of the 700 or 800 camps in operation.

Method of Check Scaling

This report is checked and a duplicate mailed at once to the licensee so that he is properly informed of any infractions of cutting regulations, such as cutting undersized timber, too high stumps. If the licensee disputes the scale the logs are still there and a check scaler is put on and the dispute immediately settled. This system tried out last season has given very satisfactory results, and will be in use again this year, with only slight modifications.

Any Questions

I have endeavored to give you as briefly as possible an outline of the work attempted and being done by the Forest Survey and Forest Service of New Brunswick, and will be glad to answer any questions.

Discussion

In response to some questions asked by the Chairman, Mr. Kinghorn informed those present that in connection with the arrangement of the five rangers acting as scalers, their work does not conflict. He saw no reason why a forest ranger should not act as game warden. He needed the co-operation of all the inhabitants as a fire warden, and their goodwill. He cannot enforce the game laws without antagonizing the inhabitants. Moses Burpee, M.E.I.C., desired to know to what extent there was co-operation between the operators in cutting timber and the railways running through acreage which was being operated upon—whether the responsibility for the slashing and the debris is divided between the two or rests on one or the other of the interested parties, and was informed that while the licensee owned the timber, the Government had to look after the slash and debris which comes under the Railway Commission of Canada on all roads except the Canadian National, the Railway paying the expense. He stated that in Maine there is a law which obliges the timber operator to take care of a strip on either side of the railway fifty feet in width. Mr. Kinghorn said that in New Brunswick the railways are responsible for 300 feet on either side from the centre of the right of way. Mr. Kirby told of the arrangement which the Canadian Pacific Railway had in the State of Maine, where one of the officials is appointed deputy fire warden and has the responsibility put on him of looking after the right of way. They maintain two tank cars at Brownville with enough hose line on these cars to fight a fire two miles from the track. Mr. Kinghorn stated that the railways were willing to live up to the fire law. An inspector makes an inspection of the ash pans and the smokestack of the locomotive. Mr. Burpee asked if any improved appliances were being tried out to equip locomotives. Asked by the Chairman if the New Brunswick Government were doing anything towards replanting forests, Mr. Kinghorn said practically nothing. By keeping out fires and with proper cutting regulations reforestation takes place. J. S. Armstrong, M.E.I.C., pointed out that large areas of land existed in the vicinity of Minto bare of trees, which once were covered with large pine. He thought it would be of great value if they were reforested. F. A. Bowman, M.E.I.C., pointed out that twenty years ago all the tamarack disappeared from Nova Scotia, having been wiped out by an insect. Mr. Burpee advised that in the State of Maine they had their trees only partially destroyed, and they had now as much as existed 25 or 30 years ago. In New Brunswick the destruction of spruce and fir by insects is dealt with by a special branch of the Dominion Government who have a staff at Fredericton.

C. O. Foss moved, seconded by F. A. Bowman, a vote of thanks to Mr. Prince for his paper, and to Mr. Kinghorn for reading the paper and answering questions. Carried unanimously.

The Chairman then announced that a special car would be waiting in front of the Board of Trade in a few minutes to take the party to the Manor House, where the visiting members would be the guests of the St. John Branch, and where the Honorable William Pugsley, D.C.L., LL.D., K.C., P.C., Lieutenant-Governor of the Province would give an address.

Luncheon at Manor House

President R. W. Leonard arrived to preside at this function. After expressing his pleasure in being present and to find such a large attendance and such an excellent programme he invited His Honor the Lieutenant-Governor of the Province to address the gathering. Lieutenant-Governor Pugsley spoke as follows:—

Colonel Leonard and Gentlemen: the remarks of the presiding officer that I am expected to make a few observations certainly were pleasing to me, because it indicates that he will be well satisfied if I make my remarks very brief, and no doubt he is giving your sentiments as well. It affords me the very greatest possible pleasure to be present with you to-day. I have the greatest possible respect for the engineering profession. It was my privilege to be a member of the provincial government and to be in the provincial legislature, in connection with the provincial and Dominion politics, altogether for a period beginning away back in 1885 and ending in 1917. During that time I had a good deal to do with the construction of various public works which were carried on by the provincial government of which I was sometimes a member and sometimes a supporter; and also carried on under my direction during the years that I was Minister of Public Works in the Dominion Government. During that long experience I was led to realize that the welfare of the country so far as the construction of public works was concerned rested very largely with the engineering profession. During my tenure of office in the Dominion Cabinet, I think my Department under my direction expended something like fifty million dollars in public works throughout this vast dominion, and I am happy to be able to say that in no single instance was it ever brought to my notice that an engineer of the Department, whether at the head office in Ottawa or as the head of the various districts throughout the Dominion, ever failed in any single instance in the performance of his duty towards the public. I became, as I have said, thoroughly satisfied that the interests of the country are so far as public expenditures are concerned in the department of public works, largely in the hands of the engineers, and also thoroughly convinced that the confidence which has been placed in the engineering branch of the department has not been misplaced. This, of course, is a very important consideration It testifies to the fact, taken in connection with the important work which has to be performed, it shows how honourable is the profession to which you belong and how much you can do for the advancement of the country in which we live and in whose future we have such great confidence. I would have liked to have been with you this morning to join with His Worship the Mayor in bidding you welcome to this city and to this province. New Brunswick is not a large province and Saint John is not a large city, and while advancement in the past has not been as great as I would like it to have been, let me tell you that I for one have great confidence in the future of this province and the future of this city, which is our chief commercial city. I wish you could go through New Brunswick at this season of the year, travel the valley of the noble Saint John which rises some three or four hundred miles up in the province of Quebec and State of Maine, and flows down over this vast territory, one of the finest sections of country which can be found anywhere in this world. A country filled with beauty; a country rich in agricultural possibilities and a country which before long, I believe, will be regarded as one of the most splendid opportunities for sightseeing which can be found anywhere on the American continent. I wish you could go to our northern rivers and see the splendid opportunities for fishing, catch our trout and noble salmon and then travel our woods and see the opportunities which there are for hunting game. New Brunswick presents attractive opportunities which we trust our friends in the upper provinces of Canada will become more familiar with. We naturally want the people of the Maritime Provinces and Quebec and the West to become better acquainted with each other to recognize the vast opportunities for development which we have and to realize what a splendid people are the people of Canada and how capable they are of doing big things, in order that they may stand shoulder to shoulder to make this a great country and make this Canada the most important of the overseas dominions of the Empire. There is one reason why I am glad to see you with us to-day. No big things can be done in Canada without the assistance and aid of the engineers of this country. It is you who plan what is to be done. You plan for the building of bridges, you plan for the building of canals, you plan for the building of railways, you plan for the mining industries of the country, and it is your advice that the big capitalists must take. There is no profession in this country I think upon which the future of Canada so much depends as upon the profession to which you have the good fortune to belong. You do not believe in talk like we lawyers and politicians do. You believe in work, and, therefore, I must recognize your beliefs and must conform to them and will now take my seat. Thanking you for the opportunity of being present and thanking you for the very patient hearing you have given to me.

Following Governor Pugsley's address, Mayor R. T. Hayes was called upon, making a speech, which he described as being mercifully brief.

At this point an item of business of the St. John Branch was entered into, in which the Chairman of the Branch proposed that Senator Domville, who was present, accept an honorary membership in *The Engineering Institute of Canada*. This was seconded by Mr. Gray. The vote by the members of the Branch was unanimous. In acknowledging the honor that he had received, Senator Domville said it was one of the happiest hours of his life to be connected with the men who had brains and knew science. At the bottom of everything was science, and the country must grow from scientific knowledge. He himself was deeply interested in scientific subjects, and in the engineers who were men of science. He was proud, even though towards the close of his life, to be paid such a compliment. He predicted that the engineering profession was destined to play a great part. Mr. Kirby proposed a toast on behalf of the new member.

President Leonard congratulated the St. John Branch on its new member, whom he had known for many years. He referred to the unrest today in industrial life. Continuing he said: There is a small proportion, estimated at one-eighth of all the industrial world, which is organized and there is a small proportion of men who are employers in the organized sense of the term. But the two together make a very small proportion of the population of this country, and yet they cause between them a very great deal of interest. The engineering profession consists almost exclusively of salaried men. There are very few of us who are classed as capitalists or employers. Neither are we in the class with trades unionists, because we are salaried men. As such, *The Engineering Institute of Canada* is the only organization in Canada which can favourably represent from one ocean to the other the great mass of people who are incidentally interested in all these questions which are before the public today and yet are not partisan on one side or the other. As such my word to you is "be steady."

Second Session

The chair was occupied by the President, Lieutenant Colonel Leonard, who immediately called upon C. O. Foss, M.E.I.C., Chairman, New Brunswick Water Powers Commission, who read his paper entitled Water Powers of New Brunswick.

Waters Powers of New Brunswick

Before going into a description and discussion of the Water Powers of New Brunswick, may I be permitted a few general observations.

The laws governing Hydrostatics and Hydraulics are so simple that the way-faring may readily understand them, yet I think I may safely say that there is no natural law so little understood even by people of high intelligence. There is no engine of equal power which is so simple of construction and installation, so uniformly sure in action and subject to so little wear and tear and depreciation as the modern up to date hydro turbine. I need not say that there is nothing miraculous about water power and that in a comparison of water with other methods of power generation we may easily make the mistake of spending so much money in the purchase, development and transmission of hydraulic power that the output may cost more than power generated in some other way, especially, when the consumption is small and limited. However, these exceptions only serve to prove the very general rule that hydro power is cheaper, surer and more flexible than any other form of power that can be developed in considerable units.

As regards water power possibilities in New Brunswick, it has been considered by the people generally that there are no power possibilities of any value outside of the Grand Falls of the St. John and a very moderate possibility at the Grand Falls of the Nepisguit, and this opinion has been strengthened by statements to that effect by parties who are supposed to be authority on the subject. If this was true the distribution of hydro-electric power in centres of population would be well nigh hopeless, for the cost of developing the Grand Falls of the St. John would be so great and its location is so remote from the centres of population, with the market at present in sight so limited, that the interest and overhead would make the cost greater than power generated by other methods. To make these powers commercially possible of development and use, the output must be used at or near the site in the manufacture of pulp and paper, the logical large industry for this Province. In the case of the Nepisguit power, the Bathurst Lumber Company are having plans prepared for the development and transmission to their pulp and saw mills in Bathurst, and the big power at the Grand Falls of the St. John will be developed in the near future for the same purpose. The parties now controlling the latter power site have a year from the close of the war to start the development, failing which the Provincial authorities will take away the control and arrange for the development by other parties. Then having disposed of the large power possibilities at the two grand falls, the question naturally occurs: where is power to be found for distribution and use in the centres of population?

The centres of population requiring, and not at present supplied with Hydro-electric power, are three:—

First, Fredericton and vicinity; Second, St. John and vicinity; Third, the towns on the North Shore from Chatham to Campbellton.

Moncton and vicinity has cheap power generated from natural gas.

St. Stephen has hydro-electric from the St. Croix.

Edmundston has a municipal plant on Green River. The Frasers have a development on the Madawaska for use in the pulp mill they have lately constructed. The capacity of this site may be considerably increased by storage on the Temiscouata Lake and they will be able to get any additional power they may need when they enlarge their plant, from Grand Falls when that is developed.

Woodstock also has a good hydro plant.

Taking the requirement of Fredericton: There are two streams falling into the St. John North of Fredericton: the Pokiok and Shogomoc, thirty-seven and forty miles respectively, following the highway which parallels the river, and thirty and thirty-three miles in an air line. These streams each drain about 50,000 acres. The Shogomoc falls 300 feet in the last two miles and the Pokiok falls 200 feet in 1½ miles and 100 feet more in about 500 feet. Both these streams have excellent opportunities for storage as they drain a country which is comparatively flat to a point about 2 miles from the St. John River. In other words, the St. John has eroded a valley 300 to 350 feet deep and on this flat country there is opportunity for storing large quantities of water by the building of comparatively inexpensive dams. These two streams if fully developed with all possible storage provided will yield at least 7000—24 hour power or 14000—12 hour power, or assuming that the working day of the future will be 8 hours then 21,000 h.p., if the pondage at the different plants is sufficient to take care of the fluctuations. The plan is to develop a small unit on the lower 100 foot drop of the Pokiok protected by the storage which is already provided by the existing dam at the outlet of Lake George. This will give power enough to cover the present requirements of Fredericton with quite a margin for increase of requirement. When more power is demanded the first unit can be more than doubled by building a new storage dam about 4½ miles from the St. John. When this is outgrown the 200 foot fall can be developed, and when that has been absorbed the Shogomoc can be developed. This should put Fredericton on the map as a manufacturing centre as it already is a Railway Centre.

The second and largest centre of population requiring Hydro power is St. John. All the power generated in St. John is by coal and the N. B. Power Company had to be given a very substantial increase in its rates to meet the greatly increased cost of coal and labor. They have been investigating possible water power for some time and now that the war is over they will have to go ahead with the development very soon. The Lepreaux River empties into the Bay of Fundy about twenty miles from St. John. The drainage is about the same as the Pokiok or Shogomoc but the run-off is nearly twice as much. We have three years continuous run-off records and we are greatly puzzled to account for the phenominal run-off, being 133% of the total rainfall recorded in St. John. The engineer who installed the gauge and took the first two years records explained the phenominal run off by assuming that the stream is receiving a large amount of subterranean drainage from the water shed of an adjoining stream, but we having taken several checks of the run-off of this stream find the same phenominal run-off, which proves conclusively that there must be a much larger rain fall on the water sheds of these streams than there is in St. John, only a distance of a few miles away. There are three power sites on the Lepreaux, two of 90 feet fall and one of 64, and having in mind the very great run-off of this stream, these three sites will produce at least three times the amount of power used by the N.B. Power Company at present. There is one power site known as "big falls" which can be made to generate 40% more power than they used last year. When St. John and vicinity has absorbed and put to use the 5000 to 6000 h.p. that can be developed on the Lepreaux, the Maguadavic, 20 miles further away, can be made to produce as much more. There is no reason why the development of this power should not be put in hand at once.

The third district where hydro power is required is along the North Shore; Bathurst alone has a small and very indifferently developed and distributed system of hydro electric power. Campbellton and Dalhousie drive their plants with gas engines, using gas produced from anthracite coal, and the cost of that makes their power very expensive. Newcastle uses steam at big expense and Chatham uses oil engines. In addition to the requirements of these several towns the Dominion pulp mill at Chatham requires some 400 to 500 h.p. The Tete-a-gouche River which enters Bathurst Harbor a little North of the town drains about 100,000 acres and has an ideal opportunity for very large storage. About 8 miles above its mouth it enters a deep and narrow gorge of nearly perpendicular rock walls. The fall through this gorge admits of four power sites, each created by a dam built to the top of the walls and flowing the water back to the next dam up the stream. At the first or upper site a dam 70 feet high will give a head of 105 feet, there being a sheer fall of 35 feet in the flow of the gorge. This dam will flow the water back about 4½ miles. At the second site a dam can be built to a height of 130 feet; the third 65 feet and the fourth 35 feet, or a total of 335 feet. These four sites will put out 6000—24 hour power or 18000—8 hour power.

So it will be noted that while it was represented to the Provincial authorities only a few years ago that there is no water power in New Brunswick aside from Grand Falls, we have already been able to locate and fairly well prove (apart from Grand Falls) the existence of 23000—24 hour power or nearly 75000—8 hour power, which if all put to work would produce a big change of conditions in this Province. This Commission has only been in existence for a little over a year and is composed of three men busy with their regular work and so are unable to give any considerable amount of time to the matter. Our people in the Maritime Provinces are surely if slowly awakening to the fact that we may overcome to a considerable extent the handicap which the Upper Provinces hold over us in manufacturing, due to their enormous water powers, by developing what we have discovered and looking for more.

Discussion

In the discussion following, which was participated in by Alex. Gray M.E.I.C., J. S. Armstrong, M.E.I.C., C. C. Kirby, A.M.E.I.C., Senator Domville, and the author of the paper, the main point brought out was the necessity for providing adequate storage basins to give continuous power. Mr. Foss stated that K. H. Smith, A.M.E.I.C., who had made a special investigation of the water powers of the Maritime Provinces was present and would no doubt add to the discussion.

Mr. Smith pointed out that the figures used in Mr. Foss's paper was necessarily approximations, since there had not been sufficient time during which records of the rainfall in New Brunswick had been kept to justify an engineer committing himself definitely to the power available figured from the run-off in its relation to the rainfall. Only one year's records have so far been kept, and it requires the records of many years to establish definitely the amount of continuous power available. He considered that storage was not a serious difficulty. Replying, Mr. Foss stated that his figures were based on the records of rainfall during the past year, which was believed to be a particularly dry one.

A hearty vote of thanks, moved by Senator Domville, seconded by Alex. Gray, was tendered the author for his excellent paper.

W. Rupert Turnbull, F.R.Ae.S., then read his paper—

Proposed Tidal Hydro-Electric Power Development of the Petitcodiac and Memramcook Rivers

We should run over first and in a brief manner the tidal developments and proposals of the past, so that you will be led, as I have been, to think that the first large tidal development in the world will probably be carried out at Hopewell, the little village that lies closest to the tidal estuaries, the Petitcodiac and Memramcook, where nature has formed two great natural reservoirs, with the exception of the dams that must be built to complete them.

Old charters show that tidal power was used in England for grinding corn, as early as the 11th century, and tidal mills have been in operation f r the same purpose, from that time to the present day.

The following extracts are ta .en from an excellent article by W. C. Horsnaill, that appeared in "The Engineer," London:—

> "No records exist showing how the earliest tide wheels were arranged, but particulars are available of several mills which were erected in the eighteenth and nineteenth centuries. In the earlier historic mills no attempts were made to produce a fall, the power being obtained from the flow of the water into and out of the pound. To develop power in this way a wheel, similar to the paddlewheels of steamships, was used, but with a reversed action; that is to say, the flow of water drove the wheel. This arrangement entailed the raising and lowering of the wheel to suit the rise and fall of the tide, as only the bottom floats could be immersed if the best results were to be obtained.
>
> A corn mill at one time existed at East Greenwich which was driven by tidal power in the way we have described. The pound had an area of about 4 acres and the wheel measured 11 feet in diameter by 12 feet long. The power was transmitted by a bevel gear at either end of the water-wheel shaft, the pinions being free to slide up and down two square vertical spindles. The water-wheel and bevel gears were mounted upon a frame which was caused to rise and fall to suit the tides, and the power was transmitted by either bevel wheel according to which way the water-wheel was running, the other bevel pinion being thrown out of gear. By these means the machinery in the mill was always driven in one direc-

tion, in spite of the reversal of the water-wheel at each turn of the tide.

The movable frame, with the water-wheel and gear weighed some 20 tons and the bottom of it was extended to form a kind of shutter, which filled up the opening underneath the wheel race, all the water flowing into or out of the pound being thus compelled to pass through the wheel.

Another type of wheel was devised to overcome the drawback of having to move up and down with the tide. This wheel was fitted with hinged floats, which arranged themselves across the stream at the bottom of the periphery, while they travelled through the water edgeways during the remainder of each revolution. With floats of this type the wheel was fixed, and the tide gradually rose over it until in some cases complete immersion took place.

An arrangement of the sluices was also adopted to compel the water to pass through the wheel in the same direction, whether flowing in or out of the pound, thus doing away with the need for reversing gear between the water-wheel and the machinery to be driven.

These wheels must have been very inefficient, as the loss of power caused by the drag of the upper portion when covered was serious, and the design was soon discarded.

Following these earlier mills came the more recent examples, many of which are still in existence, while a few of them may be seen in operation. The older mills aimed at using the current of water caused by tidal action and advantage was taken of the flow in either direction. The more modern tide wheel is arranged to operate with considerable fall, and only develops power when the water is flowing out of the pound.

The undershot wheel with straight radial floats is usually adopted, and the mill is started at half ebb or a little later, work being continued for about five hours, or until the water rises under the wheel and chokes the tail race. These arrangements give only five hours of working during each tide."

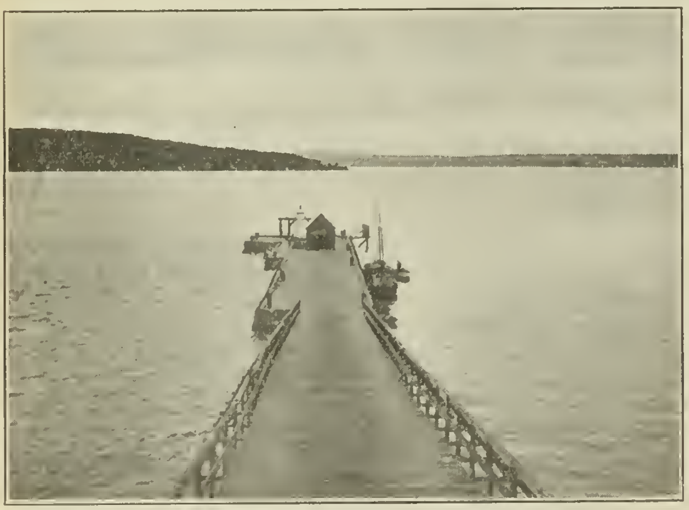


Fig. 1—New Wharf—Hopewell High Water

Fig. 1a—New Wharf—Hopewell Low Water

Listing the tidal mills that actually exist:—we have a mill at Woodbridge of 10 to 12 H.P., one at St. Osythe of 20 H.P., and one at Walton-on-the-Naze of 85 H.P.—these are all small powers, working on a low range of tide, and with only a single, small, natural reservoir—that allows of only a partial use of the tidal power for a comparatively short period of time, but Mr. Horsnaill shows that if modern turbines were installed at the plant at Walton-on-the-Naze and the power was used to develop electricity, instead of grinding corn, it would show up, as a commercial development, somewhat better than Gas Power in spite of a heavy outlay for storage batteries which would be necessary at a plant situated as Walton is.

The number of proposals for tidal plants is very considerable, and while I think I should not take up your time by discussing all of them it is worth while to examine a few of the more serious ones.

Mr. James Saunders discussed, in the Engineering Review of London, three great plants for developments in England, viz.: at Chichester Harbour, at the Menai Straits, and in the Bristol Channel. But in each case either the head of the water was too low, or the cost of forming the artificial reservoirs was too great to make the proposals commercial at the present time. His most promising scheme is that for the Bristol Channel, where the tidal head is quite sufficient for successful operation, but where the cost of forming the great artificial reservoirs, that would be here required, is prohibitive (in view of the power obtained)—the total cost of the plant figured out at $47,000,000 and the H.P. at 240,000 so the cost per H.P. would be $196.00.

C. A. Battiscombe, before the London Soc. of Engineers, also made a tidal proposal for the Bristol Channel, but his cost works out at $237.00 per H.P. and while neither of these figures would be too high for commercial developments *in some localities* they are too high to interest English Capital, for England is still a country of cheap coal, and in examining *any* hydro-electric development we must constantly keep in mind the cost of power from other sources.

Mr. Boving has proposed a tidal plant for the River Dee, but no estimates of costs are given; and coming nearer home, there have been numerous proposals for obtaining power from the tides at Sackville, at Cape Split, and at the Reversible Falls of Saint John.

Now to get *continuous* power at any of these sites, it would be necessary to form large artificial reservoirs, and the formation of such reservoirs is so costly that these proposals are not, at present, commercially feasible.

The three great desiderata for a Tidal Plant are: First; That there should be sufficient height of tide to obtain a good Head. Second; That there should be two natural reservoirs of large size so that continuous power can be obtained; and Third; That the Power plant should be central to the population that would be served.

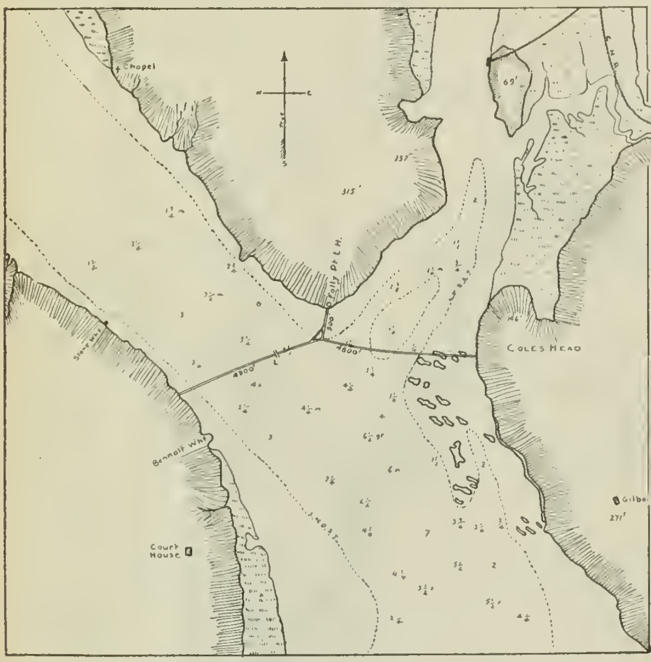
And it is these three desiderata that lead us to suppose that the *first* great tidal development in the World will take place at Hopewell. Here we have two large reservoirs almost completely formed by nature, we have a tide which is exceedingly regular and that ranks among the highest tides in the World, with a Spring Rise of 45 feet, a Neap Rise of 38 feet, and a Normal Neap Range of 32 feet, and we have this power centrally located to a present population of 250,000 who are *literally starving* for cheap electric power with no other hydro-electric developments in sight, except small ones and those that are too distant from the centres of population to make their development commercial at the present time.

Fig 2—Map showing the Watershed of the Petitcodiac and Memramcook Rivers

I have examined many other sites for tidal power, in those parts of the world, where the tides are sufficiently high to make tidal power at all possible, and I am firmly convinced that we have at Hopewell, the site that is most promising at the present time, from a commercial standpoint.

To give you some idea of the height of the tide at Hopewell, I will show some photographs that were taken this summer of the Government Wharf at Hopewell, at high water and at low water. This wharf, which is 55 feet high, is the only one to reach low water at ordinary and subnormal neap tides, it does not reach to low water at Spring Tides, and all other wharves in the neighbourhod are high water wharves, and are only reached when the tide has risen about half its height.

We will now discuss the principle which I have proposed for obtaining continuous power from these great tides, and I will draw your attention to this map of the two tidal estuaries, the Petitcodiac and the Memramcook rivers (Slide No. 2). This map shows the general trend of



Confluence of Petitcodiac & Memramcook Rivers

Fig. 3.

these rivers, and their confluence at Hopewell, and it also shows the freshwater drainage areas of the two rivers—which, although a minor item as compared to the great volume of salt water that flows up and down these rivers, should still be borne in mind in reviewing this proposal.

The dotted lines show the respective drainage areas approximately, and these have been calculated out to show a drainage basin for the Petitcodiac of 784 sq. miles and for the Memramcook of 134 sq. miles or in the ratio of nearly 6 to 1.

At present the flood tide makes up these rivers for approximately six hours and then turns and flows back into the Bay for 6½ hours, and this map also show the approximate limits of this flow, above which points the streams are fresh water.

The next slide (3) shows a scale chart of the confluence of these two rivers, at Hopewell, the proposed location of the dams that will be necessary to control the waters, the depths of water at low tide, etc.

The Western dam would be 4900 feet long, the Eastern dam 4800 feet long and a wing dam of 900 feet would connect the two, and it would, of course, be part of the plan to have a highway and trolley line (operated by the plant) over the tops of these dams connecting up the two main shores and the long peninsula that mades down between the two rivers.

This highway would only be a matter of local benefit but it would be of immense benefit to the building up of this locality. At present Hopewell can only be reached, from Coles Head by a little ferry that can only operate for a few hours near high tide, the Petitcodiac is only bridged at Moncton, 19 miles above Hopewell; the Memramcook was bridged at Upper Dorchester 5 miles above Hopewell, but this bridge is now gone, and the Government are at present making borings for a bridge to take its place that will cost about $1,000,000.

At present Hopewell, Hillsborough, and the big peninsula are hard places to get into, and still harder places to get out of, and yet they are regions of great mineral resources that only require, but still await development. The slide shows a lock in the Western dam, through which vessels could be passed at any suitable time of the tide, on their way up and down the Petitcodiac, and Hillborough and Moncton would be provided with deep water harbours instead of the mud flats which they at present enjoy at every low tide. The gates of the lock would naturally be swung by electric power furnished from the nearby power house.

The proposal provides for making the Petitcodiac a high level basin in which the water would always be high, and be replenished at every high tide, while the Memramcook River would be a low level basin to be partially filled from the high level basin and be always emptied during the latter part of the ebb tide. This arrangement would also admirably suit local conditions for the Memramcook is exclusively a farming district in which much time and money is at present expended in excluding the tides by means of dykes, and I have been informed by farmers of this valley that they would only wish to have the salt water flood their lands, about once in ten years for the purpose of fertilizing them. The navigation of this river is practically nil, so it would hardly be necessary to provide any lock in the Eastern dam—two or three times during a summer a small vessel will lie at the Dorchester Island wharf for the purpose of discharging goods but these could be as well discharged below the dam and the power company could well afford to pay for the short extra haulage.

I will now call your attention to the next slide (No. 4) which illustrates—in scheme but not to scale—the principle that I employ to get continuous power from the tides, with a varying head to be sure, but with the water always passing through the turbines in the same direction and always with a head sufficient to make turbine operation successful. The diagram shows the confluence of the two rivers, with the necessary dams and gates to control the flow—the gates J, J, etc., in the Western dam would be automatic flap-gates opening up-stream, allowing the high level basin (the Petitcodiac) to fill at every high tide and the gates H, H, etc., of the Eastern dam would be automatic flap-gates opening down-stream, and allowing the low level basin (the Memramcook) to empty on every ebb tide.

The gates G, G, etc., and G^1, G^1, etc., would be of the nature of lock-gates, they would be operated by electric motors, driven by the power-plant itself, and be under the control of the attendants who would open them and close them in accordance with the height of the external tide, at stated times that can be fixed for months in advance directly from the tide tables.

The Power House is represented as a long building, with turbines, T, T^1, etc., extending diagonally from the Wing dam to the Western dam, and these turbines discharge continuously from the high level basin into the common, triangular, spillway. Let us now follow through a cycle of operations from low tide to the following low tide, remembering that the high level basin was filled automatically at the last high tide, and that the low level basin has just been emptied during the ebb tide through the gates in the Eastern dam.

Beginning with low tide we may at first leave gates G, G, etc., open and allow the water from the spillway to discharge directly into the tidal supply (Shipody Bay), but the head will gradually decrease as the tide rises, and at about 2½ hours rise the attendants close gates G, G, etc., and open gates G^1, G^1, etc., allowing the discharge from the spillway to enter the low level basin—into this the spillway will continue to discharge for about 6½ hours, or through the last 3½ hours of flood tide and through the first 3 hours of ebb tide—after which time the water in the low level basin will have so risen, and the water of the tidal supply will have so dropped, that it will now be profitable to close gates G^1, G^1, etc., and open gates G, G, and once more allow the discharge to occur directly into the source of tidal supply and give the low level basin time to again drain out on the ebbing tide. I think you will at once grasp from this the simplicity of the system itself, but in order that we should study more fully one of the engineering problems involved, I will call your attention to the next slide (No. 5) the typical tidal cycle, at Hopewell; this curve shows a copy, in per cent of range plotted against time, of an actual tidal record, obtained at the ordinary neap tides by the tide gauge established this summer at Hopewell by the Canadian Tidal Survey, and furnished to me by the courtesy of Mr. H. W. Jones of that department. You will note how exceedingly regular the tide is, and how little affected by estuary flow, and this is one of the great advantages of Bay of Fundy tides, in general. At certain places in the World the diurnal inequality becomes so great that, for several days there is only one tide in 24 hours, and at Southampton there is a second high water occurring about two hours after the first.

In dealing with the question of tidal power at Hopewell, we must remember that although the tide is regular in type, nevertheless the *range* of the tide, and not the *rise* is the limiting factor of our power calculations, and it becomes necessary to establish and work on what might be called a "standard" range. For this purpose I have analyzed approximately, the ranges that will occur in the course of a year. I call spring tides those whose range exceeds 42 feet, they occur about 15 per cent of the time, and I think no attempt should be made to utilize them especially; I call subnormal neap tides those whose range is less than 32 feet, they also occur about 15% of the time, and some means, which are discussed later, would need to be employed to avoid the impairment of our "standard" amount of power.

All other tides I call ordinary neap tides, with a range, at Hopewell, of 32 feet to 42 feet—they occur about 70% of the time, and it is the lower range of 32 feet which I think we should adopt as our "standard" range and the curves and estimates that follow are based on this range of 32 feet.

We will now return to the discussion of the principles involved in the proposed plant, and I will ask you to examine the next slide (No. 6) which shows a tidal cycle, at a

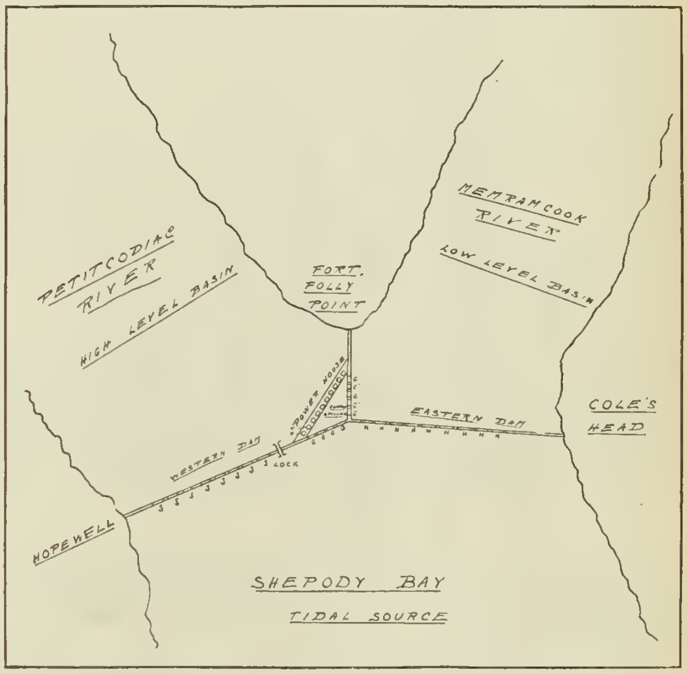


Fig. 4.—Illustration of principle for obtaining continuous power from the tides.

"standard" range of 32 feet, with an assumed drop in the high level basin of 6 inches per hour, and the level changes that will occur in the two basins with the operation of the plant as before described. If the conditions at Hopewell were absolutely ideal, the ratio of effective areas would be as 2 to 1, for the high and low level reservoirs, but unfortunately this is not the case for the Petitcodiac contains an effective area of about 330,000,000 sq. feet, while the Memramcook has only about 60,000,000 sq. feet, so that the ratio is about 5½ to 1—thus, while the water in the Petitcodiac is dropping 6 inches per hour the water in the Memramcook is rising 5½ times this, or 33 inches per hour, and these level changes are illustrated in the diagram on the screen—while the changes in effective head on the turbines is plotted immediately below.

Full lines, above, show the level changes of the high level basin, dotted lines, below, those of the L. L. basin. Starting at low water you will note, that for 2.35 hours, the level of water in the low level basin is unchanged, for the water from the spillway, is discharging into the tidal supply direct, but during this time the head is decreasing from

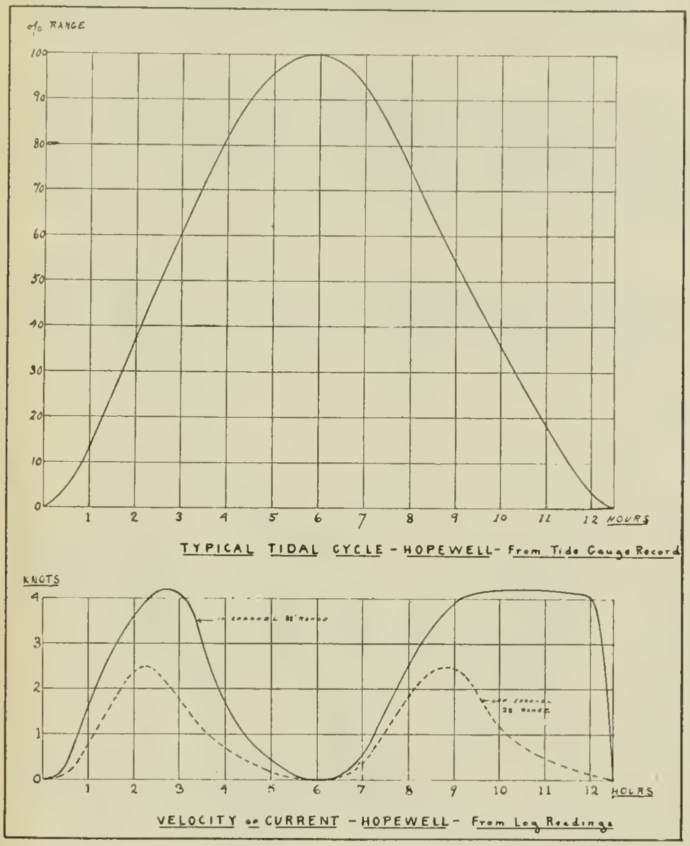


Fig. 5.

28½ feet to 13½ feet when it becomes expedient to discharge into the low level basin, when the head will at once rise to 27½ feet.

After this, for 6½ hours, the L.L. basin will rise, but the high level basin will also rise, after 4.1 hours (as the flood tide will then be filling it for 1.9 hours) and we have the head decreasing from 27½ feet to 22 feet, but afterwards increasing to 23½ at 5.2 hours.

After this the head will gradually decrease to 13½ feet, at 9 hours, when the tide in the external bay having sufficiently ebbed, the water from the spillway will be again discharged into it and the head will steadily rise to its previous maximum of 28½ feet at low tide, as shown by the curve of heads.

The average head, in this case, from low tide to low tide works out at 22¼ feet.

It will now perhaps be asked why I select a drop of 6″ per hour for the high level basin, and what the difference would be if we selected a greater or lesser drop.

It will be noted that up to a certain maximum (not shown on the curve, but which would occur at about 250,000 H.P. and at a 26 inch per hour drop) the available horse power increases with an increase in the hourly drop allowed, however, it must be borne in mind that as the hourly drop increases, the maximum head decreases, and the minimum head decreases more rapidly still, and we soon reach a case that cannot well be met by any ordinary turbines.

To illustrate this, a 4 inch drop in the high level basin gives maximum head of 30¼ feet, minimum of 20 feet, and average of 26½ feet, but 6 inch drop gives 28½ maximum, 13½ minimum and average of 22¼, and this seems to be about the maximum relative range over which we can expect a single turbine to act; we could employ duplex turbines, mounted vertically on the same shaft to the same generator, but with separate draft tubes (as suggested by James Saunders) but this means considerable added cost and is to be avoided if possible.

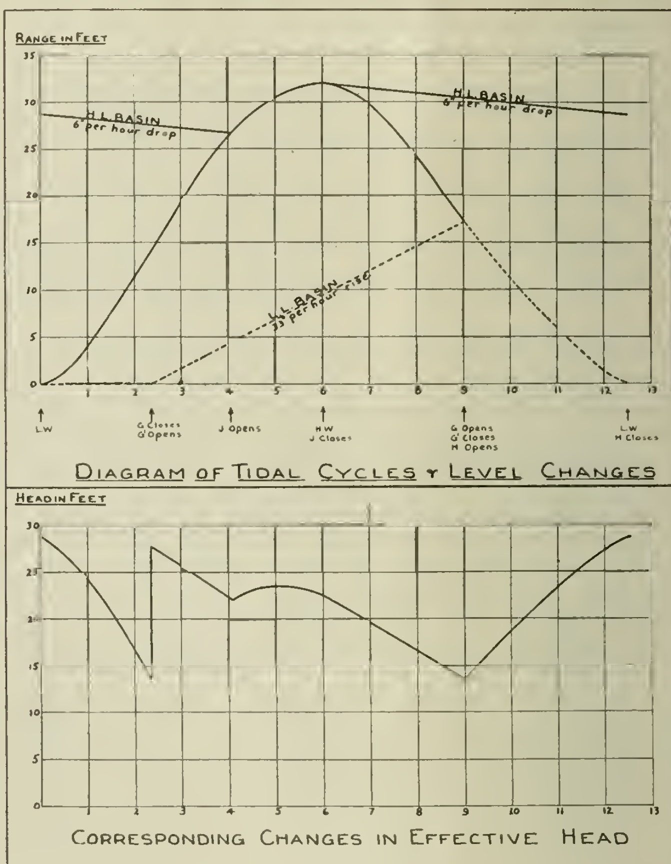


Fig. 6.

We are thus forced to adopt one of those comprises, that are often met with in engineering design, and must adopt a drop in our high level basin that will entail such a range of head that can be successfully met by the turbine designer. I am at present in correspondence with many of the leading turbine manufacturers and have no doubt they can largely overcome this difficulty of the variable head, in a moderate priced turbine, but the whole question of this variable head problem is so novel to them that the correspondence is necessarily lengthy to get them to understand the conditions involved in a tidal plant. However, one maker shows a turbine that gives 5000 H.P. at 120 ft. head and efficiency of 86% and also the same horse power at 220 ft. head and 80% efficiency, all at a constant speed of 300 r.p.m., so I think we can have no doubt that once the conditions involved at Hopewell are understood by the manufacturer and designer, we can obtain turbines that will meet the assumed condition of a 6 inch hourly drop in our high level basin and with a probable average turbine efficiency of about 83%.

and an electric tramway (both operated by surplus power from the initial installation) expropriate, by Government charter, the low-lying farms of the Memramcook valley at a fair and equitable rate, and shovel out the basin according to power requirements, removing the material by the electric railway and dumping it below the Eastern dam where it would be largely carried away by the tide, or could be formed into a useful embankment—wharf, railway terminal, or the like.

The next slide (No. 7) shows the approximate profile of the Western and Eastern dams—since it would not be policy to attempt to get the extra power that spring tides would give, the western dam need only have the height of high water, ordinary neap tides, but the height of the

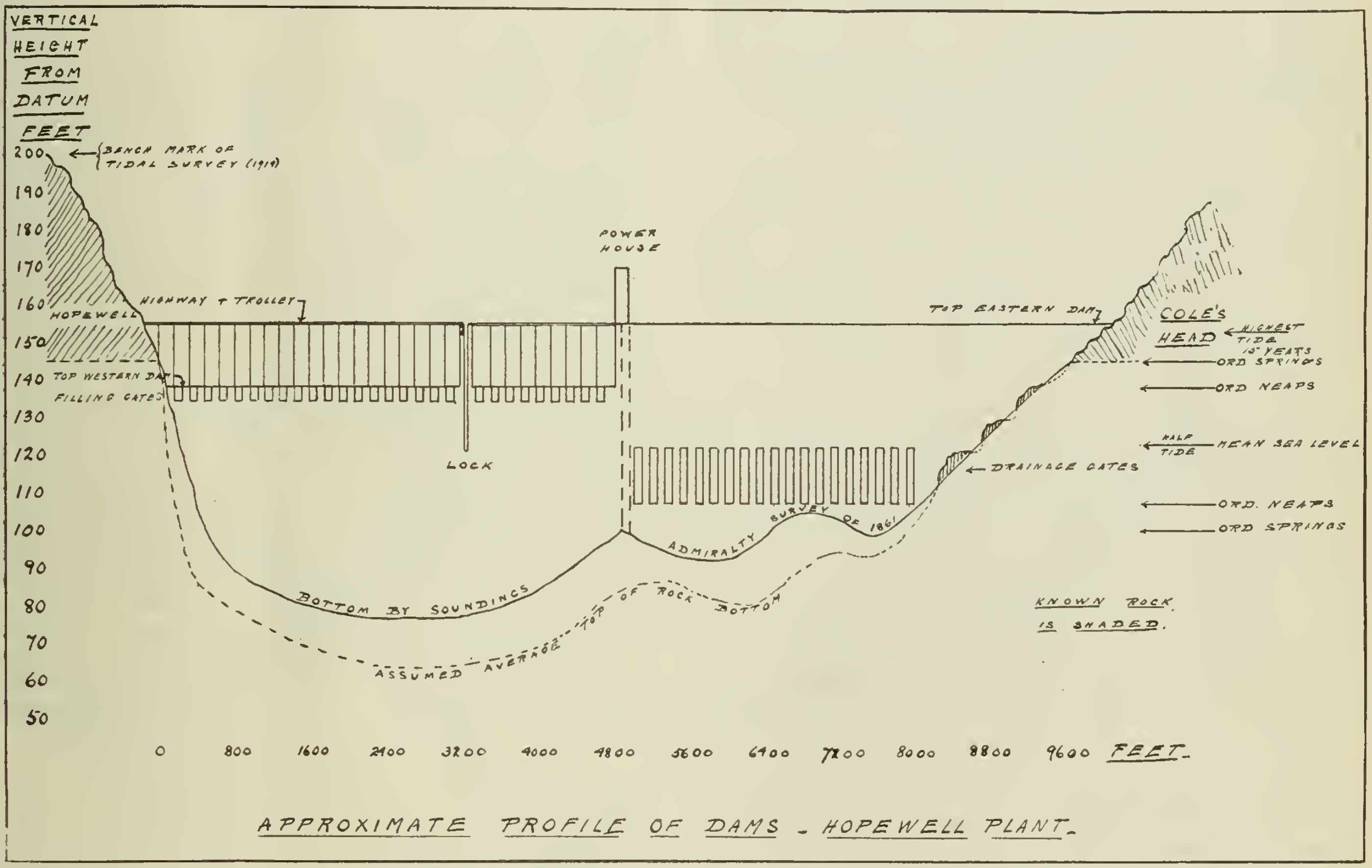


Fig. 7

As a matter of fact the initial installation called for at the present time by the existing population, would be about 90,000 gross horse power, and we note from the last slide that this corresponds to an hourly drop of 4 inches in the high level basin. Now while the population grew and the demand for electricity increased from 90,000 to 120,000 H.P. we could steadily be improving the ratio of the two basins, and thus greatly improve our power output (up to say 200,000 H.P.) and yet never exceed the limit of 6 inch hourly drop, which I have assumed as the present practical limit of single-turbine operation.

To improve this basin-ratio, to the ideal condition in which the Memramcook would have half the effective area of the Petitcodiac, I propose to use electric shovels

Eastern dam would have to be carried up beyond the highest probable spring tides to insure that the low level basin was never flooded at high tide. The slide shows this dam carried 3 feet higher than the highest spring tide that occurred during a period of 15 years. As before mentioned the tops of the dams could be utilized as highways and would thus be of invaluable local benefit, and a light steel structure is indicated on the Western dam for this purpose. The masonry width called for by the calculations would not be sufficient for a roadway, but a light steel structure could be winged out on top of the dams and made of sufficient width to carry a good roadway, an electric tram, and the power transmission lines that would go both west to St. John, and east to Halifax.

The flap-gates for filling the high level basin and emptying the low level basin are indicated in the sketch-profile. They should present no engineering difficulties but they should be designed of sufficient size to readily pass the full volume of water required by the final and maximum development.

We now come to the question of the river bottom and the location of rock for a good dam foundation, and here I must apologize for I cannot give you any exact data; I took the matter of borings up, with the Provincial Government very urgently last winter, but I was met at first with promises, and later with apathy, and I regret I could not undertake the expense of the matter personally. This summer I went twice to Hopewell, but could only obtain indirect evidence as to the depth of the rock under the muddy beds of the two rivers. The full line of the profile shows the depth of the top of the mud, according to the admiralty chart, and there is strong presumptive evidence that the top of the rock does not lie more than 15 to 20 feet below this. Where the "New Wharf" was built at Hopewell the mud soon washed out for a depth of 12 feet, when hard bottom was reached, and the outcropping of ledge rock at the mouth of the Memramcook, as shown on the chart and profiles indicates the rock bottom for a quarter of a mile, is very near the surface. The shores at Hopewell, Fort Folly Point and Coles Head are all rocky and the nature of all rock in this locality is the same, viz.:—shaley sandstone to pure sandstone sufficiently sound for making grindstones.

As to the best type of dam to build at Hopewell I feel that I should offer no opinion, for the question of dam design is an engineering specialty and only an expert in this particular branch of engineering could decide the best type to adopt and he only after a systematic line of borings were obtained along the proposed site. It has been suggested to me that a dam composed of hollow sections of concrete is a satisfactory and cheap type to build, the sections being built in a dry dock, floated into position and then sunk by filling the interior with rock and gravel. However, I doubt if this is a well proven system and, as I say, the question of best type should be decided by an expert of long experience. Such estimates of cost that I have been able to make have been based on the cyclopean concrete type of dam. In considering the best type to build at Hopewell the question of the tidal currents would have to be considered, and while these currents are not very swift, when the great height of the tide is considered, nevertheless they should receive attention. I will ask for slide No. 5 to be put on the screen again and you will there see some currrent measurements that I made this summer by using a ship's log attached to an anchored boat. When the tidal range was 38 feet the channel current reached a maximum of 4.2 knots and you will note that although the flood current soon dies out the ebb persists at near its maximum, until almost the time for the next flood tide to begin. Out of the channel the current runs swiftly for much shorter periods, and the tidal current makes shoreward as the shores are approached until we often have currents at right angles to the main stream. The dotted curve shows some measurements taken rather off the channel, with a tidal range of 28 feet, and the maximum under these conditions was 2.6 knots.

Before leaving the engineering problems that are presented by this novel plant I will mention three other items that should be considered.

The question of subnormal neap tides requires especial attention, for while my calculations are based on the least range, viz.: 32 feet, of ordinary neap tides, nevertheless there are certain tides which occur sometimes three days a month, sometimes five days a month, and sometimes not at all in a month, which have a lower range than 32 feet, and may sometimes have a range as low as 24 to 25 feet.

Now if our plant were built and running at full capacity, with a range of 32 feet, there would be an impairment of the regular capacity whenever these subnormal neaps occurred (which is about 15% of the time), and, I think some provision should be made to deal with them adequately. One method might be to keep the turbines and generators well ahead of the normal demand and use these extra ones only during the subnormal neaps; another method would be to keep the Memramcook shovelled out (as already described) well ahead of the future requirements, and thus improve the average head, and yet another method would be to build a fresh-water dam (say just below Turtle Creek about 5 miles west of Moncton) in which freshwater would be impounded and released only to make up the deficiency in head at subnormal neaps. Still another method would be to employ auxiliary steam power to assist the water-power during the water deficiency. One of the last two devices is nearly always resorted to in the case of ordinary hydro-electric plants situated on fresh water rivers. In nearly all districts the amount of rainfall varies enormously during the different months of the year and the amount of run-off and discharge varies in a direct relation to the rainfall. As an example of this, the discharge at Grand Falls on the St. John River reached a maximum in May, 1909, 50 times greater than the maximum of October 1909, and the mean discharge for the whole month of May was 20 times greater than the mean for October. In freshwater rivers a certain power may run into thousands of horse power in the spring, but be reduced to hundreds in the Fall of the year, unless adequate means are resorted to, to increase the deficiency of head.

In this matter a tidal power scores heavily over a fresh-water power. In the case of the freshwater power neither the time nor quantity of a head deficiency can be predicted, but with a tidal power both the amount and the deficiency are predicted by the tide tables several years in advance and it would thus be much easier to provide for our head deficiency which only, after all, amounts to 25% in quantity and occurs only 15% of the total time.

The best means of making up the deficit, in the case of the Hopewell Tidal plant would be best figured out in the final estimates as that one which would maintain the normal output at a minimum of cost.

The other two engineering items I wish to discuss are sediment and ice.

At the present time the never ceasing current flow up and down the two rivers keeps the river mud stirred up and the waters of both rivers show a considerable amount of sediment, and one would at first jump to the conclusion that this muddy grit (fine though it is) would produce much unusual wear on the turbines. However, what will happen as soon as the mouth of the Petitcodiac is closed by a dam? The mud in the water above the dam will undoubtedly settle, for it will have time to do so, and the water of the Petitcodiac will become clear. At present the water is never still, but with a dam the rise and fall would be reduced to a few feet and the current would be sluggish.

In a similar way the building of the dam would entirely alter the ice conditions, once the dam was built the whole river would freeze over in severe weather, and the sheet of ice would rise and fall with the water just as it does in the St. John and similar rivers. Nevertheless while the building of the dam was in progress, the question of large masses of ice moving with the current should be given every attention and quite likely some special method of cushioning the blows from ice might have to be devised.

We will not turn to a consideration of the method of distributing the power available at Hopewell, and I will ask you to examine the next slide (No. 8) and note how centrally Hopewell is placed with reference to the centres of population of both New Brunswick and Nova Scotia.

The method of transmission carries with it no special problems as we would undoubtedly use step-up transformers at the power house, transmit at about 30,000 volts with 3-phase current, and use step-down transformers at the delivery points. All this system has been so thoroughly thrashed out, and is in daily use all over Canada and under Canadian winter conditions, that it has become practically "standard" and needs no special consideration here. The principle feature that should be considered in laying out the transmission lines would be one of expediency and proper return on the capital outlay of transmission lines and line losses. Undoubtedly a main line should go west to St. John, with power for all intervening towns and villages of any size, and undoubtedly a main line should go east and south to Halifax with power for Sackville, Springhill, Amherst, Truro, etc., and also undoubtedly branch lines should go to Moncton, New Glasgow and Stellarton (as the present population would warrant this). The extension of branch lines to St. Stephen, Fredericton, Newcastle and Chatham is some-

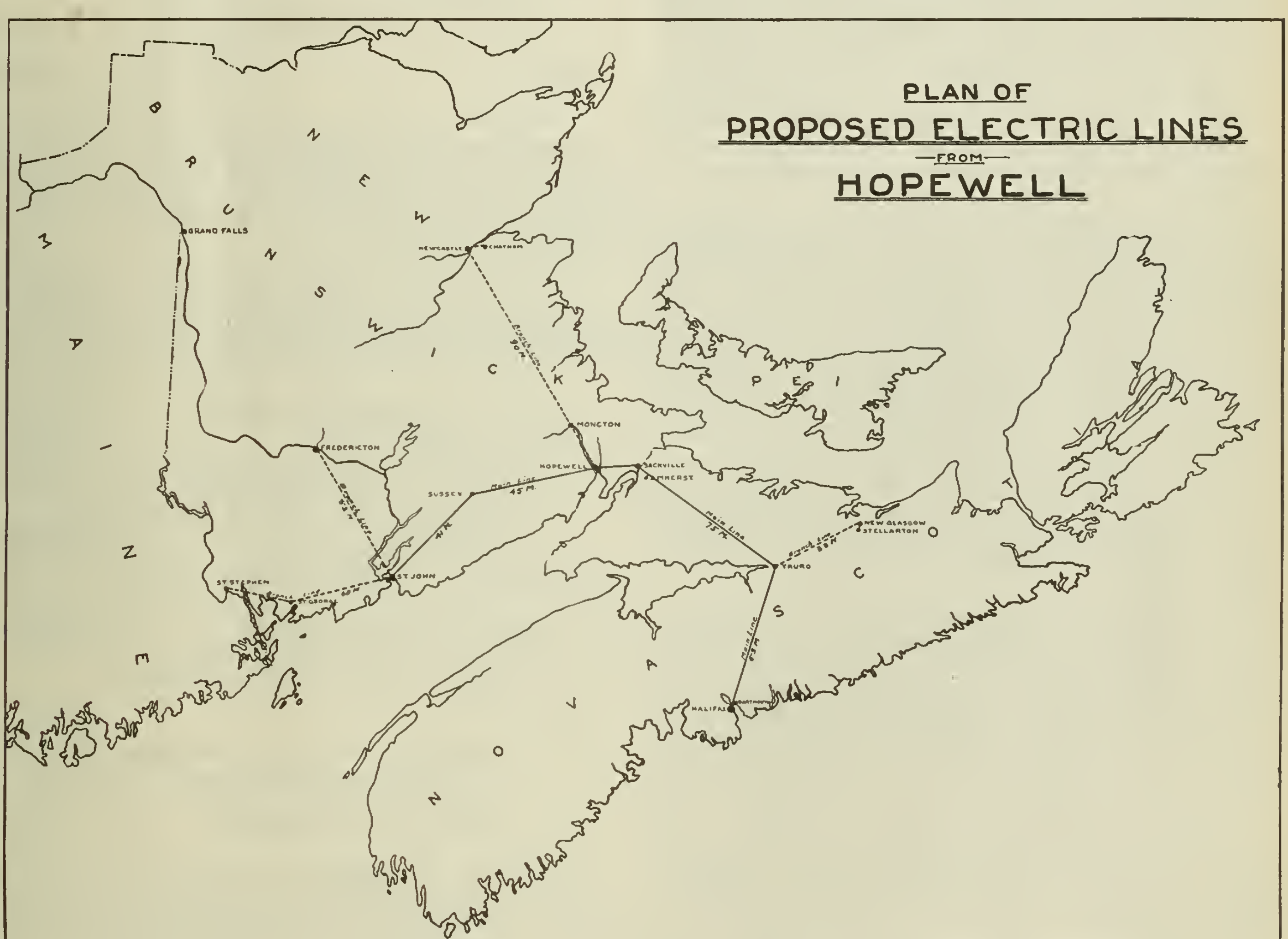


Fig 8

what doubtful at present, but there are railways that well might be economically electrified towards all these points, and I have, therefore included them in the preliminary estimate. I have prepared a table of the population that would be served by these lines, and the total works out at 250,000 inhabitants, with this as a basis we should now estimate the probable per capita use and thus obtain an estimate of the proper size of plant for the initial development at Hopewell.

When I prepared my first report on this subject it was submitted to the well-known firm of Sanderson and Porter of New York (a firm who specialize in the control and management of some sixty hydro-electric developments), and their condensed criticism was as follows:—

> "We think your proposal from an engineering standpoint is sound and it is the only scheme for utilizing tidal power that seems practical, but we are rather in doubt as to whether the population served is sufficiently large to warrant the capital expenditure."

Now this was in 1914, and I presume Sanderson and Porter based their opinion on the per capita use of hydro-electric power in the United States, which works out at 0.10 H.P. per inhabitant according to the text books. On this early report, and on their opinion, I based the letters to the newspapers that were published in St. John and Halifax and in these letters I appealed for Governmental help since it seemed at that time that while my proposal was *almost* a commercial one it was not conclusively so.

Since last January, however, newer data has come to my hand, and if this data is accurate, as I presume it is, the complexion of affairs has changed and the Hopewell plant is a really *good commercial proposition* at the present time, and needs only the Governmental help accorded by a good charter.

The data that I speak of was published in "Saturday Night" about February of this year and is contained in a very interesting table which shows the per capita use of hydro-electric power for every province of Canada and for the Dominion as a whole. It shows that British Columbia uses 0.36 H.P. per capita, Ontario 0.288, Quebec 0.267, and the whole of Canada 0.206 and these figures are for *the total population* and they should be increased at least 30% for the per capita use of *population served.* It will thus be seen that Ontario, per capita served is using about 0.37 and Quebec about 0.35 and I think we may properly assume that 0.36 would be used by the inhabitant of the Maritime Provinces as soon as you could give him really cheap electricity.

On this basis, then, the population of 250,000 would require 90,000 gross horse power, or say 45,000 H.P. at the delivery points, and I think the initial development at Hopewell should be for 90,000 Horse Power, with every provision made for increasing the output as already outlined in this paper up to 200,000 gross horse power as the population and demand increased as they undoubtedly would when cheap power was available.

We now turn to the question of costs and I have made an estimate of this as follows, and in accordance with the text books on the subject:—

Dam Cost in Cyclopean Concrete

Western Dam:	
730 lineal feet @ equivalent height of 38 ft. and $137 per lineal foot.....	$ 97,000
4,100 lineal feet @ equivalent height of 65 ft. and $300 per lineal foot.....	1,230,000
Eastern Dam:	
2,800 lineal feet @ equivalent height of 65 feet and $300 per lineal foot...	840,000
2,000 lineal feet @ equivalent height of 35 ft. and $120 per lineal foot....	240,000
Wing Dam:	
900 lineal feet @ equivalent height of 30 ft. and $94 per lineal foot.....	84,600
Total 10,530 Total Cost	$2,491,600

Now one well-known engineer, who examined my first report, considered this too low a figure and thought $4,000,000 should be allowed for dams, and since we will remain uncertain about the dam cost until borings are made it will be best to allow this higher figure in our preliminary estimates.

The other items of cost can be more accurately estimated from the known cost of equipment in existing hydro-electric developments and we have the following table of total estimated cost, see Figure No. 10:—

Dams, as per preceeding estimate...	$ 4,000,000
Lock, in Western Dam...............	100,000
Sluices, gates, etc....................	300,000
Power House of steel and concrete.....	200,000
Turbines, Generators, etc., @ $40. per gross H.P......................	3,600,000
Transmission Lines, etc..............	1,200,000
Preliminary Dredging, Dam, Trench, etc............................	100,000
Promotion, Engineering Fees, etc......	500,000
Auxiliary Plant to supply Head deficiency at Subnormal Neap Tides, say............................	1,000,000
Total cost of initial development to produce 90,000 gross H.P...	$11,000,000
Or cost per H.P. developed......	$122.50

The cost for subsequent development is much less, relatively, for in the initial development full allowance has had to be made for the final development in all items except turbines, generators and transmission lines, and the cost of a full development of 200,000 gross H.P. would work out at about $16,000,000, or $80 per gross H.P. In this estimate for final development, the cost of shovelling and dredging the Memramcook farming lands (which would be necessary as previously shown) is not figured, for it would be undoubtedly good policy to start this work as soon as the power house was in operation and take the necessary cost out of the annual income.

In considering the charge that could properly be made to the consumer, initially, we must consider the cost of steam power in the provinces, and I have it on good authority that the *actual cost* to the largest producers of electricity, by steam, was $60. per H.P. year before the war and would be about $90. per H.P. year at the present time.

Suppose now we were to charge half this rate, in the average, and place our charge at $45. per H.P. year—this would be the *average* charge, and the charge in special cases would work out about as follows:—

	Charge per K.W.H.
(1) To power users in excess of 1000 K.W. hrs. per month and 24 hour service	¾¢.
(2) To power users, in excess of 1000 K.W.H. per month and ten hour service	1.5¢.
(3) To small power users and 10 hour a day service	2.25¢.
(4) To power users, irregular service	3.0¢.
(5) To small lighting service	4.0¢.

These rates are from one-quarter to one-tenth the rates now charged in the provinces, they would attract population and develop industries, and they could be gradually reduced, as the demand for greater output increased the size of the plant, to about 60% of these rates.

On this basis then, our annual income should be $2,025,000 initially, and this would probably be apportioned about as follows:—

Depreciation and operating expenses @ 6% on cost	$ 660,000
Royalty on patent rights @ 50 cents per gross H.P. produced	45,000
Enlarging Memramcook Valley by shovelling and dredging, the power being supplied by the plant itself, say	200,000
Incidentals	20,000
Interest on Capital Expenditure @ 10% of cost	1,100,000
	$2,025,000

I trust I have now fairly presented the case for a great tidal plant at Hopewell. I believe that it is to-day a good commercial proposition for the Capitalist and it certainly would be an inestimable boon for the people of these provinces. To quote from the Commission of Conservations book on the "Water-Powers of Canada" (1911), it says, in speaking of New Brunswick:—

"The larger rivers for the most part are long and their fall is gradual,"

and again:

"There are comparatively few lakes in the upper portions of the watersheds of the majority of the rivers and, hence, little facility is afforded for the natural storage of waters for the purpose of equalizing the flow during the low water periods."

This is true of New Brunswick and it is also true of Nova Scotia, the upper provinces are steadily forging ahead of us, both industrially and in population and this advance can be ascribed largely to their abundant water-powers, and it behooves us of the lower provinces not to mourn our loss of power but to make full use of that great power that Nature has really placed at our door, viz.:—the Bay of Fundy tides.

Were we able to harness the power that is daily wasted in the two great eastern arms of this Bay, we could have the use of 3,500,000 horse power, but this is a dream for the future and is not a practical proposition for to-day. The theory of the thing is the same as for the Hopewell plant, but the execution and cost would be impossible at present.

The Hopewell plant is to-day a good commercial proposition. special engineering problems are attached to it, but they are only those that attach to any special plant, the difficulties are small in comparison to many recent engineering works that have been successfully carried out, and I trust that the near future will see this great plant in daily operation.

Discussion

In proposing a vote of thanks to Mr. Turnbull for having so kindly, although not a member, prepared such a well-thought-out paper for this professional meeting, C. H. Wright, M.E.I.C., pointed out that what the Maritime Provinces most needed at the present moment was a development of the smaller water powers, of which we had learned in a previous paper there was a very considerable horse power available. This was true of Nova Scotia as well as of New Brunswick, so that by developing these powers without delay cheaper power could be had for lighting and particularly for industrial purposes. He considered Mr. Turnbull's idea an excellent one, and expressed the hope that we should all see it carried out. He thought, however, that the amount of power proposed by the author of the paper was more than the country could absorb for many years. A. R. Crookshank, M.E.I.C., seconded the proposal of the vote of thanks.

Lieutenant-Colonel Leonard outlined the power situation in Ontario, particularly in the Niagara Peninsula, where at the time of the early electric installations twelve miles was too far to carry electric current. After the first large electric installation on the American side it was a matter of five years before any of this energy was used by Buffalo manufacturers. The whole project was considered visionary, and not based on good business. At the time the power at DeCew Falls, near St. Catherines, was developed the promoters did so against the best engineering advice they could procure. Since then 45,000 h.p. had been developed at that point. During the past fifteen years hundreds of thousands of horse power of hydro-electric energy had been developed in Ontario, yet during the war there was an actual power famine. The establishment of manufacturing industries followed as a rule where cheap power was available. He considered that according to the author's figures the cost of developing this project as a source of available power was not prohibitive. The paper was a most valuable one and the scheme not only interesting but possessed great possibilities. He expressed his pleasure in presenting the thanks of the meeting to the author.

Replying to the points raised in the discussion; Mr. Turnbull states in answer to C. H. Wright of Halifax—Regarding the cost of transmission lines at $15,000 per mile, Mr. Wright seems to ignore the fact that I have included in my estimates $1,200,000 for the cost (as per the table of costs already given) of transmission lines and my estimate is based on a cost of $4000 per mile for main lines and a cost of $2000 per mile for branch lines, and these costs should be adequate *in a timber country, with wooden poles.*

Mr. Wright's figure of $15,000 per mile must refer to an expensive type of steel skeleton pole, and it is certainly the highest figure I have ever heard quoted. $3000 per mile for transmission lines, with wooden poles, is the average figure given in text-books of the subject. Mr. Wright quotes a present figure of 4¢. per K.W.H. in Halifax. I can only say we are not so fortunate in St. John where we pay 15¢. per K.W.H. (small users) and 7½¢. per K.W.H. (to largest users) less 10% discount if account is paid in 10 days.

Mr. Wright thinks we should develop the small powers first and with this idea I am absolutely at variance the whole trouble with these Maritime Provinces is that they are unprogressive—they are content to do the *small* things and they remain *small.* In Upper Canada they are not afraid to do things in a *big* way and they grow *big* in consequence. It is a well-known fact that whenever a *big* hydro-electric development has been carried out, the population and industries have gone to it, and there is no reason to think that the Maritime Provinces would prove an exception to this rule.

Replying to Lt.-Col. R. W. Leonard's remarks on an initial charge of $45. per H.P. year, Mr. Turnbull says: I probably did not make it sufficiently clear that the $45 charge was the *average* charge to all users—to large users it would be considerably less than this, down to ¾¢. per K.W.H. for largest users, and to small users it would be more, up to 4¢. per K.W.H. for the smallest users—I did not also make it sufficiently clear, that these would probably have to be the *initial* charge and that, as time went on and the output increased to the full available horse-power, it would be quite possible to reduce the average charge per horse power year to $27 without decreasing the rate of 10% per annum on invested capital.

This matter is figured, as before, in the following table:—

For gross output of 200,000 HP. delivered H.P., 100,000—

Cost of full development		$16,000,000
Annual income from 100,000 H.P. at $27 per H.P. year		2,700,000
Apportioned as follows:		
Depreciation and operating expenses at 6% on cost..	$ 960.000	
Royalty on patent rights at 50¢. per gross H.P. produced	100,000	
Enlarging Memramcook Valley, nil, since work would by this time be completed.		
Incidentals	40,000	
Interest of Capital Expenditure @ 10% on cost	1,600,000	
Total per annum	$2,700,000	

As Lt.-Col. Leonard has pointed out, $45 per H.P. year is not a high figure, and certainly $27 per H.P. year is a figure that can be compared with the rates charged by the most favoured hydro-electric developments in existence.

The afternoon session was brought to a close by the reading of a paper and the following discussion on the Construction of the Bear River Bridge, by A. T. Macdonald, A.M.E.I.C.

The Construction of the Bear River Bridge

Prior to 1912, the Bear River was crossed by the Dominion Atlantic Railway by a bridge consisting of about 750 feet of wooden trestle on pile bents and 5-Howe Truss Spans 150 feet long on concrete piers with pile foundation; the piles being cut off about two feet above the original bed of the river.

This bridge was used for upwards of twenty-five years but the piers were disintegrating rapidly between low and high water marks from the action of the river ice and were also gradually moving down stream.

Condition of Old Bridge

This bridge was what one might call ripe and certain timid souls were known to leave the train at Deep Brook and drive by road to Bear River Station or Digby, continuing their journey the next day, in order to avoid crossing the bridge. These people, no doubt, exaggerated the state of affairs but their nerves were not equal to the strain of travelling over 1600 feet of bridge at the rate of two miles an hour. Our first work therefore was to make the old bridge safe for traffic until it could be replaced by the new one. This in itself was a very costly proceeding. A double row of piles were driven just clear of the footings of each pier and framed bents of 12 x 12 spruce erected on these and braced to form a tower. The bottom chord of the truss was given a bearing on this tower about ten feet away from the end of the truss which was reinforced to suit this new bearing. In this way the old piers which were increasing their down strain movement were largely relieved of their loads. The pier supporting the swing span slid down stream to such an extent, 10½", if I remember rightly, that it became impossible to operate it. This necessitated another opening to permit vessels to pass. Towers on pile bents were therefore erected to support a 40′ plate girder, about 200 feet east of the existing swing span and when everything was in readiness an opening was cut in the bridge and the girders dropped into position, With the aid of the Dominion Bridge Company's derrick car this was accomplished without any hold up to train traffic. This span was operated as a lift span whenever the occasion arose, the derrick car furnishing the power. The clearance for vessels, going through this opening, was just about the minimum and called for expert seamanship on the part of the skippers.

Construction on a new bridge fifty feet down stream and parallel to the old one was begun in June, 1912, and completed in June 1914. The design, starting from the west end, called for 1—50′ D.P.G., 1—100 foot D.P.G., 1—156 foot D.T.G., 1—144 foot D.T. Swing Span, 3—156 foot D.T.G., 6—100 foot D.P.G. and 1—85 foot D.P.G.; the total weight of two and a half million pounds of steel. These spans are carried on concrete piers on pile foundations with the exception of piers 3, 4 and 5, which rest on a bed of coarse gravel and boulders.

Proximity of the Old Bridge

The proximity of the old bridge to the proposed work provided another reason for the expenditure of money to strengthen its foundations. With a distance of only fifty feet between centre lines the noses of corresponding piers on the two bridges lay side by side and as dredging proceeded for the new pier, in some cases being carried below the points of the piles in the old, the tendency was for the old pier to slide bodily into the excavation. This excavation therefore had to be carried on with the greatest care and divers were freely employed to keep the old foundations under close observation. Of course the old bridge in many ways helped in the construction, the contractors being able to utilize it for the running of water lines and trolley lines for conveying material etc., and the engineering party for laying out the work and as a ready means of communication from shore to shore. But it was not an unmixed blessing as the cofferdams during the process of sinking were on several occasions hung up by masses of old timber and odd piles which had been driven in connection with the original work.

Layout

From pier 8 to the west abuttment the bridge is on a 6 degree 10 minute curve to the left with a central angle of 59 degrees 20 minutes. A base line was carefully run over the centre line of the old bridge and permanent hubs set on each bank well clear of the work from which the bridge tangent was located by off-setting fifty feet and marked by permanent hubs, which were used for giving the centre line of all piers on tangent. The transverse centre line of these piers were given from points on the deck of the old bridge. Owing to the movement of the deck, as mentioned above, these points had to be located anew for each day that it was necessary to use them. In order to eliminate as much as possible any chance of error in locating the piers on the curve, it was desided to determine the exact geometric centre of the curve and erect there a sight, which would be visible at all stages of the tide. The transverse centres of the piers being on radial lines could then be located from hubs on the semi-tangent, using the centre of the curve as a foresight.

Fig. 1.—Completed Bridge Across Bear River.

Accordingly the P. I of the curve was found and as it came on the beach at high water mark, a concrete pedestal 18″ by 18″ and two feet high was put in on pieces of 4″ by 4″, 8 feet long as piles and on this the P. I (hub A) was definitely set after repeated checking.

To establish the centre of the curve was more difficult as the water only left it for about two hours each day. With the transit on A and backsighting on T on the west end of the bridge tangent, an angle of 60 degrees and 20 minutes was laid off and the point of intersection found with a line at right angles to the tangent of the curve at the the E. C. Around this point a rock filled crib 6 ft. square and 4 ft. high was built and a 2 in. pipe 24 ft. long was securely guyed there. (Hub O.)

As a check the calculated distance from "P" to "O" was measured on the ground with a 100 ft. steel tape over stakes driven to the same elevation and 100 ft. apart. The distances along the semi-tangent from P where the radial lines for each pier intersected, were then calculated and hubs set.

The distances along the radial line from the hubs to the curve were also calculated and recorded for use when required. A hub was put in at M the mid point of the curve, from which the angles to the centre of each pier could be turned as a check on the above method. All measurements were made with a 100″ steel tape and corrections made for temperature.

Foundations

The west abuttment and piers 1 and 2 were built on solid rock and the concrete poured in the dry; no pumping being necessary. The foundation of the east abuttment is on sand and gravel; the excavation for this was taken down six feet below original ground and piles driven to refusal at a penetration averaging 18 feet..

Piers 12 to 14 were on typical Bay of Fundy mud and dry at low water. Cofferdam at 10 by 10 hemlock were built in place and sunk as the excavation progressed, being loaded with old rails, to a depth of 18 ft. and piling driven.

The penetration averaged 25 ft. The penetration under the last blow was from ½ inch to ¾ inch—a 2400 pound hammer being used with a fall of 25-ft. These cofferdams were pumped out and the piling cut off 2 ft. above the bottom and the concrete poured in the dry.

The foundations of piers 9 to 11, inclusive, were built in the same manner but the penetration and number of the piles used increased as they approached mid stream.

In pier 8—the cofferdam was 21-7 ft. deep and the average penetration of the piles fifty-eight feet. The piles about 90 in number were cut off under water and the concrete deposited with a bottom dumping bucket; the bottom of this pier covers an area of 749 sq. ft. and there are 451 cubic yards of concrete in the footing course. In all the piers the footing course is carried about four feet above low water. Between low water and extreme high water the concrete is sheathed with 4 by 6 Southern Pine with ½ inch iron plates 2 ft. wide on the angles attached by 7-9 galvanized iron bolts 15½ inches long. All concrete below high water mark is 1: 2: 4, mixture and above 1: 3: 6:

The remaining piers 3 to 7, inclusive, were a somewhat different proposition. At extreme low water the depth of water varied from 20 to 27 ft. and with a rise of tide of 28 ft. this meant a depth of 55 ft. at high water for pier 3; borings showed for piers 3 and 4 and 5 a belt of fine sand about 8 ft. thick followed by 8-ft. of mud and then 5 ft. of gravel.

At pier 6—12 ft. of mud, 5-ft. of sand and 60 ft. of mud.

The borings were taken after the work of construction had begun and were very hurried and the information obtained not very dependable. They were taken from a platform or in some cases from a scow moored over the side of the pier. A 3 inch casing pipe was a one inch water pipe attached to a force pump working inside of it, to which the bit was attached, was driven down and the washings examined. A diamond drill was used to penetrate the gravel. At pier 7 a penetration of about 90 ft.

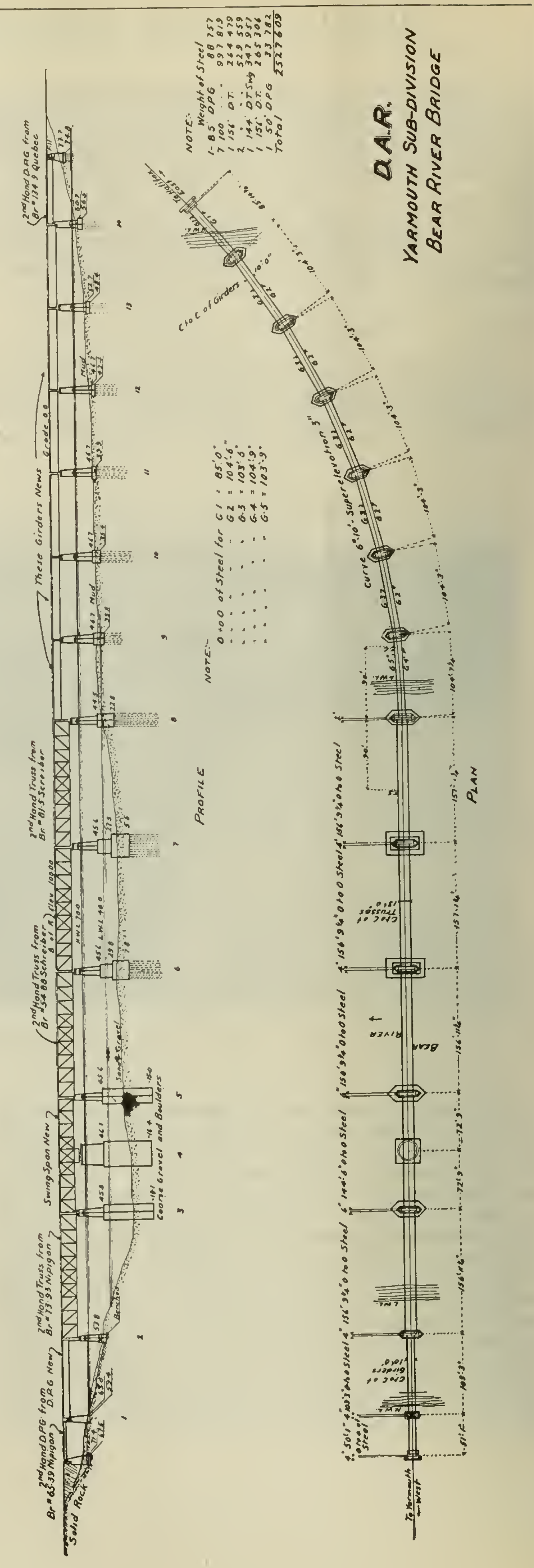


Fig. 2—Bear River, Looking East, Nov. 20th, 1912.

was obtained at which depth solid rock was reported. The platform from which the borings were taken had to be above high water mark that the work might go on continuously, so after penetrating the overlying mud there would be about 70 ft. of casing pipe when the gravel was reached.

Fig. 3.—Bear River, Jan. 1914.

When the inner pipe was raised and allowed to drop on this compact mass of gravel it bounced up again giving the impression that solid rock had been encountered. This idea was strengthened when the drilling made no further progress until the diamond was put on. I may say here that no solid rock was encountered at any of these piers when the work was completed.

It was finally decided to sink foundations for 3, 4, and 5 down to the gravel or about 20 ft. of excavation, by open dredging. Pier 3 was started first; a double wall cofferdam was constructed with a space of 4 ft. between the walls; the inner wall stopped about 12-ft. short of the outer and they were connected by a solid floor of 10 by 10 hemlock forming a cutting edge. Projecting below this was about 16 inch of ½ inch steel plate. The cofferdam about 30-ft. high was floated into position; the space between the walls filled with concrete and old rails piled on; dredging was then begun with an orange peel bucket through a well in the centre of the dam. As the cofferdam went down it was built up to keep the top above low water level. The position of the cutting edge was determined daily by obtaining the levels of four points on the dam equidistant from the cutting edge and the dredging directed accordingly to keep the dam vertical.

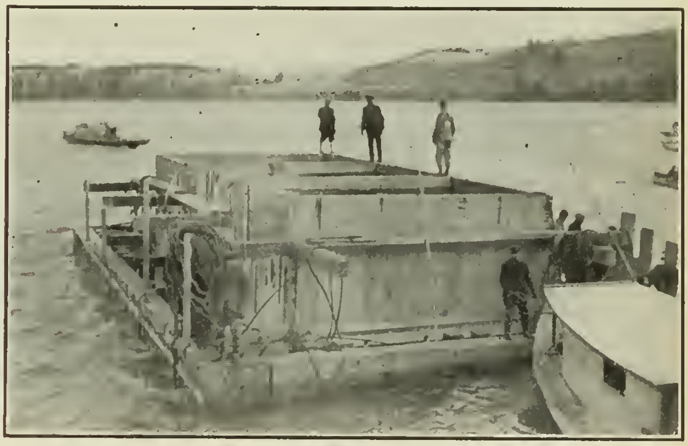


Fig. 4.—Caisson No. 6, Bear River, Feb. 10th, 1914.

This was quite successful until a depth of 12-ft. had been obtained, when one side of the dam got hung up on a large boulder, with the result that the dam took a list of about 15 degrees from the vertical.

Divers were then sent down to direct water jets around the obstructions and dredging was carried on the outside of the dam on the high side, finally the dam was straightened up into its correct position at a penetration of about 28-ft. and resting on a bed of coarse gravel and boulders. The total height of the dam is 62.4-ft. containing 130,000 ft. of timber and 1473 cubic yards of concrete.

Pier 4—the pivot pier, was sunk in similar manner to the depth of 36-ft., and contains 175,000 ft. of timber and 19,000 cubic yards of concrete; pier 5 was sunk to a depth of 40 ft. and contains 142,000 ft. of timber and 1453 cubic yards of concrete.

At pier 6 and 7 where the boring showed a considerable depth of mud it was decided to excavate about 15 ft. and drive piles. After the excavation was complete, there was a depth of 35 ft. of water at low water and the Foundation Company Ltd., who were doing the work introduced their underwater method of driving piles.

Underwater Driving

This method caused considerable discussion on the work, the contractors claiming that it developed at least 85% efficiency as compared with the ordinary method of driving piles with a drop hammer. I may here say that results did not bear this out as the average penetration with the underwater method was only about one half of what was obtained at the same location with the lighter hammer falling through air.

To enable you to form your own opinions of this method, I will describe the equipment used. The guide pile and hammer were handled by a stiff leg derrick operated by a 25 H.P. 3 drum hoist. The guide constructed of four 3½″ steel angles latticed together, was 22″ sq. inside measurements, and all rivets were sunk on the inside. It was made in 15 ft. sections capable of being bolted together to give the required length. Lugs riveted to the top section rested on crossed timbers on the cofferdam and the guide hung there from, just clear of the bottom of the excavation and over the spot where the pile was to be driven. The pile was then inserted in the guide and allowed to drop to the bottom. With heavy piles as much as ten feet penetration was obtained in some cases right at the start. The hammer weighing about 5,000 lbs., was built to give a clearance of about ¼″ all around inside the guide and terminated in a truncated pyramid. The hammer was lowered into the guide after the pile, and driving commenced, a fall of from 12 to 15 ft. being given. The fall was thus limited as it was found that the pile heads broomed badly. The piles used were exceptionally good but many of them failed to stand up under this treatment. The maximum penetration obtained was 46 ft whilst test piles, driven from the same location from a scow with a 24,000 lb. hammer and a dolly gave a penetration of 65 ft. However the big advantage of being able to drive under water was that the work could go on at all stages of the tide and this meant at high water the driving was being done through 70 ft. of water. The condition of the old bridge was such that anything within reason which would hasten completion of the new could not be neglected.

The length of the bridge is 1640-ft.; the total yardage of concrete used was 13,000 cubic yards; the contractors for the abuttments, and piers 1, 2 and 8 to 14, inclusive, were Messrs. Powers and Brewer of St. John and for piers 3 to 7, inclusive, were the Foundation Company Ltd., of New York and Montreal.

G. G. Hare, M.E.I.C., was the engineer for the D. A. R.; the writer being resident engineer.

Discussion

Owing to the late hour the discussion on this paper was limited. George Hare, M.E.I.C., asked the author if he would explain the cause of the brooming of the piles when driving them under water. In reply the author stated that the pile driver in striking the blow forms a cushion of water which is driven into the head of the pile. This not only greatly minimized the driving force of the blow, but was a factor in dissipating the energy, part of which was absorbed in the brooming of the pile.

A vote of thanks moved by Mr. Armstrong, seconded by Mr. Hare was tendered the author, bringing the afternoon session to a close.

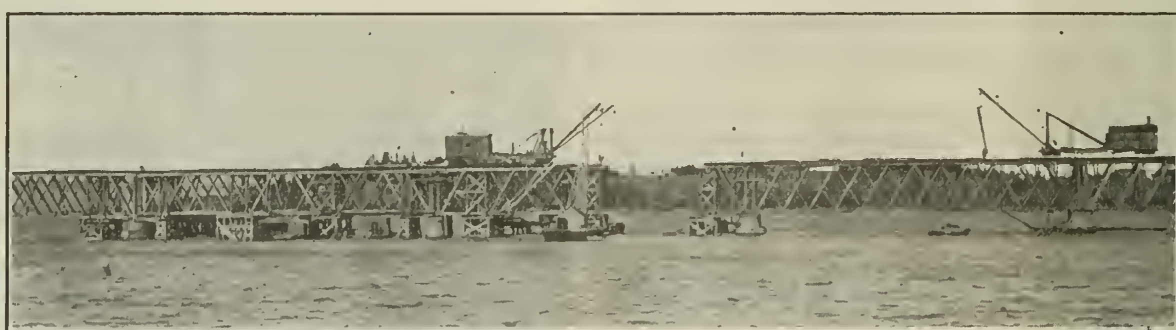


Fig. 5.—Bear River, Nov. 2nd, 1913.

Third Session

The president occupied the chair at the evening session, which was largely attended. The paper for this session, which was by F. P. Vaughan, A.M.E.I.C., accompanying which the author gave a unique and fascinating demonstration of experiments with high tension high frequency electric current.

High Potential, High Frequency Apparatus and Experiments

I take pleasure in presenting to you to-night a few experiments with alternating currents of high potential and high frequency. The use of high frequency currents has ceased to be of academic interest only and are used very extensively to-day in:—

Wireless Telegraphy and Telephony.

The testing of high voltage insulators and Lightning Arrestors.

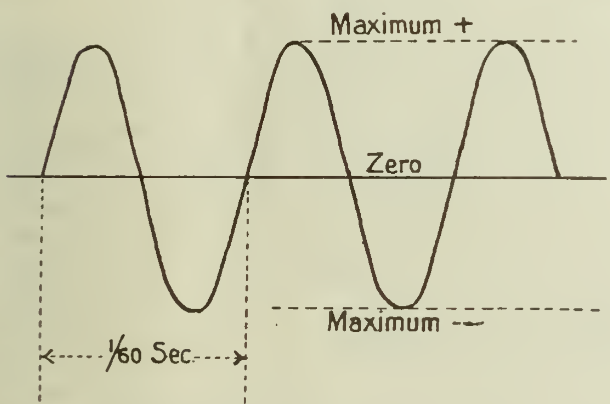
The production of Ozone (0^3) and Nitrogen.

X-ray Work.

The electric-culture of plants.

And when properly used and applied in Electro Therapeutics, have produced some remarkable results.

They have also quite recently been successfully applied to electric high frequency furnaces.



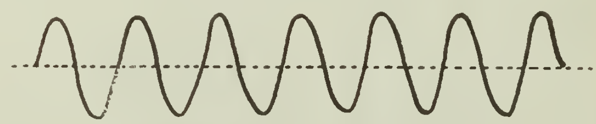
Alternating currents used commercially are, relatively speaking, of low frequency being from 25 to 60 cycles per second. To-night, however, we are dealing with alternating currents with a frequency into the millions, with a voltage of hundreds of thousands of volts. For the benefit of those not familiar with this subject, a few explanations may be necessary.

An alternating current is one that periodically changes its direction of flow a certain number of times per second; it is the reverse of direct current, which is assumed to leave at a positive pole and return by the negative. With an alternating current, the terminals are alternatively positive and negative. The current rising in voltage from zero to a maximum positive. falling again to zero, changes sign and rising to a maximum negative and again falling to zero and repeating this operation. The period of time taken for this operation with 60 cycle current would be 1/60 of a second for a complete cycle of two alternations.

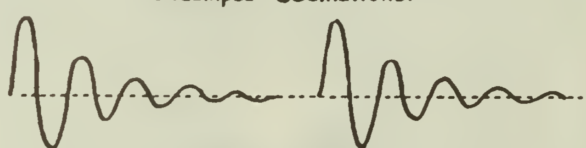
The primary current used to-night, taken from the New Brunswick Power Co's mains, has a voltage of 110 volts and a frequency of 60 cycles a second. As stated before, alternating currents met with in commercial use, are, relatively speaking, of low frequency. If, however, the frequency were from 1,000 to 100,000 they are generally called high frequency currents and when the frequency rises to a value of a million or so, they are generally called electric oscillations.

When an alternating current of very high frequency exists in a circuit, and continues uninterruptedly it is usually called an undamped or persistent electric oscillation (such as are used in wireless telephony and which require to be above 20,000 per second, to be above an audible frequency).

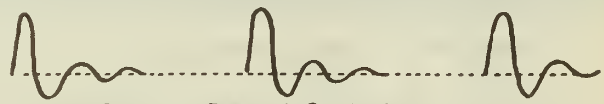
In the experiments to-night, however, we are concerned with an alternating current of very high frequency, which consists of separate groups of alternating currents; each group beginning with the same amplitude but then damping down more or less rapidly to zero, and after a short period of time beginning again. These are known as damped electric oscillations. The rate at which the amplitude dies away in each train is called damping. A train of very few oscillations say four or five, is called a highly damped train and over 100 or more a feebly damped train.



Undamped Oscillations.



Feebly Damped Oscillations.

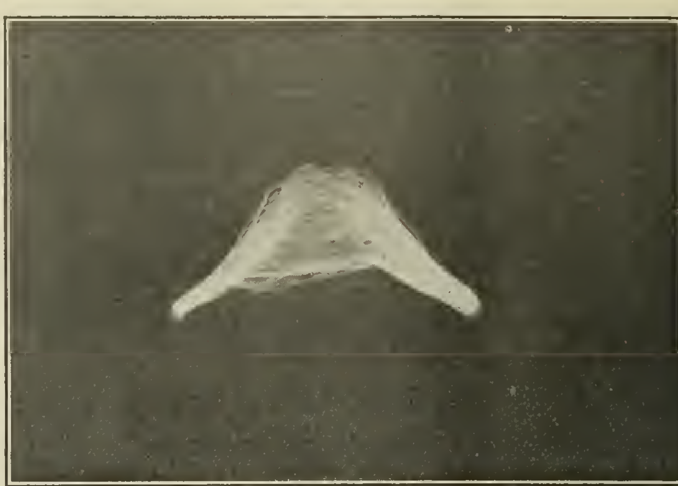


Strongly Damped Oscillations.

These high frequency currents do not follow the same laws as low frequency currents and when using thick copper wires, the effective resistance may be very much greater than it would be for continuous or low frequency currents. For this reason, therefore, stranded wires, made of twisted fine insulated copper wires, should be used. However, if the wire is of small diameter, then even for high frequency current this increase in resistance, due to the concentration of the current at the surface of the wire is not a very serious matter.

There is another point in connection with the above that when a wire is made into a coil of many close turns, its high frequency resistance is very much greater than if the same wire were stretched out straight, and for this reason considerable difference of potential may exist between a few turns of wire when coiled in a helix, and which is conveying high frequency currents. Until quite recently there were but three practical methods by which means, high frequency currents could be generated.

One of these methods employed an alternating current generator of special construction, having a very large number of stator pole pieces and the rotor driven at a very high rate of speed, viz.: 10 to 20,000 R.P.M. The maximum frequency obtainable by this method is about 100,000 cycles per second and includes machines of this type developed by Nikola Tesla, R.A. Fessenden and E. F. W. Alexanderson, whose latest machine is rated at 200 kw., the rotor of which weighs 3½ tons and has a speed of 2,100 R.P.M., the whole machine weighing 12 tons, and has a frequency of 22,000 cycles per second. The results to be obtained by this method are by the means of a very expensive and in some cases a dangerous machine due to the excessive speed, although they possess undoubtedly very great advantages in radio telephony but so far have been used for laboratory experiments only. Another type of high frequency alternator operating on the principale of electrical resonance has been developed by Dr. Goldschmidt, which generates radio currents at frequencies from 30,000 to 75,000 cycles per second.



Twelve inch discharge between two inch brass balls.

Large Oscillation (Instantaneous) discharge.

The second method is by means of the direct current arc. When an ordinary arc is shunted by a suitable inductance and capacity sustained oscillations are set up in the circuit. This method produces a persistent or undamped wave and has been successfully developed by Duddell and Poulsen and is used successfully for wireless telegraphy and telephony and will, I believe, in the near future in the larger installations supersede the spark method for wireless transmission.

The latest development for the generation of undamped oscillations is the vacuum valve tubes, such as the General Electric Pliotion oscillators, same being a highly exhausted two or three element vacuum valve of enlarged dimensions.

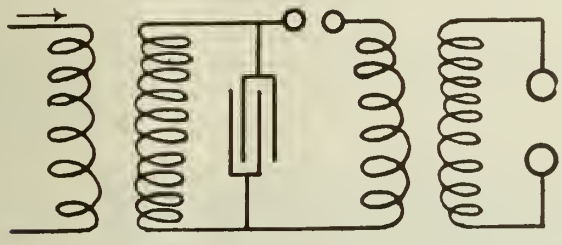
The third and most well-known method of producing high frequency currents, due, I think, to Lord Kelvin, but better known by the striking experiments of Nikola Tesla, is by the discharge of a condenser, same being charged to a high potential and discharged through a circuit having inductance and low resistance; a train of damped oscillations being set up at every discharge of the condenser.

As a mechanical analogy, we can compare the charged condenser to a weight attached to a spring.

To discharge the condenser. we drop the weight and it will oscillate backwards and forwards, finally coming to rest after oscillating backward and forward a number of times. The number of oscillations per second will depend on the mass of the weight and the strength of the spring, which would correspond to the self-induction and capacity in our electrical circuit. The number of oscillations it would make before coming to rest would depend on the friction, which tends to stop the weight, or by the resistance or other losses in the electrical circuit. It is necessary to arrange the circuit for the production of the trains of damped electric oscillations by condenser discharges, so that the inductive circuit is in series with the condenser. This usually consists of one circuit, of a transformer containing no iron, called an air core transformer. Two circuits are wound one over the other and highly insulated from each other, one of these is called the primary, the other the secondary.

Discharge between two glass bottles filled with water.

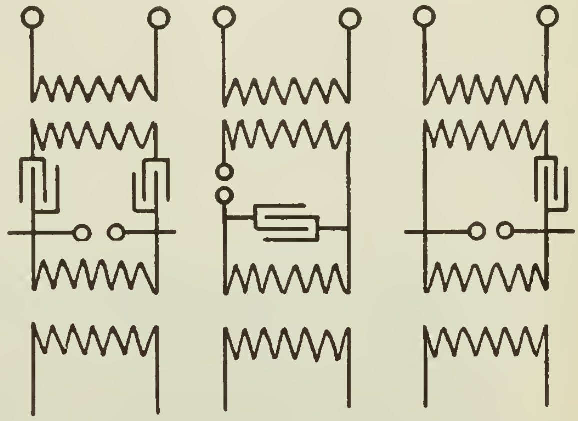
The primary circuit is arranged in series with a condenser and spark gap. This being the circuit in which electric oscillations are set up by the discharge of the condenser. The oscillations in the primary, induce other oscillations in the secondary and if the secondary has a greater number of turns than the primary, the secondary voltage will be greater than that of the primary in the following ratio. If the two circuits, that is the primary and secondary are more or less widely separated or loosely coupled and turned to resonance, the damping be negligible, the ratio of transformation, is determined entirely by the capacities in the two circuits, but when the circuits are close together or closely coupled, but not turned in resonance, the ratio is determined by the relative number of turns in the two circuits.



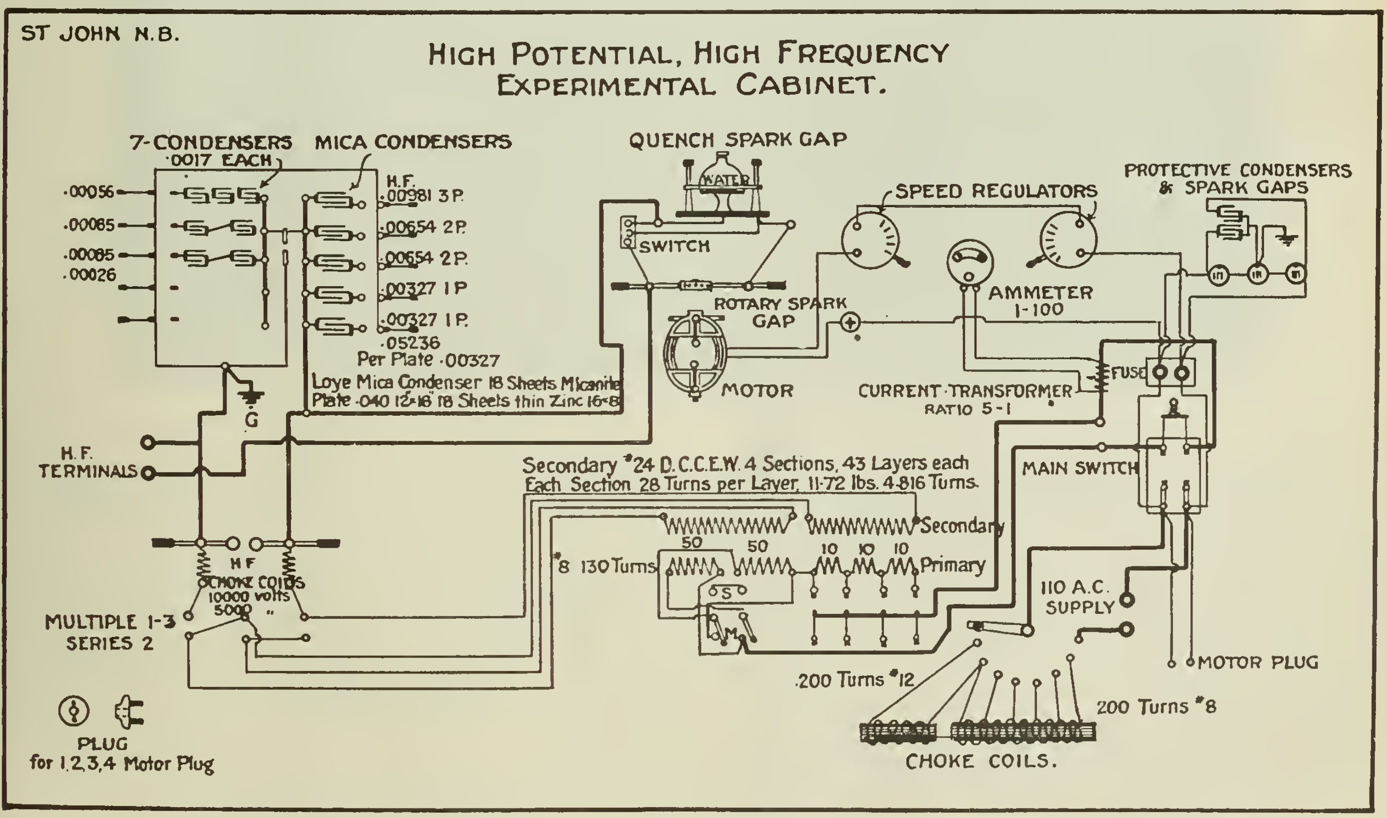
The apparatus may be connected in several ways, although the results obtained differ but little.

The general arrangement of the apparatus are shown on the accompanying diagram.

Current is supplied to the apparatus at a voltage of 110 volts, this first passes through a variable inductance, which is in series with the primary of the transformer and in some cases serves to limit the current supplied, although in some of the experiments is not used. The transformer consists of a core type transformer with silicon steel core and is of the magnetic leakage type, the primary being wound on one leg and the secondary on the other leg.



The voltage of 110 volts supplied to the primary is stepped up to 10 or 12 thousand volts due to the difference in the ratio of the number of turns on the two coils. The secondary circuit is shunted with a variable mica condenser, which is in series with a spark gap and the primary of the oscillation transformer, which sets up oscillations in the secondary of same, increasing the voltage to many



thousands of volts and in some of the demonstrations to-night reaches a value of half a million volts.

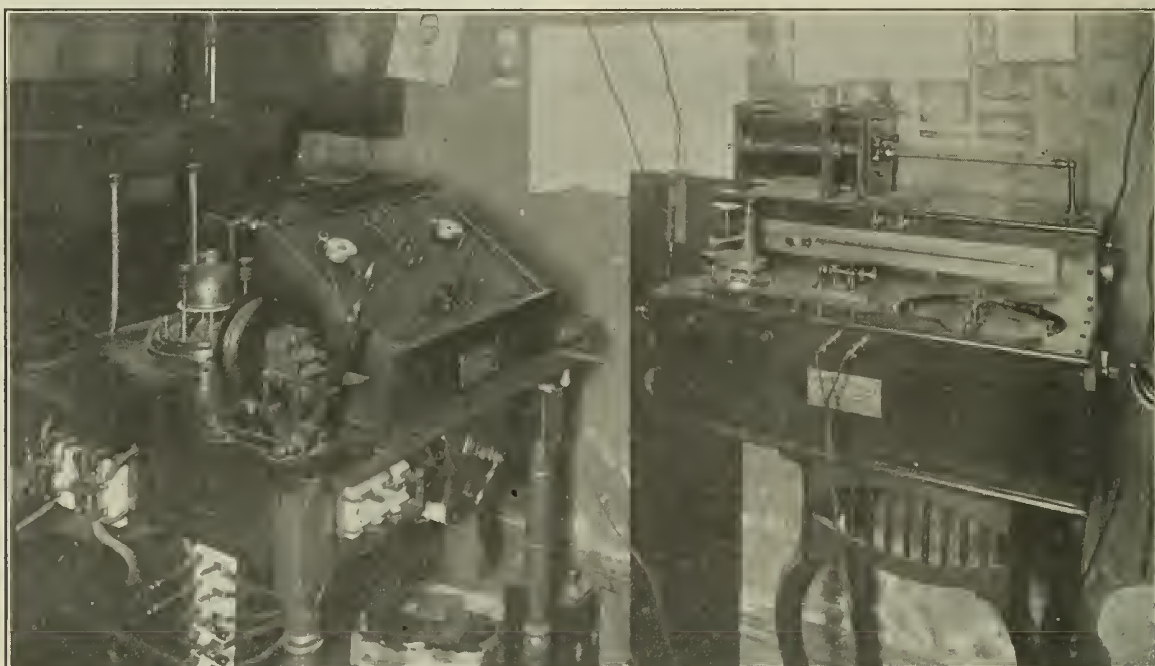
The successful operation of the apparatus depends primarily on the proper disruption of the arc at the spark gap, which in this case consists of a spoked wheel with 12 projections, driven by a small motor at a speed of 1800 to 2400 R.P.M.

There are other forms of spark gaps, which are suitable and give satisfactory results, many types of which I have used successfully but, the one mentioned above has many advantages and is largely used to-day with many of the commercial wireless telegraph installations. The discharge across the spark gap is practically a short circuit; across the secondary terminals of the transformer, and if this arc is not suppressed or broken up, there will not be a true oscillatory discharge in the condenser circuit or only a weak one, for the reason that as the arc discharge holds, the secondary terminals of the transformer are reduced in potential and not until the arc is destroyed that the spark gap can build up a sufficient difference of potential to give a fresh charge to the condenser. each charge. The length of the spark gap is determined by the type of service required. If we require long sparks from the secondary of the high frequency transformer or oscillator the spark gap in the condenser circuit should be long, but when a high effective current is required, the gap should be short. If the gap is made too short a flaming arc will occur in place of a loud bright spark, and no oscillations or only weak ones, are set up, for the reasons as stated before. On account of the exceedingly high frequency of the oscillatory discharge of the condenser, the inductive effects are remarkable, considering the small quantity of electricity stored in the condenser.

According to Sir Oliver Lodge, the rate of oscillations for a pint size Leyden jar or condenser is ten millions per second, but for large capacities the rate is less rapid.

It is very necessary in any of the experiments to have the circuits turned to resonance otherwise, the results obtained are disappointingly small.

In some of the experiments to-night we are using a capacity of .036 m. f. approx. and when charged to a potential of 10,000 volts, the condenser would hold a charge of .00036 coulomb which can do the work of 3.6 joules which with an inductance of 699 C.M. the frequency becomes 1,000,000 cycles per second. This does not imply that this frequency is maintained continuously but during the period of oscillation that the condenser discharges through the primary of the oscillation transformer, when the capacity used is very large the voltage may not be high enough to jump the spark gap, in the first period of the cycle with a long gap only one train may result, while with a shorter gap, several trains may take place during each half cycle.



Another view of apparatus in laboratory showing wireless receiving set in right hand corner.

The inductance and capacity of the secondary systems also influences the number of discharges obtainable during an alternation. The less the inductance and capacity of the conductors connected to any given oscillator, the greater the number of discharges obtainable per second; and likewise, if the inductance and capacity of an oscillator be reduced the rate of sparking will be increased when the spark gap is long, more energy is stored up in the condenser but as it is only charged once or twice per half cycle, the total available energy may be less than when a short gap is used. With a short gap the charging and discharging takes place many more times per half cycle, although not as much energy is stored up in

With a frequency of one million cycles, there would be 2,000,000 alternations per second.

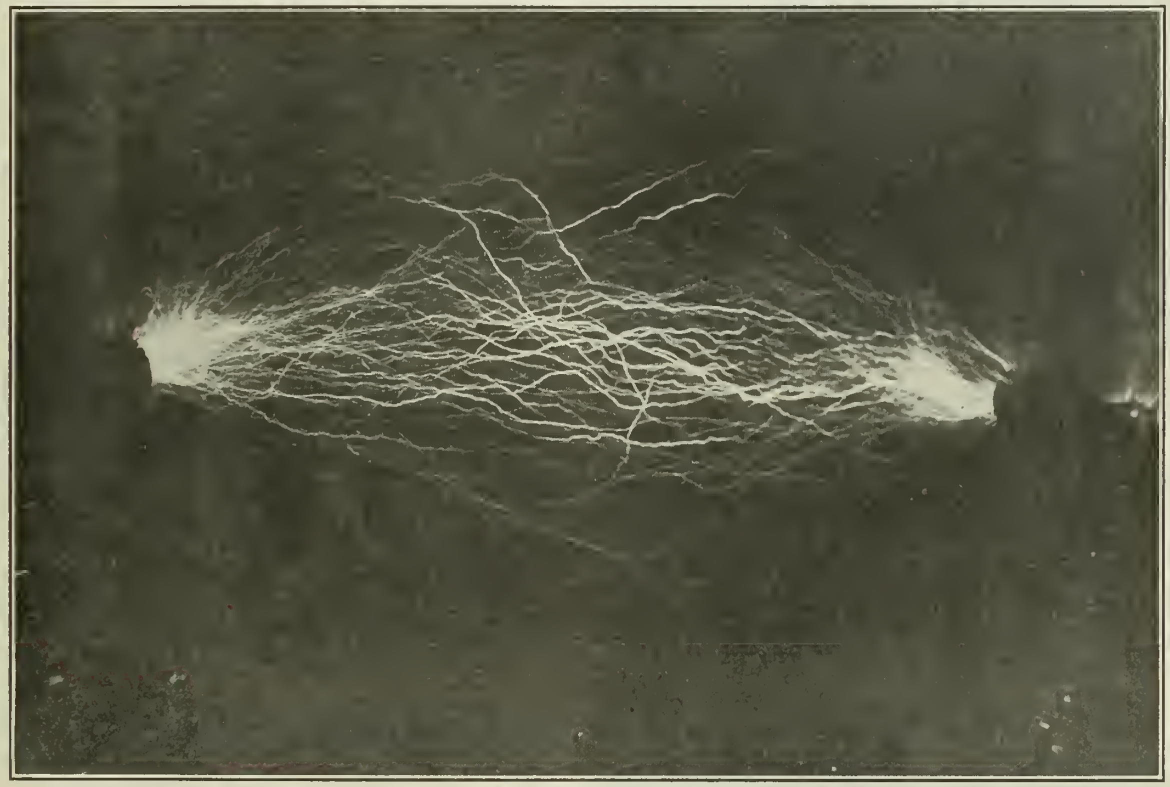
If the condenser is discharged once in every alternation or in 1/2,000.000 of a second, the average current required to discharge .00036 coulomb in 2 millionth of a second, 720 amperes.

If 8 alternations are required before the entire energy of 3.6 joules is dissipated which is at the rate of .000,004 of a second, which is at the rate of 900,000 joules (or watt seconds) or 900 k.w., or 1200 H.P., so that while the energy stored in the condenser is small, the rate of doing work, when released in a short period of time is verv great.

Although the current in the discharge circuit is very large, the heating effect upon the wires is not nearly as great as for direct current, for the reason that during part of the low frequency cycle the condenser is being charged only a fraction of the ampere flows through the secondary of the low frequency transformer and condenser and the wires cool off to a certain extent during the comparatively long period of charging in each of the one hundred and twenty (120) alternations per second.

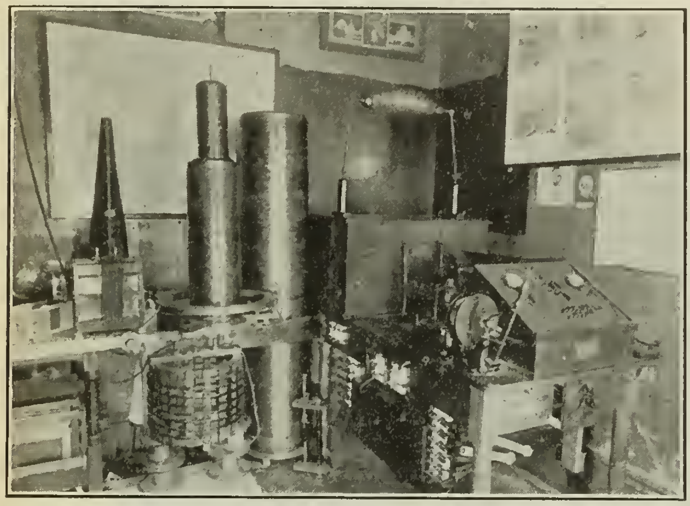
It may be of interest to state that lightning is of an oscillating character, being practically the discharge of a condenser; the charged cloud acting as one plate of a condenser and the earth as the other, or in some cases, different clouds acting in the same respect to one another. (Standard Hand Book Electrical Engineers). If an area on the surface of the earth 100 ft. square is subjected to the discharge of a cloud, also 100 ft. square at a distance of a thousand feet (1000) in this case the capacity is very small being approx. .000027 Microferads the air space separating the cloud and earth, and if the disruptive strength of air is 30,000 volts per C.M. a potential of 912,000,000 volts would exist between the earth and cloud just before the stroke. The amount of electricity stored would be .025 coulombs, a very small value when considered by itself. The energy stored would, however, be very great on account of the high difference of potential and would be 11,200 kw., seconds or joules, being almost equal to the energy of a pound of dynamite, with a lightning discharge, the frequency of the discharge may be from 100,000 to 5,000,000 per second in which case the maximum value of the current is from 15,000 to 750,000 amperes.

The electric culture of plants was like many other discoveries the result of accident. Some years ago a Swedish professor named Lemstrom, while conducting some experiments trying to reproduce the northern lights with electric discharges through vacuum tubes. These experiments being conducted in his greenhouse, noticed incidently that the plants seemed to thrive, due to the electrification thus produced. He also states that he noticed as remarkable, the flourishing development of plants in the Arctic regions, where the sunlight was very weak and he attributed part of this growth to the influence of electric discharges. Since which time experiments along these lines have been repeated and extended and in 1917 and 1918 electric culture experiments at Llantwit, South Wales. The increase production in potatoes electrically treated was 12.6 to 17.2% over those not so treated under similar conditions; also states that in a crop of oats so treated showed a 35% increase in grain, 17% in straw.



Spectacular Miniature Lightning

One of the things of particular interest with regard to high frequency currents is, its effect on the human body, for we can pass a large amount of current through the body with a high frequency current, which would prove fatal if performed with the same current at low frequencv. Two theories have been advanced with regard to the above. One of these is that as the current is oscillating at such enormous frequencies, the nerves do not have time to respond. The other, that as high frequency currents tend to travel on the surface, they do not penetrate deep enough to effect the nerves.



General view of H. F. Apparatus in corner of Laboratory of the writer

It is generally conceded that 1/10 of an ampere of current if passed, through a vital part of the body, would prove fatal, yet in some of the demonstrations to-night, we are passing currents, the effective value of which is in excess of one ampere or more and whose maximum value would be considerably greater. (Viz. 166 Amp.)

The brush discharges from the oscillators are very spectacular. The larger one when properly turned to resonance, giving a free discharge in air 5 or 6 feet long (see photos). The large oscillator consists of a wooden frame covered with cardboard, the height of which is thirty-one (31) inches and being eighteen (18) inches in diameter at the base. It is wound with a single layer of No. 24 D.C.C. Magnet Wire, each wire being separated by a turn of string. The primary winding which is loosely coupled, consisted of three (3) turns of 2″ copper strip wound between turns with a piece of 2″ leather belt. The smaller oscillator is similarly constructed only with a lesser number of turns in the secondary.

Twenty-two inch discharge between two inch balls, long exposure.

If a lamp taking ¾ of an ampere be held between two people, one of them making contact with the oscillator with a metal rod, which is moved toward the grounded end, a point is reached, where the lamp burns up to full candle power or can even be burnt out.

In a similar manner, small wires can be melted and many other striking experiments can be performed, Geisler and Vacuum tubes are brilliantly lighted a considerable distance away, due to the very strong electro static field.

Discussion

The high standing and excellence of the paper on this subject, declared President Leonard, was an evidence of the wisdom of enlarging the scope of the former Canadian Society of Civil Engineers. whereby it represented every class of the engineering profession. He compared the author in the electrical field to his namesake past president Vaughan, and the position he held in the mechanical engineering field. F. A. Bowman, M.E.I.C., after moving a vote of thanks to the author, related an experience of attending a lecture given by Nicola Tesla, the pioneer in the high frequency field, and where the experiments shown did not compare with those the author had just demonstrated. He informed those present that Mr. Vaughan was a pioneer in the field of wireless telephony, and had been the originator of some of the principles which were now adopted in making it effective. The vote of thanks was seconded by C. O. Foss and adopted by the meeting with considerable enthusiasm.

A. R. Crookshank asked several questions which brought out the information from the author that the chief function of lightning rods in addition to providing a path in case a building was struck which might or might not be followed, was to lower the potential between the clouds and the earth. The aurora was an electrical condition made possible by the dryness of the air in northern latitudes due to a difference in potentials between localities. In a lightning discharge the earth might be positive or negative, as conditions varied rapidly. Mr. Crookshank pointed out that Mr. Vaughan was one of the first men in the world to make use of the wireless telephone. During the war Mr. Vaughan had used his valuable knowledge regarding wireless telephony in the interests of the British Admiralty, for which he deserved great credit: Dr. Vaughan's assistant in the demonstrations was Lieutenant Ashley, who is in charge of the wireless telephone installations for the British Government on this side of the water, the meeting being fortunate in having two such authorities present.

Fourth Session

On calling the meeting to order, Mr. Kirby, who presided in the early part of the meeting, asked F. A. Bowman, M.E.I.C., Plant Engineer, Maritime Telephone & Telegraph Company and Chairman of the Halifax Branch, to read his paper Engineering Problems connected with the use of Telephone Cables; of which an abstract by the author follows:—

Engineering Problems involved in the use of Telephone Cables.

To understand the problems involved in the use of telephone cables, it will be necessary first to consider what is to be done; secondly, the nature of the materials that must be used; and thirdly the difficulties that arise in using these materials.

It must be borne in mind that every telephone installed involves the provision of two wires or its circuit from it right back to the switchboard, to which it is connected. In the case of the so-called party-lines, two or more telephones are connected to one circuit, but that does not materially affect the problem. It becomes apparent immediately that where thousands of telephones are installed in a City some means must be taken of getting all these circuits compressed into the smallest possible space. The telephone cable is the result. These cables consist of anywhere from 15 to 1200 pairs of wires, grouped together. The sizes ordinarily used are 15, 25, 50, 100 and 200 pairs for work on poles; and 100, 200, 400 and 600 in underground conduits. 800 and 1200 pair cables are used in the largest cities; the wires in them are No. 24 B. & S. Gauge and their use involves very special conditions and difficulties.

There are distinct electrical limits to the length of the circuit commonly called a "loop" from the switchboard to the subscriber's instrument. Transmission may be very good from one subscriber to another in a city and yet neither of them could carry on a conversation over a toll line of 100 miles. Sooner or later every telephone is used to talk over long distance lines. Consequently, it is necessary that its ability to do so should be the standard. It will be at once realized from this that it is necessary to keep the electrical losses in the subscribers loop down to a minimum. This is one of the several reasons why different exchanges must be established in a city, because by so doing the loss from the subscriber's instrument to the switchboard can be kept low. Even if it is necessary to transmit the conversation from the first switchboard to a second, special devices can be introduced into the comparatively few trunks between the two switchboards, that could not be placed on all subscribers lines.

The unit of transmission is thirty miles of No. 19 B. & S. Gauge paper insulated lead covered cable, and all other circuits and apparatus are measured in terms of this.

The next problem to consider, is the mechanical means of getting these groups of circuits into a reasonably sized cable. The current used by a telephone is so small that a very small wire may be used to carry it a considerable distance before the loss, due to the ohmic resistance of the wire, becomes too great. It must be remembered that a telephone current is an alternating current of very high frequency, varying from 800 to 16000 cycles per second. Consequently the mutual inductances of the two wires of the circuit, and the inductive affect on it of the other telephone circuits near it become very serious. These difficulties are overcome by twisting the two wires of a circuit together and by laying up all the circuits with a special system of twisting in reference to each other. The next difficulty is that of the mutual capacity of the two wires to each other, and to all the other wires in the cable.

We know that the mutual capacity of two wires is proportional to the specific inductive capacity of the insulation or dielectric between them. The insulation that has the lowest specific inductive capacity is dry air; but how can wires, tightly packed together be insulated with dry air? Next lowest on the list of specific inductive capacities comes dry paper. So the wires are insulated by being loosely wrapped with two layers or strips of dry manilla tinsel wound in opposite directions. These loose layers imprison a certain amount of air even when the whole bunch of wires is compressed together in a sheath. It is evident that this mechanically flimsy and highly hygroscopic insulation must be absolutely protected from injury and dampness. This is done by a lead sheath, which is spread over the bunch of wires by the same process of squirting that is used in making lead pipes. The resulting cable is very satisfactory from an electrical standpoint, but is mechanically weak.

The mechanical weakness of the cable and the absolute necessity of keeping every trace of moisture out of it form the difficulties mentioned under our third heading. The first question that arises is as to what shall be done when the individual circuits must leave the cable to be connected to the switchboard at one end, and to the individual telephone at the other. This is accomplished by means of potheads and rack ends and cable terminals.

The sizes of cables most commonly used in what is called "Aerial work," that is, cables suspended from poles, are 25, 50 and 100 pairs. When the wires in them are No. 22 B. & S. Gauge or .025 inch diameter, which is the size ordinarily used, the weight of the three sizes mentioned is respectively .85, 1.20 and 1.97 pounds per foot of length. Let us assume a span of 100 feet between poles and that the cables are allowed to have a sag of two feet in the centre of the span. The tension strain in the cables would then be for 25-pair, 532 pounds; for 50-pair, 750 pounds and for 100-pair, 1230 pounds. It is evident at once that the thin lead sheath would not sustain this strain, and it must be remembered that in our climate, a coating of sleet or wet snow may easily double the load.

It therefore is necessary to support the cable, which is done by attaching it to a stranded steel wire, called a messenger. These messenger wires are of crucible steel, and the sizes ordinarily used are made up of 7 No. 13 B. W. Gauge or 7 No. 12 B. W. Gauge wires. These messengers are erected first and pulled up reasonably tight. From this messenger the cable is suspended.

It wil be seen at once that if cables are erected in summer time, so as to make a very nice looking job, the initial strain may be such that when the strain of wind and ice and contraction from drop of temperature occur, the messenger will fail. It therefore becomes necessary to find out what initial sag must be given if the cable is erected at, let us say, a temperature of 60° F. in order that when carrying a given load of ice, plus wind and a drop of temperature to zero, the strains shall not exceed a safe limit.

These loads on the messenger wires are, of course, horizontal strains on the poles, which are to a large extent balanced at each pole by the span on either side of it, until the end of the line is reached, where the end pole is must take the whole strain. Two difficulties are met here. First the question of the strength of the pole to withstand the horizontal strain; and secondly the securing of it in the ground so that it will not give under the strain. The second difficulty can be partially met by some form of bracing below the ground level or by setting in concrete, but in very soft soils it becomes a serious matter and involves very heavy concrete work. The first difficulty is much more serious. If the extreme loads referred to are met and calculations for them have allowed the factor of safety to be reduced to 2, we have a strain of 5000 pounds in the case of a 7/13 strand messenger. If there are 4 of these on a pole it means a horizontal strain of 20,000 pounds, applied 20 or 25 feet above the ground.

Some form of guying or bracing is therefore absolutely necessary. Bracing is much less used than guying, for several reasons. The principal one is the difficulty of getting a firm setting for the foot of the brace. If the soil is at all soft the brace is forced into the ground by the strain unless some form of plank footing is adopted to distribute the strain over a larger area of ground. Then in the Spring the frost coming out heaves both pole and brace, increasing the heaving of the pole and leaving a space under the foot of the brace that seriously reduces its resistance. Then again the brace is much more unsightly, and on streets and roads may take up too much room. On the other hand a guy anchored to a log or some form of anchor plate carefully set below the frost limit, offers a much greater and an unvarying resistance to the movement of the pole. The action of the guy is also to place the pole entirely in compression.

From the above description it will be seen that a pole line is really a series of structures resembling in many ways a bridge of the suspension or cantilever type. The poles take the place of the towers or piers of the bridge and the stability of the whole is dependant on the proper anchorages at each end.

So far we have dealt with the mechanical strain in the cables and the structures that support them, from which it will be seen that the engineering problems involved are very interesting. The variation in the conditions of ordinary work in Cities and Towns is so limited that tables are available covering practically all of them, so that they do not have to be calculated on each occasion. We now approach another group of problems that call for solution in each individual case. The solutions being dependant on the accumulation of data that calls for engineering, skill and experience of a high order, first to gather it, and then to apply it.

We have shown that as each telephone has to be supplied with two wires, the problem of compressing the immense number of wires into a reasonable space has evolved the telephone cable. Also that these cables are made up in certain standard sizes which have been proved to be those most suitable for the work. Now we must take up the questions involved in the layout of a cable plant. What size cable must be run on a certain street to take care of the existing telephones and provide a reasonable margin for expansion, without erecting too great a capacity and having a large part of the plant lying idle, perhaps for years. So much has been written about the load factor of power stations that it has become a fairly familiar problem and it is generally realized that a power station has to have a generating capacity equal to the largest load it will be required to carry, which load may only come for a day or a few days in the year. It is not as generally known that the telephone engineer is confronted with a similar problem with a form of plant that is much less elastic than a power plant. Primemovers, generators and transformers will carry a material overload for a short time without serious injury and so tide over a load peak, but when a telephone cable has had the last pair of wires in it connected to a subscriber, its limit is absolutely reached, and the only solution is the erection of more cable. The same thing applies in the case of the switchboard.

Let us take a simple illustration. A new street is opened and a few houses built on it. We erect a pole line and put on a 10-pin arm, which will, of course, carry only five circuits, and string open wires as required until it is filled. More houses go up and we put on a second arm. Building becomes more brisk and more telephones are called for and the second arm fills up. Seeing the way things are going we decide that a cable must be put up. As we have ten circuits on the street already there is no use in putting up a 15-pair cable, as our guess is that it will be filled up in a very short time, so we erect a 25-pair. If we guess well and the growth continues, the cable becomes reasonably full and our investment pays for itself. If something happens to stop the growth in that street we may have as much as 50% of that plant idle for years. This would not be a serious matter if it was confined to a street or two, but when you stop to think of the ramifications of a telephone system in the larger cities or even in a good-sized town, it will be seen that the problem of balancing adequate facilities against idle plant becomes a very interesting problem in probabilities. It must also be remembered that it is necessary to reserve 25 pairs of wires right back to the switchboard to feed that cable. While it can sometimes be arranged to utilize some of the wires in the main cables feeding that cable for a time to feed circuits elsewhere, the amount of this that can be done is small and is only a temporary expedient.

Another problem of great importance is to keep the length of the circuits down to the lowest possible limit. This point was touched on from an electrical standpoint earlier in this paper, in connection with transmission, but is equally important from the standpoint of the capital to be invested. One of the great reasons why the cost of giving telephone service increases with the number of subscribers, is due to the fact that as the use of the telephone spreads over a City the length of line per telephone and consequently the capital cost increases. Also the item of idle plant previously referred to materially increases as the area to be served increases.

The way these two problems are met is to make a detailed study of each street, basing its probable telephone requirements on certain probabilities that experience has allowed us to tabulate and then work back towards our office, gathering the branches into mains as we go. At the same time we must determine the point which is the shortest distance from all the expected telephones in that area If a new Central Office is tobe built,it will of course be placed as near as possible to this wire centre. If it is rearranging cables to an existing office, it will mean that a very heavy main lead must be arranged from the office to this centre.

Two points are kept in view in making these studies. The first is the ultimate development that will probably occur in a given number of years, the second is what construction must be carried on at once to take care of the growth for a portion of this ultimate period and how it can be arranged so as to be readily expanded to the ultimate with the minimum of rearrangement and substitution of one size of cable for another.

Underground conduits and cables have two disadvantages. The first is, the high initial cost, and the second is, their lack of flexibility owing to the difficulty of connecting individual circuits to them.

Underground conduits consist of groups of ducts into which the cables are drawn. The ducts are laid in groups and a manhole has to be constructed at frequent intervals. In City work a manhole must be constructed at practically every street intersection. In the case of long distances between cross-streets an intermediate manhole must be made. The mechanical weakness of the lead-sheathed cable limits the length of it that can be drawn in at one time.

In the manholes the lengths of cable are spliced together and it is only here that any branches can be taken off.

Whenever it is known that a certain street is to be paved, an effort is made by the Telephone Company to lay conduit in advance. In such a case it is necessary, if possible, to lay sufficient duct to take care of all future requirements on that street. This involves a heavy capital outlay that may be idle for a long period.

In those parts of a City that are completely built up, provision must be made to get the underground wires into the buildings. If there are large buildings of an apparently permanent type, branch ducts from the nearest manhole are laid directly into them. Where the buildings are smaller, branches are carried through lanes and alleyways to the centre of the block. Branch cables are drawn into these ducts and carried above the ground to a distributing pole or up the side of a building and distribution made by smaller cables or individual circuits as the case may call for.

On outlying streets, where pole lines may still be retained, branch ducts are carried from a manhole to a suitable pole and up the pole far enough to protect the cable from injury. These branches are known as branches, laterals, or risers. A branch always consists of at least two ducts and if of more at least one spare is run so that in case of a cable going back, another can be run in and connected up and the bad one withdrawn.

Discussion

A long and interesting discussion followed the reading of this paper, many questions being asked the author, showing the interest which his subject had aroused. The questions were for the most part answered by referring to the apparatus which he had at the meeting. Mr. Cushing moved, seconded by Mr. Burpee, a vote of thanks to Mr. Bowman for his interesting paper and for the detailed information he had given on the subject. The Chairman asked W. B. MacKay, A.M.E.I.C. to read his paper on Heating Problems Produced by Some of the Modern Methods of Building Construction. Before reading the paper the author stated that heating engineering was one of the newest branches, and the heating engineer suffered from a lack of any data. Heretofore heating had for the most part been in the hands of mechanics and that unscientific knowledge was probably responsible for many of the failures in the past.

* Heating Problems Produced by Some of the Modern Methods of Building Construction.

At the conclusion of the paper the author stated that effective heating has never been fully understood, and that it was under investigation now by three commissions, the result of which might be to change the character of buildings or the character of our heating plants. There were many uncertain and unknown elements entering into the application of a first-class heating plant to a building. He suggested that in the construction of buildings greater care be exercised in choosing materials that are not subjected to much heat loss. After a modern building is completed little is known of what it represents in the way of heating efficiency.

Mr. Kirby stated that the paper just read by Mr. MacKay represented a unique experience as he found that everything he had learned about this subject was now upset. Mr. Stead asked for some information on the humble hot air plant largely used in New Brunswick. Mr. MacKay replied that the system was somewhat the result of trade competition. Plumbing had been handled by plumbers and steam fitters.

*Paper will appear in November issue.

There are two kinds of warm air heating systems. One in which the air is taken from the outside and the other from the inside. I hesitate on many occasions to get mixed up in the argument. One fellow says the only thing that is good is taking the air from the outside and the other says, from the inside and save coal. The heat loss from this room alone is one third of the total heating of the building. You are perfectly safe to take air from the inside and that produces rather good circulation. You say you will heat a house with 100 degrees. That means that heat at seventy and zero outside, the difference between 100 and 70, will give you the net results, or the heat loss from the building. Warm air heat has been the victim of insidious trade practice. Warm air plants have cost more than hot water. Of course there is nothing to freeze up and they have many advantages. In milder climates and in the United States warm air is a very well developed form of heating. The only reason why I avoid the discussion of it here, is that I wish to preserve my life. They look at you and say, who are you that you should talk to me with my 40 years experience. Mr. Kirby: You said that you took the heat loss for glass at 100 and three-inch concrete slab at 200—twice as much as a sheet of glass? Mr. MacKay: Yes. Mr. Armstrong: Three-inch glass would be what? Mr. MacKay: That is an unusual type of building material. I would say that glass would be practically the same as concrete. Dry air is the best insulator. 85% magnesia is the best covering. Any substance which contains minute air cells is good.

Mr. Armstrong: What would you say about a glass window with two panes separated with an air space of one inch? Mr. MacKay: replied that it was a very good step towards preventing heat loss. One had the small air space which was the best insulator. In a granite wall 28 inches in thickness, with and without an air space of two inches, the difference is 20 per cent. The size of the air space made a difference, as too much air space made an eddy of its own. A radiator painted with five coats of enamel paint increased the heat five per cent. Heat conduction is much more rapid through anything that is moist than anything that is dry. Colonel Leonard asked if the author had any information regarind 4 inch studding with metal lath and plaster on both sides, making an air space, and was informed that the ratio was 3.4. Further discussion brought out the point that brick veneer was the best from the viewpoint of low conductivity of heat—it represented the warmest house that could be built for the money. Mr. Armstrong moved, seconded by Mr. Stead, a vote of thanks for the intensely interesting paper, which was carried unanimously.

Fifth Session

Luncheon meeting at Bond's Restaurant

At noon the Board of Trade of the City of St. John were the hosts at an enjoyable luncheon at which about 150 were present, given at Bond's restaurant. R. B. Emerson, President of the Board of Trade, extended a hearty welcome to the visiting and local engineers. He made eulogistic references, stating that no progress could be made without the assistance of the engineer. His field was expanding and becoming greater and greater. Now that the war is over engineers are needed as never before to build up a bigger, better and greater Canada from ocean to ocean.

The President of *The Institute* then thanked the Board of Trade most heartily and the citizens of St. John for their kindness and hospitality being shown to the members of *The Institute* during the present convention. He was pleased to hear from the Chairman of the Board of Trade such an expression of appreciation of engineers and engineering work. He outlined the great growth of engineering services during the past forty years. When the Canadian Society of Civil Engineers was organized, engineering was limited. To-day it was universal. The former Society had grown into a large national engineering organization embracing every class of professional engineer. Members of the engineering profession, now strongly organized in Canada in one body, embracing all branches of the profession, occupied a unique position in their intimate yet unbiased relations with both capital and labor, understanding and sympathizing with the problems of both and were the one body of men organized and in a position to help solve the great problem now confronting the people of Canada. Organized labor represented possibly one-eighth of the workers and the number of employers employing organized labor represented possibly one two-hundredth part of the employers of labor in Canada, leaving the vast majority of the people unrepresented in labor disputes unless it be by the membership of *The Engineering Institute*, who suffer in common with all the people. Engineers were accustomed to solving actual problems and as the labor problem is one in human engineering, the minds of the men in the profession, both on account of their type of mind and their intimate relations with both capital and labor, were the minds that could best solve those questions. He desired the business men of Canada to appreciate the fact that the Engineers of Canada who had so well demonstrated their efficiency in the great war were the men who must develop the material resources of the country and their constructive training will bring them to conclusion that in the labor problem would be of material benefit to the nation.

Engineers, being educated men, trained in practical work, have as a body maintained their steadiness at a time when the contending parties in labor disputes and many others who obtained their knowledge largely from reading, have lost their sense of perspective.

Major Hayes of St. John gave a brief address, followed by C. C. Kirby, A.M.E.I.C. After thanking the Board of Trade on behalf of the members in St. John, he said in part: "The St. John branch of *The Engineering Institute* is taking a very keen interest in local problems, and although we do not wish just now to go on record very strongly—we do not feel that we have yet been organized in St. John sufficiently long to take any very prominent part in local discussions, but we are following them with intense interest and we intend before very long to make ourselves felt. The St. John Branch before long will let you know that it is in existence."

J. K. Ganong spoke briefly regarding the work of engineers. The spirit of the engineer is achievement. The world would profit if we could all become imbued with that same spirit.

F. A. Bowman, M.E.I.C., Chairman of the Halifax Branch, was glad of the opportunity of being present, and emphasized the fact that this meeting was an example of the spirit of co-operation which is growing up all over the world. The evolution of the present *Engineering Institute* from the former Canadian Society of Civil Engineers was a further illustration of this. "We have a branch at Halifax and one at St. John, which join forces in holding professional meetings, besides the respective meetings of the branches. This was the second professional meeting in the Maritime Provinces, called for the purpose of discussing problems peculiar to this section, getting better acquainted, and co-operating for mutual advantage. Mr. Vaughan, who we regret so much is not with us to-day, emphasized that last year in addressing the meeting at Halifax. He was just back from a meeting in the West, and he said how much he had been struck with the peculiar, to a certain extent, local problems that the engineers there had to meet. The papers at that meeting dealt very largely with such questions as the adequate water supply for the Western prairie cities and the effect of that prairie water which is strongly alkali, upon concrete. In these Provinces we also have a problem regarding concrete, being the effect of tidal water on concrete. We are now investigating, and a committee will report on this subject at another session of this meeting. These meetings are a further advantage in giving us an opportunity of meeting the business men, and laying before them our problems which result in our becoming better acquainted and each having a better understanding of one another.

A. H. Wetmore, who last year as President of the St. John Board of Trade attended the professional meeting at Halifax, in a brief well worded address assured the engineers of the pleasure and benefit he drived from associating with them.

The President of the Board of Trade then called upon Colonel Leonard to take the chair, who on doing so extended a cordial invitation to the members of the Board of Trade present to remain to hear the paper on Canadian Corps Engineering Problems during the Advance of 1918, by R. F. Armstrong, A.M.E.I.C., Town Manager of Woodstock, New Brunswick.

Mr. Armstrong, who did such excellent work as an officer in the Engineering Corps, was enthusiastically received upon rising to read his paper.

F. A. Bowman M.E.I.C., Chairman of the Halifax Branch.

Problems of the Canadian Engineers in France, 1918

It is not proposed in this paper to give a technical or detailed discussion on any particular piece of work carried on by the Canadian Corps Engineers but in a general way to describe the organization and the various problems which confronted our engineers, particularly during the advance which started on August 8th, 1918, and continued steadily up until the Armistice day.

Organization

Previous to 1918, the Canadian Engineers were organized on the same basis as the Royal Engineers and with each infantry brigade there was attached, for engineering duties, one field company of engineers. Under this arrangement the sappers were so few in number that they could only act as supervisers and all forward working parties had to be supplied from the Infantry. This was unsatisfactory both to the Infantry and to the Engineers; to the Infantryman because he resented the fact of being under the orders of a sapper of probably lower rank, and to the engineer because his working crew had to be broken in for each job and often there was considerable trouble in arranging details between the two parties. Early in 1918 the new organization was authorized and the engineers were formed into four brigades, each brigade consisting of three battalions of about the same strength as an infantry battalion. Each brigade was responsible to the chief engineer for the entire engineering work of the infantry division with which they worked. Then there was what was known as Corps troops, consisting of troop companies which were used for special works such as heavy bridging, water supply, dam construction, etc. These corps troops were also responsible to the chief engineer. The chief engineer divided his work into five branches—bridging, water supply light railways, roads and defenses, and at the head of each branch placed a field engineer who was held responsible to him for the work of his department.

Defensive Measures, April to July, 1918

April 1918 found the Canadians in the Arras, Roclincourt, Vimy sector and as the dropping back of the Allied troops in the Bethune Area North of Vimy and also in the sector South of Arras left the Canadians in a very prominent salient, plans were immediately undertaken, in case of a withdrawal, to make the advance of the enemy as difficult as possible. Bridges and road intersections were mined and rather a comprehensive scheme of flooding the low land on each side of the Scarpe River was adopted. A topographical survey was made of about five miles of the Scarpe River Valley and the location of dams, sluiceways, dykes, etc., decided upon so as to flood certain areas. The areas to be flooded were then covered with barbed wire entanglements and the construction of the dams at once proceeded with. It was the writer's good fortune to be associated in this topographical survey and in the construction of the dams. The dams were each about 36 feet long, of an average depth of 12 feet and were constructed with a timber crig, rock filled; a core wall in centre being made of clay. The sluice in each dam was built of heavy timber and was about 7 ft. wide, the gate being arranged so as to be dropped in sections when the occasion demanded.

The attached plan shows the part of the Scarpe River Valley between St. Nicolas and Etrum that it was proposed to flood, the portion marked in blue showing area that could be flooded. The dam sites were as follows:—

1.	G. 16 C 95.35	Rock filled timber crib	15′ high,	36′ long.
2.	G. 15 D 90.50	" " "	" 9′	" 36′ "
3.	G. 15 C 40.95	" " "	" 10′	" 35′ "
4.	G. 14 D 35.85	" " "	" 11′	" 37′ "
5.	L. 10 A 45.95	" " "	" 10′	" 33′ "
6.	G. 15 C 50.90	Earth, rock, timber crib	9′ high	32′ long.

These dams were all constructed at the same time and a working crew of about fifteen sappers and seventy men were employed on each job. Work was completed in five days. The estimated flow of the stream was 114 cubic feet per second and the estimated time to flood the areas—72 hours after the closing of the sluice gate. During a period of foggy weather when observation by enemy planes was not permissable, the scheme was tried out and came fully up to expectations, but fortunately, as now history knows, the Canadians, never had to fall back and this inundation scheme, as a defensive measure, never was used and the dams were opened up and dykes torn down.

From May until July there was very little interesting engineering work carried on except the digging of extensive systems of trenches, building of strong points, and machine gun posts, placing barbed wire, etc. The area was divided into defense lines, the idea being in a withdrawal to defend one line as long as possible and then have an organized withdrawal to the next defense point.

Preparation for the Advance

Early in August the Canadians moved South to take part in the famous drive of August 8th, and the engineers immediately started preparations for the work entailed in the attack. In this Amiens push, road construction, tramway construction and water supply works were probably the most important phases of the engineering work but as we passed over a country which for months had been used only as a "No Man's land," and where there was nothing left but a mass of shell holes and the wreckage of old buildings, our engineers were called upon to meet almost all problems expected in military work. In this advance the new engineering organization proved itself to be well adapted to a moving warfare and the work of the engineers was highly commended by the other branches of the service.

The Advance at Arras

On the 23rd of August the Canadian Corps which had been carrying on successfully in the Amiens area since August 8th, was moved again to the vicinity of Arras and the Engineers at once started preparations for the series of operations which commenced with the opening of this attack on August 26th, and lasted up until Mons was reached on Armistice day. In this advance the Canadian Engineers may be said to have come into their own as here was a scope for bridge building, tramway building, road construction and water supply work which was a pleasant change to the old tiresome trench and wire entanglement details.

Bridging Operations

The Germans were very thorough in their demolition work for not only were the girder sections of bridges cut by explosives and dropped into the Rivers or Canals, but the abutments were completely destroyed and large craters blown in the approach roads. These craters had all to be filled, or bridged, before the heavy bridging material could be rushed forward. These points were also subjected to considerable harassing fire for in no way could the enemy better delay our advance than by holding up the bridging work.

The bridging operations may be divided into three phases, viz.:—

1. Crossings for Infantry.
2. Crossings for first line transport, i.e., field guns, horse transport, etc.
3. Heavy bridges to take tanks, heavy guns, lorries, etc.

Infantry Crossings

These consisted of improvised crossings over the damaged structure or by using cork bridges. Sufficient slabs of cork to give the requisite buoyancy were baled together with wire netting and connected at about 8 foot intervals by two light stringers. Slabs were nailed across these stringers and the bridge so formed took infantry across in single file. The German foot bridge was similar in many respects but instead of cork piers he used hollow wrought iron cylinders. These were more easily handled than our cork slabs, but were very easily punctured and put out of commission by fragments of shells.

Crossings for 1st Line Transport

The pontoons and trestle equipment of the ARMY proved itself invaluable for crossing the Canal systems and a bridge of 90 feet span could be erected in one and half hours' time under adverse conditions. Trestle bridges were constructed with whatever material was available from the captured material dumps.

Heavy Bridges

The construction of heavy bridges over the Canals presented many problems. The latest type of tank had a live load of 37 tons and the new six inch gun an axle load of 17 tons. The canals were approximately 90 feet wide and the clear span necessary about 108 feet. Clear span bridges were often necessary as it was impossible to remove the damaged structure and its presence in the bottom of Canal prevented the use of trestles and cribbing, at least for speedy construction.

The British Army had adopted a new bridge called the "Inglis Portable Military Bridge Rectangular Type," and this proved most valuable. It is composed of a number of identical bays, 12 feet long, 12 feet high and 12 feet wide and designed to carry a dead load of 84 tons, distributed over a clear span of 84 feet. It is of the Warren Girder Type; the tension and compression members being mild steel, lap welded tubes, thickened at the ends and pin connected in steel junction boxes. The transoms and transverse stiffeners are I beams, the web being cut out in places by an oxy-acetylene plant, to reduce the weight for handling to a minimum. Each part of the bridge can be manhandled, the weight of one 12 foot bay in skeleton form—that is ready for launching—being 1.735 tons and one bay of the finished structure complete with decking 3.16 tons.

The first bay of the bridge is built on a two wheeled trolley then a long arm, sufficient for the gap to be bridged is built out as a cantilever on one side, and a shorter counter balance is constructed simultaneously on the other side of the trolley. When skeleton bridge is completed the end bay of the counter balance is loaded with road bearers until balance is obtained. The bridge is then pushed forward by hand power over the gap, the trolley moving on a prepared track and the far side of the bridge lowered on its abutments. The counterbalance is first removed, then the trolley, then the near side lowered on its abutment and the decking laid. In September, 1918, a bridge of this type, 108 feet clear span, was erected under heavy shell fire across the Canal du Nord and opened for traffic in 12½ hours. A work party of 200 sappers being employed on the construction of the bridge, abutments and approaches. The bridge at this span was good for a distributed load of 51 tons and after the erection of a trestle, as a centre support, took all classes of transport.

The bridge can be built of any span in multiples of 12 feet but is limited to 120 feet with a distributed load of 41 tons. Immediately this bridge was erected construction was started on a bridge of a more permanent type allowing the Inglis bridge to be removed in preparation for use in another attack.

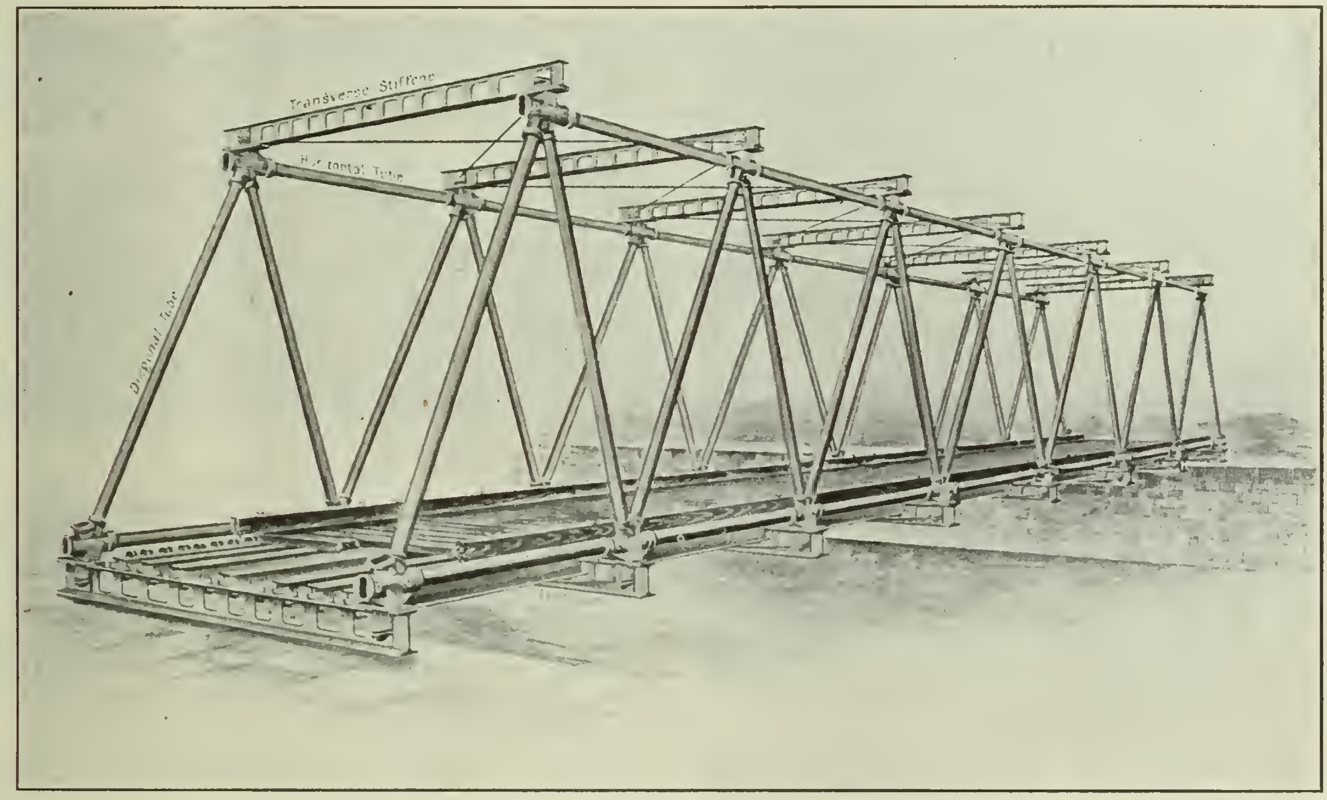


Fig. 1.—"Rectangular" Type Inglis Portable Military Bridge.

The Germans had large dumps of good squared bridging timber and with these I beams, many bridges were constructed, the Canadian sapper being very much in his element with a cross-cut-saw, squared timber and spikes; a welcome change from the old trench warfare days of pick and shovel work.

During the 1918 advance 200 bridges were constructed by the Canadian Engineers, of which 86 were for heavy traffic. In the bridging operations aeroplane observation was a most important element and by a detailed study of aeroplane photographs many points were noted which were taken advantage of in the preparations and much time saved when the construction of the bridge was undertaken.

Tramways

The Canadian Corps Tramways played a most important part in the 1918 advance. They were able to push their rails up after the advancing troops and act as an ammunition supply link between the broad gauge railhead and the forward field guns. The average daily tonnage hauled by the Canadian Corps Tramways during 1918 was 1500 tons, and it can be readily seen from these figures how valuable their work was in relieving lorry and horse traffic and the consequent blocking of traffic.

Roads

An enormous amount of work was also done on roads. In the initial stages of an attack when "No Man's land" was passed over it meant practically the building of a new road and as the enemy retreated at each road intersection he left huge craters which had to be filled. Included in this work was also the searching for delay road mines, which while a dangerous task was the means of saving many lives. During the 1918 advances 773 miles of roads were repaired and maintained for lorry traffic and when you consider that hundreds and hundreds of from two to five ton lorries as well as horse transports are continually moving over these roads, during a show, you can perhaps realize the work which was accomplished. In addition to this there was 290 miles of dry weather track constructed to keep horse transport off the main roads.

Water Supply

In the water supply work a special company was organized in each engineer brigade and worked with the infantry division to which it was attached. A portion of this section went forward with the advancing infantry, taking with them representatives from the C.A.M.C., with apparatus to carry out a quick melatic test for poisoned water. This detail immediately investigated for water points, sending back to another portion of the section information as to what apparatus was required at each definite location to reclaim a supply. This second detail then came forward with the necessary equipment, which was chiefly tools for cleaning the well. Small hand pumping sets, windlasses, buckets, etc. In the meantime the first detail had placed signs at the water points with information as to whether or not water was fit to drink and had pushed forward with the advancing troops. The hand sets were hurriedly put in operation, getting a supply of water to the forward troops, and as soon as source had proved of a fair capacity the hand set was moved to a more forward position and replaced by a small mechanical set which pumped water into canvas reservoirs and troughs. As soon as a source had been proved by these small mechanical sets worth further development Corps Troops came forward and replaced the small sets with larger ones, placed elevated canvas tanks with piping from pump to reservoir and from reservoir to standpipe, dixie fillers and horse troughs, feeding these points by gravity. The small mechanical sets were then moved forward to a more advanced location and the large sets in their turn were replaced by a permanent supply obtained by drilling wells and putting in an air lift or other form of deep well equipment. In this way we kept out equipment constantly in use and as the concentration was in the forward ten miles only the rear country did not require much maintenance except to supply water points for the railway and, as the railway troops came up these rear water points were usually taken over by them.

In the different villages passed through there were numerous small wells from which the Germans in their retreat had removed the pumping equipment and hurriedly filled in. In no cases did we find poisoned water and in most cases we were able to clear sufficient wells and in conjunction with an occasional small spring, stream or a town pumping plant which could be quickly overhauled we were able to care for the troops in perhaps a more satisfactory manner than might be expected when it is realized that a moving force of approximately 100,000 men and 25,000 horses, to say nothing of mechanical equipment, had to be supplied. The hand sets consisted of suction lift pumps and hand chain helice sets, that is sets with a continuous bucket chain bolt. The small mechanical sets were rotary and plunger pumps connected on same base to a four cylinder gasoline engine and had a capacity of from 1500 to 3000 gallons per hour against a 120′ head. The Merryweather Steam Portable Fire Engine Set was also used to good advantage. On deep wells where sufficient diameter was available hand elevator sets were used. These consisted of a canvas continuous belt driven by a gasoline engine and suspended into the water. On coming to the pulleys at the top it was squeezed between rollers and the water collected in an elevated chamber and feeding horse troughs and tanks by gravity. These pumps gave considerable trouble owing to difficulty in regulating speed of engine and level of pulley causing a sway and consequent wearing of belt. When working satisfactorily they had a capacity of 8000 gallons per hour.

The more permanent sets consisted of several types of pumps with capacities up to 9000 gallons per hour against 300′ head, and driven by gasoline or oil engines. When these sets were placed it was customary to place piping to a canvas elevated reservoir, capacity 18,000 gallons, and feed water points from this reservoir. Well drilling sets were used to good advantage and a six inch casing was usually placed and well fitted with air pipe line so as to be connected to a portable air left set which travelled around from well to well in a lorry. These sets pumped up to 12,000 gallons per hour and would fill the elevated canvas reservoirs and then move on to another well.

In addition to the development of these sources in districts where no suitable source could be obtained, water tanks and reservoirs were placed and kept filled by tank lorries hauling water from the most suitable pumping station. Also seven portable sterilizing sets were kept in constant use. These sets were mounted in a lorry and consisted of pump and sterilizing equipment with a small laboratory for testing the water, and had a capacity for treating and delivering 1200 gallons per hour. The water was pumped direct through special filters which removed the organic matter and was then treated with chlorine solution or gas to kill the bacteria.

During August, September and October 42 pumping stations were installed, 85 water points were established and fed by tank lorries, 55,000 feet of pipe was placed or reclaimed, 30 reservoirs of 9000 to 18,000 gallons were constructed, 6000 lineal feet of horse troughing placed, 40 water tank lorries kept in constant use and a daily supply delivery from the various sources of about 1,000,000 gallons which was made to supply approximately 100,000 men and 25,000 horses.

After the Armistice the water supplies in the Canadian Corps Area on the Rhine were investigated. In this area numerous small springs and streams give every opportunity to develop small local supplies and, therefore, few central pumping stations exist outside of the main towns. In the are along the banks of the river Rhine the practice seems to be to sink large shallow collecting wells and draw the water from the water shed on each side of the river. The surface water is naturally filtered through the fine sand in the area and the tests of the water are most satisfactory. No artificial purification is attempted.

In this brief paper, I have endeavoured to outline a few—a very few of the undertakings on land in which the members of the Canadian Engineers were engaged and which played no inconspicuous part, if I may be permitted to say it, in the final result. But it was only a small part of the war game. In the marine service; in aerial undertakings; in the electrical field; in the devising of ways and means to meet the gas and such-like problems which the Hun thrust upon us, and in other ways which may never be recorded, the Canadian Engineer did his part and tried to do it well. Now that the war is over and the arts of peace have taken the place of the arts of war, there is a relatively large field of usefulness in Canada for the members of the profession when events have so shaped themselves as to bring them and their talents into full play.

Discussion

Colonel Leonard congratulated Mr. Armstrong on his excellent paper, stating that the engineering problems of the war were great indeed, the paper giving only a partial idea of what they involved.

C. McN. Steeves, A.M.E.I.C., expressed his appreciation of the paper, as he had come in personal contact with the engineering work described by the speaker and had a knowledge of the good work he had done while there. He moved a vote of thanks to Mr. Armstrong, which was tendered in the form of hearty applause from all present.

As guests of the St. John Branch, the party, including the wives of a number of the local members, motored to Hampton, which is a delightful run of 25 miles on a splendid road, and passing through the charming scenery which the Valley of the Kennebecasis affords. At the Wayside Inn at Hampton the members of the party enjoyed afternoon tea, leaving at five o'clock for Gondola Point. An orchestra had been provided and the evening programme took the form of a dance, which was entered into with enthusiasm and heartily enjoyed by all present.

Sixth Session

At ten o'clock A.M. on Friday, the members assembled in front of St. Andrews Church, where a group photograph was taken, leaving shortly after on a sight-seeing trip about the harbor, ending at Courtenay Bay, where the important engineering work there under way was inspected.

Visit to Courtenay Bay

Here the members were the guests of the St. John Dry Dock and Shipbuilding Company, Limited, whose genial manager, Alex. Dufresne, M.E.I.C., had made elaborate arrangements for the welcoming and the entertainment of his guests. Besides the personal welcome of Mr. Dufresne, who is General Manager of the Company, large banners greeted the visitors proclaiming a welcome to the plant. Throughout the works numerous signs were in evidence conveying a welcome to the members of *The Engineering Institute* from the Bedford Construction Company, Limited who are sub-contractors for the entire work at Courtenay Bay.

Here also one of the most enjoyable functions of the professional meeting took place. In a dining hall especially constructed for the occasion surrounded by evergreens and having at one end a beautifully wrought design in sweet peas bearing the letters E.I.C. about one hundred men sat down to a well appointed banquet board where a meal was provided that would have done credit to the chef of a modern hotel. The chair was occupied by the host, Mr. Dufresne, with Colonel Leonard and Mayor Hayes seated on either side, and at the head table besides officers of *The Institute* a number of civic and county officials. After the toast to the King had been drunk Colonel Leonard addressed the assembly briefly, congratulating the St. John Branch on the excellent manner in which they had planned and carried out all the arrangements to combined to make the fifth professional meeting of *The Institute* such an unqualified success. He thanked the St. John Dry Dock and Construction Company for their lavish hospitality. He proposed a toast to Mr. Dufresne, who learned that he was a jolly good fellow expressed in no uncertain tone. Replying Mr. Dufresne said that it had been a great pleasure to entertain the members of *The Institute.* He was glad that they had an opportunity of seeing the work being carried out at Courtenay Bay, and expressed the hope that at some future date when the dry dock had been completed that he might again have the pleasure of entertaining them.

G. C. Murdock, M.E.I.C., proposed a toast to the city of St. John and the Municipality of the City and County of St. John, coupling with it Mayor Hayes, Warden Golding and Councillor O'Brien, all of whom replied briefly. Mr. Murdock also as Chairman of the Entertainment Committee proposed that the thanks of *The Institute* be conveyed to the Board of Trade for the use of their rooms and their kindness in many other ways, also to the City of St. John and to the Mayor for the assistance rendered to the St. John Branch in making their arrangements, to the St. John Dry Dock and Construction Company, to the owners of the various automobiles loaned to the Committee, to the members who had prepared so many splendid papers, and to the newspapers of St. John to whom the engineers owed a debt of gratitude for the trouble they had gone to in covering the meetings, the liberal amount of space they provided, also to all who in any way assisted in making the Convention a success and the able reporters who attended. This motion was seconded by Mr. Kirby and tendered by Colonel Leonard to those present on behalf of *The Institute.* A vote of thanks to the members of the St. John Branch on behalf of the visiting members for the excellent programme which they had provided and for the generous entertainment which characterized the gathering was proposed by R. Freeman, M.E.I.C., and seconded by W. P. Morrison, M.E.I.C.

Report of Concrete Committee

President Leonard announced that as the only other matter to come up at this professional meeting was the report of the Committee appointed last year to investigate and report on the action of sea water on concrete, rather than adjourn to the assembly rooms advantage would be taken of the occasion to have the reported presented.

THE BEDFORD CONSTRUCTION CO., Limited

WELCOME

The Members of

The Engineering Institute

The Committee of the Halifax Branch, consisting of A. C. Brown, A.M.E.I.C., James McGregor, M.E.I.C., and A. F. Dyer, A.M.E.I.C., through Mr. Bowman, presented the following report:—

In accordance with your instructions, we, having been appointed by your Executive Committee to report upon the action of sea-water on concrete in Nova Scotia, now beg to report as follows:—

As the time at our disposal was too short to allow of any conclusive experiments being carried out, our investigations had to be made on existing concrete structures in contact with sea-water. With this in view we wrote to various engineers stationed in Nova Scotia, likely to have experience of the action of sea-water on marine structures, and whose records or opinions it was thought would be valuable, but we regret to report that we have not yet received any replies or expressions of opinion from them.

Your Committee has therefore been obliged to draw up this report based on the experiences and opinions of its members.

Marine concrete structures in Nova Scotia are subjected to both chemical and mechanical forces tending to disintegrate their mass. In the case of non-reinforced concrete structures the chemical action is generally slight and where the concrete has been well proportioned and made with first-class materials, having the exposed parts dense and the surface smooth with the concrete as nearly as possibly impervious, and where special care had been taken to remove all laitance or defective materials at construction joints, the chemical action is negligible.

On the other hand if sea-water has access to the heart of the mass by way of poorly made construction joints or porous concrete, very serious trouble may result.

Where concrete is continually submerged in sea-water, and in consequence more or less constantly saturated, we find that chemical action does not take place to any noticeable extent, but where there is seepage or percolation of sea-water through concrete, thus allowing fresh supplies of sea-water to come in contact with the inner concrete, chemical action has been found to occur in the walls of such structures as graving docks, canal locks, etc., and it is our experience that it may be expected where the concrete is porous or has defective construction joints.

In general, we are of the opinion that the chemical action of sea-water on mass concrete in Nova Scotia is not serious in itself.

The mechanical forces acting on concrete immersed in or exposed to sea-water, are those of frost and the abrasion of floating bodies, chiefly ice. The results of these forces are apparent in practically every unprotected concrete structure in these waters. These forces, of necessity, act only between tide levels, but where the precaution has been taken of covering the concrete surfaces between tides with insulating or protective material, such as stone masonry, planking, etc., the action of frost and ice upon the concrete appears to have been prevented.

The action of frost and ice on concrete is dependable upon the density and strength of the concrete and some structures may survive several winters without showing signs of such action, but it is our experience that even a dense concrete will eventually succumb, and that the precaution of protecting concrete between tide levels should always be taken.

In the case of reinforced concrete structures the same chemical and mechanical forces acting on the concrete have to be considered, but in addition there is the chemical action of the sea-water on the embedded steel.

Below the level of low water there appears to be little, if any, action on the steel, between tide levels there may be some slight corrosion of embedded steel, but if the concrete covering is dense and it, in turn is protected by sheathing, the action will not be serious, if there be any at all. Above the level of high water the corrosion of the steel, with consequent cracking of the concrete appears to be more rapid. This action is probably due to finely divided particles of salt-water carried by the air which find their way through the covering of concrete to the steel. This action is found to vary with the temperature of the air, and has not been found so serious in Nova Scotia as it has been in warmer climates. Care should be taken that all reinforcing steel in a marine structure be covered with not less than two inches of very dense and smooth concrete.

The practice of leaving in the concrete the steel bolts or tie rods and wires used for bracing the forms, is objectionable and should be avoided for even when these bolts are cut off a distance in from the face, and the hole plastered over, unsatisfactory results are likely to be obtained as these bolts will ultimately prove to be starting points of deterioration.

The belief that a reinforced concrete marine structure will require little or no maintenance does not, in the present limited state of our knowledge, appear to be fully warranted, and it would seem advisable that such structures should be kept under close observation and any defects which may appear should be promptly remedied.

(Sgd.) A. C. Brown,
James McGregor,
A. F. Dyer.

As Chairman of the St. John Committee to investigate this subject, Mr. Gray reported the work that the Committee had done. It was resolved that these committees be continued and be asked to report further at the next Maritime professional meeting.

On behalf of the Halifax Branch, Mr. Bowman extended a hearty invitation to hold the next professional meeting at Halifax.

The singing of the National Anthem brought the Convention to a close.

Registry of Attendance

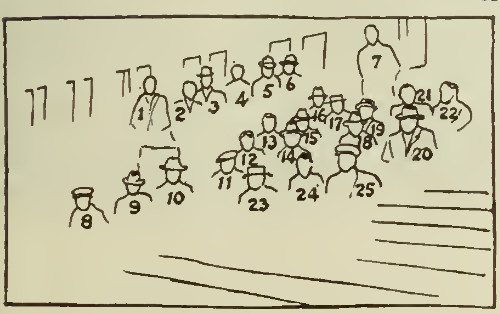
The following signed the register of the Convention:—

R. W. Leonard, St. Catharines, Ont.; C. C. Kirby, St. John, N.B.; Fraser S. Keith, Montreal, Que.; A. Gray, St. John, N.B.; G. G. Hare, St. John, N.B.; F. A. Bowman, Halifax, N.S.; J. R. Freeman, Halifax, N.S.; J. G. Dryden, Halifax, N.S.; O. S. Cox, Halifax, N.S.; W. P. Morrison, Halifax, N.S.; F. G. Goodspeed, St. John, N.B.; C. H. Wright, Halifax, N.S.; A. T. Macdonald, Halifax, N.S.; K. H. Smith, Halifax, N.S.; C. O. Foss, St. John, N.B.;

C. McN. Steeves, St. John, N.B.; J. S. Armstrong, Fredericton, N.B.; R. T. Hayes, St. John, N.B.; Geo. Ballantyne, St. John, N.B.; S. Guy Ashley, Barrington, N.S.; F. P. Vaughan, St. John, N.B.; John B. Jones, St. John, N.B.; Geoffrey Stead, Chatham, N.B.; Walter T. Earle, St. John, N.B.; C. St. J. Wilson, Halifax, N.S.; J. A. Grant, St. John, N.B.; F. W. Holt, St. John, N.B.; Moses Burpee, Houlton, Me.; Gilbert G. Murdoch, St. John, N.B.; A. G. Tapley, St. John, N.B.; C. S. Bennett, St. John, N.B.; H. M. Hopper, St. John, N.B.; T. E. O'Leary, St. John, N.B.; F. X. Jennings, St. John, N.B.; G. S. Macdonald, St. John, N.B.; A. R. Crookshank, St. John, N.B.; Grover Keith, St. John, N.B.; G. N. Hatfield, St. John, N.B.; Carlo Carneil, St. John, N.B.; H. C. Kinghorn, Fredericton, N.B.; J. A. W. Waring, St. John, N.B.; H. E. Huestis, St. John, N.B.; R. E. Armstrong, St. John, N.B.; H. D. Macaulay, St. John, N.B.; D. W. Burpee, Fredericton, N.B.; H. J. MacKenzie, Minto, N.B.; J. E. Marshall, St. John, N.B.; H. H. Donnelly, St. John, N.B.; G. D. Leonard, St. John, N.B.; C. G. Price, St. John, N.B.; Barry Wilson, St. John, N.B.; Ralph McInerney, St. John, N.B.; Hon. Wm. Pugsley, Lieut.-Governor of N.B., St. John, N.B.; Hon. James Domville, Rothesay, N.B.; A. O. Wolff, Brownville, Me.; D. R. Smith, St. John, N.B.; A. H. Case, St. John Standard; J. J. Hebert, St. John, N.B.; A. R. Dufresne, St. John, N.B.; R. B. Emerson, St. John, N.B.; E. J. Owens, St. John, N.B.; A. V. F. Duffy, St. John, N.B.; W. W. Gerow, St. John, N.B.; D. L. Hutchison, St. John, N.B.; W. R. Turnbull, Rothesay, N.B.; H. D. Needham, St. John, N.B.; J. M. McC. Lamb, St. John, N.B.; John R. Walsh, St. John, N.B.; T. L. Richardson, St. John, N.B.; E. R. Reid, St. John, N.B.; A. H. Wetmore, St. John, N.B.; John Thornton, St. John, N.B.; G. E. Martin, Chatham, N.B.; H. N. Putnam, Halifax, N.S.; J. P. Mooney, St. John, N.B.; B. Allen, St. John, N.B.; Samuel A. Sewell, St. John, N.B.; D. A. Duffy, St. John, N.B.; C. D. McAllister, St. John, N.B.; Chas. W. West, Boston, Mass.; W. B. MacKay, Halifax, N.S.; G. E. Howie, Fredericton, N.B.; H. G. Black, St. John, N.B.; J. W. Duncan, St. John, N.B.; T. J. Nesbit, St. John, N.B.; S. C. Webb, St. John, N.B.; J. O. Winfield, Halifax, N.S.; J. Newlands, St. John, N.B.; R. F. Armstrong, Woodstock, N.B.; R. H. Cushing, St. John, N.B.; C. L. Tracey, Fredericton, N.B.; H. L. Seymour, Ottawa, Ont.; R. J. Sandover Sly, Campbellton, N.B.; G. A. Hilyard, St. John, N.B.; W. J. Pickrell, St. John, N.B.; H. C. Grant, St. John, N.B.; L. S. Benjamin, St. John, N.B.; H. H. Wetmore, St. John, N.B.; J. T. Turnbull, St. John, N.B.; E. G. Cameron, St. John, N.B. A. A. Dodge St. John, N.B.; J. H. McHinney, St. John, N.B.; V. S. Chesnut, St. John, N.B.; Jas. Gilchrist, St. John, N.B.; A. F. Foote, Toronto, Ont.; H. Thorne, Windsor, Ont.; Wm. Golding, Fairville, N.B.; S. M. Telfer, St. John, N.B.

Saskatchewan Annual Meeting

Group photograph of the Annual Meeting of the Saskatchewan Branch of the Engineering Institute of Canada held at Regina, June 21st, 1919.



(1) R. H. Murray, (2) K. M. Perry, (3) G. Murray, (4) J. H. Puntin, (5)W. R. Warren, (6) S. Parker, (7) W. A. Begg, (8) R. J. Fife, (9) H. R. Mackenzie, (10) H. G. McVean, (11) L. A. Thornton, (12) R. J. Leckie, (13) H. S. Carpenter, (14) F. S. Keith, (15) J. B. C. Keith, (16) R. N. Coke, (17) M. L. Wade, (18) J. L. R. Parsons, (19) E. G. W. Montgomery, (20) D. A. R. McCannell, (21) C. W. Dill, (22) E. B. Webster, (23) W. T. Daniels, (24) M. B. Weekes, (25) R. W. Allen.

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

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Engineering Legislation

From the minutes of a meeting of the Council held on Tuesday, September 23rd, it will be seen that further consideration was given to the report of the scrutineers regarding legislation and the relation of *The Institute* in connection with proposed legislation. The resolution at the Annual Meeting at Ottawa stated that in the case of a favorable opinion from the members, the Council of *The Institute* should immediately take the necessary measures in co-operation with the Branches to have the legislation enacted.

After a full discussion it was resolved: *That the Council would further in every way the desire of the members regarding legislation, and, inasmuch as the actual application of such legislation is in the hands of the engineers in each province, it is desirable that the Branches and Provincial Divisions in co-operation with other engineering organizations in each province, take the initiative, and in which they are assured of the moral support of The Institute.*

It may be pointed out that legislation as proposed by the special committee recognizes no existing engineering body, and, therefore, all bodies of professional engineers, or bodies composed in part only of professional engineers are on an equal footing in this connection. Engineers in the various provinces will no doubt in making their plans to secure enactment on behalf of professional engineers invite the co-operation of all qualified engineers, whether members of recognized institutions or not.

Classification and Compensation of Engineers

Previous issues of *The Journal* have given the members of *The Institute* information as to the main features of the bill now before the Dominion Parliament relating to the Reclassification of the Civil Service of Canada in as far as this bill affects the engineering profession. Following the work already done by Council in exerting its influence through a special committee in the interests of engineers employed in the civil service, on being advised that the bill would come before Parliament at the short session of Parliament, the Secretary was instructed to meet the various deputy ministers and the chief engineers of departments employing a considerable number of engineers, and also the Civil Service Commission, in order to secure information which would be of advantage to the Council, and enable the members and *The Institute* at large, more effectively to render assistance in this connection.

In an interview with a member of the Civil Service Commission, he stated that representations made by the deputy ministers of various departments had all been considered, and had resulted in many changes amounting to fifty percent of the classification. The reclassification volume was being re-printed, and the new edition would be the one submitted to Parliament. This member of the Commission, and he spoke for the other members thereof, was most emphatic in his attitude towards any concerted opposition to the passing of the bill, stating that if such occurred when the bill was presented to Parliament, that not only would it not pass at this session, but in all likelihood it would never pass. From the various heads of departments and deputies, it was learned, that while many changes had been recommended, although it was not clear that the recommendations would be accepted in full, the general opinion seemed to be that every support should be given the bill in order that it be passed, since the necessary machinery was provided for dealing with individual cases. An advisory board to the Civil Service Commission has been appointed, of which A. St. Laurent, M.E.I.C. is a member, and it is understood that a board of appeal will be constituted whereby any decision of the Civil Service Commission, acting on the advice of the advisory board, or upon representation made by a deputy regarding any classification, may be appealed and given reconsideration.

Inasmuch as the proposed bill elevates engineers employed by the Government from the class of clerks, and gives them a certain status, which they never had in the service, and in the majority of cases gives an increased remuneration, it was decided by Council to give every support to the proposed bill. It is also urged that individuals refrain from expressing any personal dissatisfaction which may exist at the present time, in order that the bill may be passed, and that their individual cases may be considered by the machinery provided.

The interest which the proposed bill has aroused is illustrated by report of the chairman of the Committee on Classification and Compensation of Engineers, and of State and Municipal section of the Engineering Council to Alfred D. Flinn the Secretary under date of August 27th. While the Council of *The Engineering Institute of Canada* is supporting this bill because it marks a step in advance and because it enables *The Institute* to devote its influence on behalf of any individual position, the committee of the Engineering Council objects to the classifications because they do not sufficiently reward those particularly in the higher engineering service, and because the classification proposed inasfar as engineering positions are concerned is not adequately corelated.

The conclusion of Chairman A. S. Tuttle's report to Engineering Council reads:

> "It would seem to the writer that this report is open to serious criticism on the grounds that it fails to group engineering service along orderly lines, that it provides too narrow limits for promotions within a grade, and that the compensation proposed for all grades, in inadequate for the service rendered. The latter criticism seems particularly pertinent in comparison with the rates now being demanded by organized labor. The practicability of properly meeting present day conditions by the addition of a "Special War Bonus" to the proposed rates in order to meet the present high cost of living is also to be questioned on the ground that, and as set forth in the circular letter issued by Council's Committee on Classification and Compensation of State and Municipal Engineers, the "revolutionary change in the cost of living" is one which "unless modified by further economic disturbance is likely to be permanent or to continue for a long time to come."

The above outline illustrates, if nothing else, that the engineering bodies as represented by the national organizations are aroused to the fullest extent to a sense of the inadequacy of the remuneration of engineers at the present time, and it must naturally follow, that with the strength of the organizations directed on behalf of the inadequately paid engineer, within a very short time, a definite improvement in the salary situation, and a pronounced elevation in the standard of engineers must necessarily be realized.

Professional Meeting at St. John

Following the high standard established at Halifax a year ago when the first Professional Meeting of the Maritime Provinces was held, those who attended last year anticipated much from the St. John meeting and none was disappointed. Hospitality is the characteristic feature of the citizens of St. John, and this was manifest in a magnificent manner throughout the three days of the Convention. Particular praise is due to the men who arranged the program, and who were responsible for the social functions which contributed so much to the pleasure and success of this gathering. An optimistic estimate of the number expected placed this at seventy-five. The official register showed one hundred and six names, all of whom, with very few exceptions, are members of *The Institute*.

The meeting besides demonstrating the high engineering standard of the men in the Maritime provinces, exemplified more than anything else could the spirit of fraternity and good fellowship that has permeated the ranks of the engineering profession since the establishment of the Halifax and St. John Branches less than two years ago.

The account of the proceedings of this meeting appear in the general section of this issue and will be read with interest by engineers throughout Canada and elsewhere. The papers were for the most part unique and distinctive and a credit to the ability of the various authors.

In addition to an obligation on the part of *The Institute* to the loyal members who spent so much of their time and energy in arranging the details of this gathering, *The Institute* owe a debt to the City of St. John which was officially represented by Mayor Hayes at all of the gatherings and functions, to the Board of Trade for their generosity in placing their rooms at our disposal and for their enjoyable luncheon at which the members of *The Institute* were their guests, to the owners of automobiles who generously placed them at the disposal of the local branch, to the various companies who extended invitations to visit their works, to the Bedford Construction Company, and particularly to the St. John Dry Dock and Ship Building Company for the munificent manner in which they entertained the delegates at their works.

The general impression that those privileged to attend this gathering received was, that such gatherings within a very few years will do much to consolidate the engineering profession in a body, whose members are well acquainted one with another, who appreciate one another as they never did before, who take a great pride in their profession and who are each and every one working together for a common object, the welfare of the engineering profession.

Officers and Members of Council

In the report of Council published in the current issue will be found under the heading, "Nominations for Ballot," the report of the Nomination Committee as received and approved by Council relating to the election of officers for the year 1920.

In Section 68 of the By-Laws under the caption "Nominees for Officers' Ballot sent to Members," it is required that within seven days after the first meeting of Council in October the Secretary shall mail to each Corporate Member of the Society the list of nominees for the Officers' Ballot. The publication of the list in *The Journal* is according to another clause of the By-Laws equivalent to the requirements above mentioned.

It is further provided that additional nominations for the Officers' Ballot signed by ten or more Corporate Members and accompanied by written acceptance of those nominated, if received by the Secretary, on or before the first day of December, shall be accepted by Council and shall also be placed on the ballot. The title "Special nomination" shall be placed conspicuously near such names, and the names of the members making such nominations shall be shown on some part of the ballot sheet.

National Industrial Conference

Industrial Canada in meeting for a week's conference in the Senate Chamber at Ottawa from September fifteenth to twentieth, at the request of the Government of Canada, through Hon. Senator Gideon Robertson, Minister of Labour, inaugurated a new era in this country in the relations between capital and labour. The conference itself was an epoch in this respect, not so much from what was definitely accomplished, but on account of the fact that for the first time representatives from capital and representatives from labour met on common ground to discuss an agenda designed to promote greater harmony in their mutual relations. The outstanding feature as far as the public of Canada is concerned is that recognition was given for the first time to the position held by what Hon. MacKenzie King describes as the third and fourth groups in the problem, being the managerial and the community.

Due largely to the activities of Wills McLachlan, consulting engineer, Toronto, who, as vice-chairman of the labour sub-committee of the Construction and Development Committee of the Cabinet, has spent a great deal of time and given considerable thought to this subject, the other parties in the discussion were represented by the third group and who, representing neither capital nor labour, did effective work on the various committees, their influence showing the value of such representation. *The Engineering Institute of Canada* was represented in this group by Lieut.-Col. R. P. Rogers, D.S.O., Professor H. M. MacKay and the Secretary of *The Institute.*

What is believed to be the most important result of this conference, in addition to an added respect both on the part of capital and labour for each other and the recognition of the third party, was the decision to recommend to the Government the establishment of industrial councils as may be requested, in various industries and designed to meet the various situations as they may arise.

Professional Engineers of New Brunswick

On Friday September 12th, a meeting of all engineers in New Brunswick was held for the purpose of organizing an association of professional engineers in New Brunswick and to take steps to secure an Act in the Provincial Legislature relating to professional engineers. The question of financing such an application was taken up, and the members present agreed to contribute to the cost which it was stated would be about $150.00. It was proposed to use as a basis with such slight amendments as might be desired, the Act respecting the engineering profession which had been prepared by the committee at Montreal. It was decided to have the headquarters of the Association at St. John. The following officers were appointed: President, C. C. Kirby, A.M.E.I.C., Vice President, Geoffrey Stead, A.M.E.I.C., Secretary, A. R. Crookshank, M.E.I.C. Councillors:—B. M. Hill, M.E.I.C., Fredericton, R. F. Armstrong, A.M.E.I.C., Woodstock, C. B. Brown, M.E.I.C., Moncton, D. F. Maxwell, M.E.I.C., St. Stephen, R. F. Sandover-Sly, A.M.E.I.C., Campbellton, C. O. Foss, M.E.I.C., G. G. Murdoch, M.E.I.C., J. A. Grant, A.M.E.I.C., and A. R. Dufresne, M.E.I.C., of St. John.

Our New Treasurer

There will be universal gratification throughout *The Institute* in the acceptance by Brig.-Gen. Sir Alexander Bertram, M.E.I.C. of the honorary duties of Treasurer of *The Institute.* Sir Alexander is too well known both in the industrial and engineering life of this country to require any lengthy biographical sketch in these columns. His devotion to the work of *The Institute* and to the welfare of the engineering profession are also matters

BRIG.-GEN. SIR ALEXANDER BERTRAM, M.E.I.C.,

Treasurer of the *Institute.*

of general knowledge to those who come constantly in contact with him. In accepting this position the new Treasurer has further demonstrated his willingness and ability to render unselfish service on behalf of the profession in which he has long occupied such an exalted position.

N. S. Water Power Commission

Under the Power Commission Act passed at the last session of the Nova Scotia Legislature, a power commission for the province of Nova Scotia has recently been appointed and is undertaking immediately definite investigations with a view to an early development of certain water powers adjacent to the city of Halifax. The members of the Commission are Hon. E. H. Armstrong, Commissioner of Public Works and Mines, Chairman, R. H. MacKay of New Glasgow and F. C. Whitman of Annapolis. K. H. Smith, A.M.E.I.C., Hydraulic Engineer of the Dominion Water Power Branch who, for some time past has been in charge of hydrometric work and water power investigations in the Maritime Provinces and at the same time has acted as engineer to the Nova Scotia and New Brunswick authorities concerning water power matters, has been appointed Chief Engineer of the Commission and Acting Secretary. It is expected that with the approval of the Director of Water Power, Mr. Smith will be able to continue in his present capacity with the Dominion Water Power Branch as it is thought that such an arrangement will be in the interest of all concerned.

The Commission held its organization meeting on Tuesday, Sept. 9th and is already in consultation with General C. H. Mitchell, M.E.I.C. of the firm of C. H. & P. H. Mitchell, Consulting Engineers, Toronto, with a view to definite action at an early date.

Engineering Standards Association Activity

Under the secretaryship of Captain R. J. Durley, the Canadian Engineering Standards Association is beginning to exercise the influence in the engineering life in Canada, which those, who are responsible for its establishment hoped it would. A meeting of the Association was held at Ottawa on September eighth, at which H. H. Vaughan, M.E.I.C. presided.

New members were appointed as follows: J. M. R. Fairbairn, M.E.I.C., nominated by the Canadian Pacific Ry.; H. G. Kelley, M.E.I.C., nominated by the Grand Trunk Ry.; A. F. Stewart, M.E.I.C., nominated by the Canadian National Rys.; F. A. Gaby, M.E.I.C., nominated by the Hydro-Electric Power Commission of Oatario; A. A. Dion, M.E.I.C., nominated by the Canadian Electrical Association and J. Stadler, the Canadian Pulp and Paper Association.

Chairmen of sectional committees were approved as follows; Electrical sectional committee, Dr. L. A. Herdt, M.E.I.C.; Sectional committee on steel bridges and construction, G. H. Duggan, M.E.I.C.; Sectional committee on wire rope, Prof. H. M. MacKay, M.E.I.C. Recommendations as to membership of the following sub-committees were received, and the committees appointed accordingly: Sub-committee on steel railway bridges, P. B. Motley, M.E.I.C. Sub-committee on incandescent lamps, John Murphy, M.E.I.C. Sub-committee on transformers, A. A. Dion, M.E.I.C.

The secretary reported the progress made with regard to various questions already under consideration, and further reported a number of requests for action on the part of the association. Several of these were approved for further enquiry and report.

The chairman welcomed C. Le Maistre, the secretary of the British Engineering Standards Association, who is now on a visit to Canada and the United States. Mr. Le Maistre described briefly the work of the B.E.S.A., and drew the attention of the committee to certain matters in which his association would welcome the assistance and co-operation of the Canadian Engineering Standards Association, referring especially to proposals which have been made with a view of obtaining some degree of Anglo-American agreement as to screw-thread standards. Mr. Le Maistre further pointed out the desirability of international agreement as to rules affecting electrical appliances and fittings, particularly for interior use. As regards the first suggestion, it was decided to appoint a sub-committee on screw-threads, with instructions to consider and report on Mr. Le Maistre's communication.

Considerable discussion took place on the question of rules for electrical appliances, and the committee agreed that the formulation of a "Canadian Electric Code" was most desirable. The committee then directed that a sub-committee should be called together to enquire and report further as to this point.

Montreal Aqueduct Arbitration

W. F. Tye, M.E.I.C., J. M. R. Fairbairn, M.E.I.C. and Aime Geoffrion, K.C., the Board of Arbitration to adjudicate between the City of Montreal and the Cook Construction Company in connection with the contract work for widening the city aqueduct have presented their decision to the Administrative Commission of Montreal. By this award claims allowed against the city aggregate four hundred and thirty eight thousand dollars and a counter claim of one hundred and thirty thousand dollars is conceded to the city leaving three hundred and eight thousand dollars payable to the Cook Construction Company. Messrs. Fairbairn and Geoffrion submitted the claim by the City of Montreal for damages in connection with the break in the conduit in favor of the city, holding the Company liable in damages for the sum of eighty one thousand, eight hundred and eighty nine dollars. To this Mr. Tye dissented on four points, viz: in regard to the reinforcement of the conduit, as to tamping on the back of the trench, as to the underdrain, and finally the company was not informed of a washout that occurred before the signing of the contract. His opinion was that had the conduit been as represented it would not have broken. The other awards were all unanimous.

Members having copies of the May number of *The Journal*, which they do not wish to keep for reference, would confer a great favor by mailing them to the Secretary. About twenty copies are required.

Civil Service Classification

Questions from men in the Civil Service, and the replies of the Civil Service Commissioners which are of interest to the engineering profession.

Status of Temporaries

Question: Please tell me if the employees in the separation allowance and assigned pay branch of the Department of Militia and Defence who have seen three or more years of service will be made permanent. If not, what standing will they have?—No. 63.

Answer: The mere fact of classification will not make a temporary position a permanent one nor will it give temporary employees, whether in permanent or temporary positions, permanent status. Under classification the status of temporary employees will receive exactly the same as at present; the classification, it should be remembered is of positions, not of persons.

Head of Household

Question: I am married and have three young children; my mother also lives with me. My wife and mother each have a private income of $200 yearly. Am I classed with or without dependents for the forthcoming bonus?—No. 64.

Answer: Apparently a person in the situation described would be entitled to receive the bonus as the head of a household, if otherwise qualified. The order in council provides that where a son, daughter, or wife is employed he or she shall not be considered as contributing to the support of other members of the household dependent on the supporting head. In cases of the receipt of small incomes, as cited above, not sufficient to be considered as contributing substantially to the support of the dependent children, it would appear reasonable to consider the husband the sole supporting head of a household. In such cases the facts should be entered on the declaration form and referred to the department concerned for approval.

Bonus for 1918 Work

Question: I worked in the Separation Allowance and Assigned Pay Branch from July, 1917, to May 31, 1918. On June 1, 1918, I secured a position with a commercial firm in Ottawa and on June 13, of this year enlisted in the Royal Northwest Mounted Police. I understood from the paymaster of the separation allowance and assigned pay branch a few months ago that a certain amount of bonus was payable for service during April and May, 1918, but that having left the service I could not have it. He added that provision was about to be made by Parliament, however, for the payment of such bonuses to those who had left the governmental employ. Can you kindly advise me if I may expect any bonus from the separation allowance and assigned pay branch?—No. 72.

Answer: The payment of any bonus for services rendered before April 1, 1919, is not in the hands of the Civil Service Commission. If you think you are entitled to a bonus for service given before that time you should take up the matter with the department or with the paymaster.

Mechanics and Labourers

Question: 1. Are mechanics who receive a monthly (not hourly) pay to be considered civil servants? 2. Are they considered premanent employees? 3. Are mechanics, helpers, and labourers receiving hourly wages considered civil servants and permanent employees? 4. Are mechanics and foremen mechanics in line for promotion? If so what is the next rank to which a mechanic would be likely to be promoted if qualified? 5. Will seniority be given preference in promotion, other qualifications being equal? 6. Are mechanics (monthly men) receiving from $47 to $68 per month less than local prevailing rates entitled to the $420 bonus? 7. Will there be any material changes in the answers to the above questions if the proposed civil service classification becomes law?—No. 73.

Answer: 1, 2 and 3. The positions in a department depend upon the work to be done. This means that certain positions will be permanent and others temporary A permanent position will normally be filled by a permanent employee, though in some cases a temporary employee may for the time being fill a permanent position; as an example, a permanent position would be filled by a temporary employee if the Civil Service Commission had no list of eligibles when a vacancy occurred. Employees filling temporary positions are of course temporary. Whether a position is permanent or temporary depends upon the organization of the department and whether the employee is temporary depends upon the nature of his appointment. Therefore, the method of payment (whether by the hour, week, or month) is not the determining factor, though as a rule permanent employees are more likely to be paid by the month or year and temporary employees by the hour or day. According to the Civil Service act of 1918 and the proposed amendments mechanics, helpers, and labourers are considered civil servants unless they are employed on the government railways, but whether they are permanent or temporary depends upon the nature of the position and the nature of the appointment. 4. Mechanics are in line for promotion; if you will look in the classification under "Tradesmen," you will find the lines of promotion in part indicated. 5. Seniority is always one of the factors considered in making promotions. 6. So many factors must be taken into consideration that a definite answer to your question with regard to the bonus can not be given until the department's pay lists are submitted to the Civil Service Commission. 7. The proposed classification does not materially change the answers to the above questions but the legislation to make it effective states the governing principles much more clearly than the present law and in fact would make the matter so clear that you would probably not find it necessary to ask questions of this kind. At present the status is determined partly by acts of Parliament, partly by orders in council, partly by long established custom, and partly by departmental rules and civil service regulations, while if the classification were adopted together with the necessary legislation the whole matter would be made clear by the law, the classification, and the regulations of the Civil Service Commission (approved by the governor in council).

Returned Soldier

Question: I received my first permanent appointment as a clerk-stenographer, April 1, 1915. I enlisted in September, 1915, and served in France until May 3, 1919, returning to Canada June 15. On enlistment my salary was $650 per annum and I have received the statutory increases which make my present salary $800 per annum. During my absence five new clerks have been added to the staff and last October four of these were promoted to grade 3A of the third division and are receiving a salary of $1000. I should like to know how I will be affected by the reclassification. Will I be junior to these clerks who have come into the department since my enlistment? Doing the same work as they am I not entitled to the same salary?. Will the fact that I have been overseas for over three years be allowed to retard my promotion, or will this be readjusted in the classification?—No. 75.

Answer: Some of the matters you mention are taken care of by the classification and some are not. Your position will be classified on the basis of the duties you perform and the responsibilities you exercise. If you are doing the same work as new clerks added to the staff after your departure your position will be classified exactly the same as theirs. Where you will fit into the salary scale, however, will depend upon the legislation adopted to make the classification effective and the regulations thereunder drawn up by the Civil Service Commission and approved by the governor in council. If by some chance the salaries of the four promoted should be higher than the maximum for the class under the classification, they would undoubtedly be allowed to retain what they have already secured. Whether you would be junior to these clerks who came into the department later than you did is a matter not covered by the classification, but the general practice has been to allow those who enlisted full credit for the period they were absent on military service. Your absence overseas will certainly not be allowed to retard your future promotion; but the classification is not retroactive with regard to promotion and if under existing law and practice you failed to receive a promotion that you would have received had you not enlisted the classification will not rectify that state of affairs.

Prevaling Rates

Question: 1. What is meant by "prevailing rates" in the classification with regard to mechanics? 2. How many days holiday in the year are the staff of the department of public works entitled to?—No. 81.

Answer: 1. The term "prevailing rates" as used in the classification is interpreted to mean the rates paid to persons doing the same kind of work in the commercial filed in any given neighbourhood or region. 2. The Civil Service Act of 1918, provides that the deputy head may grant to each officer, clerk, or employee a yearly leave of absence not exceeding eighteen days in any one year, exclusive of Sundays and holidays, if they have been at least one year in the service. This section applies to the department of public works.

New and Old Salaries

Question: I would like to know whether the salaries will be increased according to the schedule of the classification, no matter what difference there may be between the present and the reclassified salaries?—No. 82.

Answer: The legislation proposed at the last session of Parliament to make the classification effective provided that persons receiving a salary below minimum for their positions should be raised at once to the minimum and the new salary dated back to April 1, 1919.

Military and Civil Pay

Question: 1. A letter carrier who enlisted was to receive his regular pay of $3 per day, less the military pay of $1.10 per day. He was discharged May 28, 1919, the above pay being from April 30, 1919, until the date of discharge at the old rate of bonus. What pay should he receive? 2. Does the pay of a civil servant, less military pay, mean thirty-one days a month?—No. 83.

Answer: 1 and 2. These are matters to be taken up and adjusted by the department. The only way in which the classification can possibly enter into the matter is the fact that the rates may be retroactive to April 1, 1919. This matter, however, has not yet been decided by parliament and, therefore, the adjustment is entirely one to make with the department.

Salary of Returned Soldier

Question: I am a returned soldier and have been in the railway mail service since February 8, 1917. My salary is now $600 per year, plus mileage, plus $180 western provisional allowance, plus $380 bonus. Under the classification are we to be given an increase in salary? 2. Is there to be any difference in our mileage rates? 3. Will the new salary and mileage rates date back to April 1, 1919? 4. How many hours per week are railway mail clerks supposed to work? 5. Does seniority count in this branch of the service under the new bill?—No. 86.

Answer: 1. According to the legislation proposed at the last session of Parliament every employee's salary will be at least the minimum for his class. The minimum for railway mail clerks is $780 per year; the bonus is taken care of by an order in council which provides that no employee shall have his bonus reduced. 2. The mileage rate provided by the classification is one cent a mile, whether the work is done in the day or at night. 3. According to the legislation introduced at the last session of Parliament, the rates were to be retroactive to April 1, 1919. The legislation for the coming session has not yet been prepared. 4. At present the number of hours of work per week is entirely a departmental matter. The bill introduced at the last session provides that the Civil Service Commission shall, with the approval of the Governor in Council, work out standard working hours for each branch of the service. 5. The new bill makes no provision for seniority although the regulations to be made by the Civil Service Commission and approved by the Governor-in-Council will, undoubtedly, contain some sections on this matter.

Bonus for Husband and Wife

Question: Will you please state whether this year's Order-in-Council re the high cost of living bonus to civil servants precludes both a husband and wife from drawing a bonus ?—No. 89.

Answer: Under the Order-in-Council it is possible for both a husband and wife if legally employed to draw a single person's bonus. If there are children whose earnings do not exceed $200 per year from all sources, the husband may receive the full bonus given to the heads of households. Only one person in the family group, however, is entitled to the head of household bonus.

1918 Bonus

Question: I have been employed in the department of public works for about thirty-five years off and on since I came back from the Nile expedition for the relief of General Gordon in 1884-1885. I worked for a period of five months in 1918. Am I entitled to any bonus for that service ?—No. 90.

Answer: The $10,000,000 bonus the administration of which is under the general direction of the Civil Service Commission is to be paid only for services rendered since April 1, 1919. If you think you are entitled to any bonus for services in 1918, you should take the matter up with the department.

Question: Will the Board of Hearings continue to hear representations after the classification has been made effective by Parliament or will it discontinue its sittings at once ?—No. 92.

Answer: Without question the Civil Service Commission will either retain the present Board of Hearings or some similar body indefinitely. The civil service is a living, growing thing, subject to constant change, with frequent adjustments necessary. The Organization Branch through conference with deputy and branch heads can make most adjustments, but there are many matters that the Commission itself will have to decide. It is too early, however, to say that the board as at present constituted will continue, as this is a matter which must be determined partly by experience and undoubtedly the Civil Service Commission will wish to perfect the procedure as experience shows changes to be desirable.

Application of Classification

Question: It was stated in the question box in July that employees would learn through departmental channels in the month of August how their positions have been classified. I have not yet been able to learn what my classification is. When will the employees get this information ?—No. 93.

Answer: Owing to the moving forward of the date when Parliament met, it was necessary to make a change in the original plans. It is the intention to take up the classification at this session of Parliament, and, therefore, early in August the efforts of the Organization Branch of the Civil Service Commission were centred on getting ready the classification itself and the work of making the application perforce suffered somewhat. Nevertheless the work of applying the classsification has been completed in several departments and approved by the deputy and branch heads. In other departments the work is practically complete, only a few cases being left open for discussion. In some departments, owing to the pressure to getting the classification itself ready, no work as yet has been done, but this will be pushed rapidly in the immediate future. It is the understanding of the Organization Branch that the employees of some of the departments have already been informed of the classification of their positions and that in others, where the work is practically complete, no information will be given out until a few remaining cases are settled.

Set up of Classification

Question: Like many others I find it exceedingly difficult to understand the classification because it is a large book of nearly 700 pages with the classes in alphabetical order. In the new edition would it not be possible to group the classes in some way so that those related to each other will be place together ? This would greatly facilitate the analysis of the classification by everybody interested, and would also make the problem of administrative officers in departments very much easier.—No. 94.

Answer: In the new edition the alphabetical arrangement of classes as at present will be retained by will be supplemented by a list of classes arranged but services in order to show the grouping according to the kind of work performed. Under each service there will not only be the title of the class but also the minimum and maximum salary. In addition there will be an alphabetical list of class titles with salaries. These two additions, it is thought, will facilitate the use of the book and will not add materially to its size.

Present Rights

Question: When will employees know whether the amended Civil Service Act gives them the right to go to the present maximum even if the rates are above the classification rates or whether the provision will be the same as in the bill introduced at the last session to the effect that employees above the maximum shall get only their present salaries ?—No. 95.

Answer: The bill will probably be ready before September 20th. Until the printed bill comes out, there is no means of knowing what the section with regard to present rights of employees will contain.

War Bonus

Question: Why do some people who have never worked on war work receive the bonus, while there are others who have worked on war work and do not receive it.—No. 99.

Answer: The bonus is called a war bonus because it is given to supplement the salaries which would be adequate in normal times but which are too low to meet the abnormal high cost of living which has resulted from the war. The basis for granting the bonus is not employment or non-employment in war work. The Order-in-Council provided for the distribution of ten million dollars appropriated by Parliament states specifically the manner in which the bonus shall be distributed and to whom it shall be paid.

Commission's Powers

Question: Before the reclassification of the civil service can have any possible chance of being a practical success, must not the administrative powers of the ministers and the deputy ministers of the various departments relative to the personnel of the service be curtailed?—No. 100.

Answer: The civil service act of 1908 made the Civil Service Commission in effect an employment agency for the inside service and the act of 1918 extended the Commission's duties to include the whole service. The 1918 act gave the Commission very broad powers—broader perhaps than those exercised by any other civil service commission in existence. Before the Commission can make a really effective attack upon its problems, however, it must have a classification, and the Act must be amended to make effective the classification that has been worked out. This, however, is not really an extension of the Commission's powers but a provision for machinery to enable it to exercise its powers economically.

CORRESPONDENCE

Legislation

Dear Mr. Keith,

I see by the August issue of *The Journal* (P. 561) that at the first meeting of Council — July 22nd — following the closing date for the ballot re Legislation, scrutineers were appointed, and that their report would be made available as soon as an adjourned meeting of the Council had been held.

Of course I am not in a position to say that there has been any unnecessary or purposeful delay in this matter, but it is five months since the Legislation Committee met in Montreal and prepared a draft bill. Of course I am aware that the Council does not usually meet during the two or three summer months, but I hope that there may be no further unnecessary delay.

I am not empowered to speak for the Halifax Branch, but I believe it is the hope of several Members that we may be in a position to bring our draft Bill before the Legislature of Nova Scotia at its next session, (in February, 1920), and before we can take any formal steps in this direction it will be essential that we have some months in advance to organize a campaign of canvassing, and to do a lot of talk.

I suppose you will be at the meeting in St. John on the 10th, 11th and 12th of this month, and I shall look forward to seeing you there, though it is not at all certain that I shall be able to manage it, this being my busy season.

Enclosed I hand you a cutting from the Halifax "Evening Recorder" of the 19th ult. descriptive of the visit of His Royal Highness the Prince of Wales to our little Studley Quoit Club, containing a very full and correct report of my "few but well chosen remarks" on that occasion. I take it that on the occasion of His Royal Highness's Canadian tour very few Engineers will have an opportunity, or the responsibility, of playing host to, or speechifying to, or in the presence of, H.R.H. and therefore it is possible that, if space permits, you may deem my remarks worthy of reproduction in the columns of the next issue of *The Journal.* Naturally this would please me very much.

In several recent issues of *The Journal* I have seen numerous critiques of our draft Bill and I have felt disposed to offer some counter-criticisms for production in the columns of *The Journal,* but, after all, what is the use. The leading idea that occurs to me in connection with these criticisms is that the writers have not given sufficicent credit to the fourteen Members of the Committee for the earnest study, and thorough and careful thought that we gave the matter. There is hardly any point in any of the criticisms that I have seen that was not pretty thoroughly thrashed out in that strenuous week in Montreal early in April. I do not know whether it is the intention to have any discussion, formal or otherwise, on this subject at the St. John meeting, but the prospect of its consideration and the opportunity for further discussion and canvass would be an extra inducement for me to make an effort to attend the Convention. The meeting begins this day week, so you will hardly have time to drop me a line before then and I am sorry I did not write you a week ago, but I have been much away from Halifax and very busy.

Yours very truly,

C. E. W. Dodwell.

* * *

Letter to Dr Tudsbery

J. H. T. Tudsbery, Esq., D.Sc., etc.,
Secty. Inst. C.E.,
Great George St.,
Westminster, London.

Dear Dr. Tudsbery,

Presuming that *The Journal of the Engineering Institute of Canada* is regularly sent to you, I would ask you to refer to page 410 of the May 1919 issue, and page 458 of the June issue, by which you will observe that the Engineers of Canada are making an effort to put the profession of Engineering on all fours with those of medicine, law and others, in regard to legal status and recognition by Legislative Enactment.

We began this campaign 23 years ago and we succeeded, not without difficulty, in getting Acts passed by the Legislatures of the Provinces of Quebec and Manitoba.

(Under the Provisions of the British North America Act, 1867, consolidating the Provinces into the Dominion, Federal Legislation of the character desired would be *ultra vires* in the Provinces and therefore Legislative relief must be sought in each of the nine Provinces).

The Quebec and Manitoba Acts have not been unqualified successes, owing to various causes and we are now reviving the campaign on more general lines.

To the Engineers of Canada there seems no valid reason why the noblest of all professions should be the only one lacking status and protection of the law, but we are confronted by many difficulties and by captious and unreasonable opposition from many unexpected quarters.

We admit that the whole matter has its *cons* as well as its *pros*, among the former is the basic fact that in Great Britain, where the profession is on the highest plane, the Engineer has no legal status and the question "why not?" has been asked, and is being asked, of many Engineers, by many Engineers in search of solid foundation for arguments pro and the stirring up of the luke-warm.

May I ask that you will do me the favour of enlightening me as to the attitude of the Inst. C. E. in regard to this whole question.

Has the Inst. C. E. ever considered it, and with what result?

Why is not the profession of Engineering in Great Britain a "closed" or protected profession like Law, Medicine and others?

One answer to the last question would, I suppose, be that the Inst. C. E., being over a century old, and The Engineering Society of the world *par excellence*, Membership therein is practically equivalent to legal status and that an Engineer whose name is not found in its Membership Register has not a look in. This fact, however, does not bear directly on our situation, because our organization, "*The Engineering Institute of Canada*," (of which the title was changed last year from The Canadian Society of Civil Engineers) is only thirty-two years old and it will be many years, perhaps a century or two, before we can attain the commanding influence and status of the Inst. C. E., especially in view of the vast size of Canada, where dozens of Engineering organizations may, and no doubt will, spring up in the future.

I shall be very grateful if you will give me a frank and full reply to this inquiry, with such hints and opinions as will either support our movement or show us good reasons for abandoning it.

Yours very sincerely,

C. E. W. Dodwell.

Dr Tudsbery's Reply

Dear Mr. Dodwell,

Your letter of the 11th June reaches me at the very time when the Council has undertaken to consider the highly important question you refer to, and I think your note, received at such a time, will be much appreciated by the President and other Members of the Council, who are very considerably interested in this question, and will be very serviceable to the deliberations which, speaking personally, I sincerely hope may result in some steps for the improvement of the Civil Engineer's status — and consequently his interests — throughout the whole Empire.

I shall not forget to communicate with you further when the Council have made some definite progress in their consideration of these matters.

Yours very sincerely,

(Sgd.) J. F. T. Tudsbery.

* * *

Adopting Institute Specification

Dear Sir:—

I am very much obliged for your letter of the 26th August. As we are making the cement specification of *The Engineering Institute of Canada* an integral part of our specification I think it is probable that we will reprint it on paper of a size to match with our standard specification. Nevertheless I am very much obliged to you for your suggestion that the Council would have this printed for us at cost.

Yours truly,

(Signed) A. F. Stewart, M.E.I.C.
Chief Engineer,
Toronto, Aug. 28th, 19. Can. Nor. Rly. Eastern Lines.
AFS/W Canadian National Railways.

Report of Council Meeting

An adjourned meeting of the Council was held at the rooms of *The Institute*, 176 Mansfield Street, on Monday, September 8th, at eight o'clock in the evening.

Civil Service Reclassification: (a) The report of the Secretary's visit to Ottawa, on August 26th and 27th, regarding Civil Service Reclassification was rceived and noted.

(b) A night lettergram from the Border Cities Branch asking the Council to strongly urge the Federal Government to pass reclassification of engineers in the Civil Service as per Arthur D. Young's report, was received and noted. It was felt that no further action was necessary on the part of the Council at this time.

(c) A circular addressed to the Engineering Council by the Chairman of the New York State Committee on the classification and compensation of engineers was received and noted.

National Industrial Conference: The personnel of the representatives of *The Institute* to the National Industrial Conference at Ottawa, September 15th to 20th was considered. Lieut.-Col. R. P. Rogers, D.S.O., A.M.E.I.C., was nominated by the President and it was left to the Executive to secure the consent of two other delegates to attend this Conference, and to notify the Minister of Labor accordingly. The delegates finally nominated and who attended the Conference were Lieut.-Col. R. P. Rogers, D.S.O., Professor H. M. MacKay, and Fraser S. Keith.

Maritime General Professional Meeting: A circular letter was read from the Secretary of the St. John Branch outlining the General Professional Meeting at St. John, and approved.

New Brunswick Engineers: The calling of a meeting of all New Brunswick engineers for the purpose of organizing the Provincial Institute or Society and for the election of temporary officers thereof, at 4 o'clock in the afternoon on the 12th instant, was noted.

American Welding Society: A letter from Comfort A. Adams acknowledging the Secretary's letter of August 27th, was read and noted.

Treasurership: A letter of acceptance of the office of Treasurer by Brigadier-General Sir Alexander Bertram was read and was noted with pleasure.

Badges: A letter was read from R. Hemsley, Jeweller, stating that he had no record of the former issue of badges of the Society. The contents of the letter were noted.

A letter was read from Caron Freres quoting a price of fifty cents per badge for the necessary engraving. It was decided to accept this offer and the Secretary was authorized to order the necessary badges on this basis.

Western Professional Meeting: A letter was read from the Secretary of the Manitoba Branch suggesting that in view of the conditions in the West no Professional Meeting be held this year. It was decided that the Secretary should write a letter to Edmonton suggesting that the holding of the Professional Meeting be given reconsideration in view of the unsettled conditions in the West.

Suggested Change in By-Laws: (a) The suggestion to change the date of the issuing of the Charter, By-laws and List of Members was discussed and it was decided that the book should be complete as at December 31st of each year.

(a) The suggestion that each Branch be known as the " Engineering Institute of " Toronto " (for example) was discussed, and it was decided that the proposed change is not desirable, at present, especially as it entails radical changes throughout the By-laws, forms and other stationery.

Western Canada Irrigation Association: The receipt of a letter from the acting Secretary of the Western Canada Irrigation Association acknowledging the appointment of our delegates was noted.

Standard Specification for Portland Cement: A communication was read from A. F. Stewart, M.E.I.C. stating that the Canadian National Railways are making our Standard Specification an integral part of their specification. The communication was noted with pleasure.

* * *

The regular monthly meeting of Council was held at the rooms of *The Institute,* 176 Mansfield Street, Tuesday, September 23rd at 8.15 P.M.

Nominations for Ballot: The report of the Chairman of the Nominating Committee, Professor H. M. MacKay, was considered in connection with the acceptances and withdrawals from the ballot. Subject to the acceptance of two from whom no reply had been received, the following was declared to be the ballot for the election of officers for the coming year:—

President: R. A. Ross, Montreal

Vice Presidents: W. G. Chace, Winnipeg; A. S. Dawson, Calgary; Brig. Gen. C. H. Mitchell, Toronto. John Murphy, Ottawa.

Councillors:

District No. 1: Frederick B. Brown, Montreal; J. Duchastel, Montreal; V. I. Smart, Montreal; Julian C. Smith, Montreal.

District No. 2: F. T. Cole, Quebec; A. R. Decary, Quebec.

District No. 3: F. A. Bowman, Halifax; W. P. Morrison, Halifax.

District No. 4: J. B. Challies, Ottawa; Col. Alex. Macphail.

District No. 5: R. K. Palmer, Hamilton; E. R. Gray, Hamilton.

District No. 6: (One Year) W. J. Dick, Winnipeg; B. S. McKenzie, Winnipeg; (Two Years) Guy C. Dunn, Winnipeg; J. M. Leamy, Winnipeg.

District No. 7: J. R. C. Macredie, Moose Jaw; C. P. Richards, Regina.

District No. 8: G. W. Craig, Calgary; F. H. Peters, Calgary.

District No. 9: H. M. Burwell, Vancouver; C. Brakenridge, Vancouver.

The Secretary was instructed to carry out the procedure in this connection in accordance with the By-Laws.

Legislation: Further consideration was given to the report of the scrutineers and the attitude of *The Institute* regarding proposed legislation. It was pointed out that the resolution at the Annual General Meeting at Ottawa stated that in the case of a favourable verdict from the members, the Council of *The Institute* shall immediately take the necessary measures in co-operation with the Branches to have such legislation enacted. It was resolved that the Council would further in every way the desire of the members in this connection and, inasmuch as the actual application of such legislation is in the hands of the engineers in each province, it is desirable that the Branches and Provincial Divisions in co-operation with other engineering organizations in the various provinces, take the initiative therein and in which they would have the moral support of *The Institute.* Messrs. Ross and Vaughan were appointed a Committee in addition to the Executive Committee to draft a letter to be forwarded to the Branches and also a letter to the Canadian Mining Institute dealing with this subject.

Provincial Road Engineers in British Columbia: Inasmuch as no direct word had yet been received from either of the Branches in British Columbia regarding the question which had arisen regarding the proposed non employment of engineers for the building of road work by a prominent politican, it was decided to await definite information before action could be taken.

Badges for Honorary Members: A proposal by a member of Council that the Honorary Members of *The Institute* be presented with badges was considered and approved. The Secretary was instructed to order a gold badge for each of the Honorary Members and have same engraved for presentation.

Suggested Government Standard: The suggestion that *The Institute* request in connection with advertisements for engineers in the Civil Service that membership standing in *The Institute* be included in the qualifications advertised for in engineering positions in the Civil Service, was considered further and the matter left in the hands of the Executive Committee for action.

National Industrial Conference: The Secretary reported that, accompanied by Professor H. M. MacKay and Lieut.-Col. R. P. Rogers, D.S.O., he had attended the National Industrial Conference, as instructed and would present a complete report at a later meeting.

Additional Journals for Universities: Consideration was given to a proposal to print three hundred extra Journals to be sent to the science faculties of the various universities for distribution among the students and the proposal was approved. The Secretary was also instructed to advise the univertities of the Student's Prizes, available each year.

Ballot. A ballot was canvassed and the following elections and transfers affected.

Members

Walter Halcro Boyd, B.A.Sc. (Univ. Tor.), of Ottawa, Ont., chief topographer, Geological Survey of Canada; Clement A. K. Cornwall, B.Sc. (E.E.), M.Sc. (McGill Univ.), of Victoria, B.C., assistant supt. B. C. Electric Railway Co.; David Kyle, M.E. (Royal Tech. Coll.), of Sault Ste. Marie, Ont., Vice President, in charge of operations, Algoma Steel Corp.

Associate Members

Herbert William Ault, of Ottawa, Ont., chief draftsman, Reclamation Service, Topographical Surveys; Harry E. Balfour, of Quebec, P.Q., assistant engr., Jos. Gosselin, Ltd.; Jules Armand Beauchemin, B.A.Sc. (Laval Univ.), of Ottawa, Ont., assistant engr., Upper Ottawa Storage; Victor Stanley Chestnut, B.A.Sc. (post graduate) (Univ. Tor.), of East St. John, N.B., assistant engr., St. John Dry Dock & Shipbuilding Co.; Hugh Walter Frith, of Vancouver, B.C., reclamation and gen. harbor work, Vancouver Harbor Commission; Harold Paul Fuller, of St. James, Man., assistant engr., C.N.R.; Lawrence Ernest Habben, of Shawinigan Falls, Que., assistant designing engr., Can. Electro Products; Lieut. Donald Wilbur Hodsdon, of Nelson, B.C., with C.E.F. 1916-19. At present, assistant district engr., Water Rights Branch; David Wilson Jamieson, of Ottawa, Ont., assistant to district engr., Department of Public Works; William Cole Macdonald, E.E., (Dalhousie Coll.), of Woodman's Point, N.B., engr. and accountant, Kennedy and MacDonald, St. John and Que. Ry.; Major John Gordon MacLachlan, of Kamloops, B.C., (2 years in France). Div. engr. of constr., C.N.R.; Thomas Vincent McCarthy, B.A.Sc. (Univ. Tor.), of Toronto, Ont., (1916-19 with C.F.A.), Assistant laboratory engr., Hydro-Electric Power Commission; James Cecil McDougall, B.Sc., B. Arch. (McGill Univ.), of Montreal, Que., practising architecture; J. F. O'Connor, of Aylmer East, Que., in charge of railway work, United Grain Growers, Hutton, B.C.; Samuel Rutherford Parker, of Regina, Sask., acting constrn. engr., Dept. of Telephones, Regina; Capt. Frank Mortimer Perry, of Sault Ste. Marie, Ont., Inspecting engr. on constrn., Algoma Steel Corp.; Maurice Polet, of Edmonton, Alta., supt. and engr. Edmonton Interurban Ry.; Major Charles Henry Pozer, B.Sc. (C.E.) (McGill Univ.), of Vancouver, B.C., (1917-19 with C.R.T.). Industrial surveyor, vocational branch, Soldiers' Civil Re-Establishment; Capt. Herbert William Racey, of Westmount, P.Q., engineering staff of Dominion Glass Co., Montreal; Arthur Salkeld Runciman, S.P.S., of Montreal, P.Q., on experimental work, Marconi Wireless Telegraph Co.; Harry B. Sherman, of Regina, Sask., traffic supt., Saskatchewan Government Telephones; Sigmund Wang, Chem. Engr. (Coll. of Christiania), chief chemist in charge of laboratories, Riordon Pulp and Paper Co., Ltd., Karl Ewart Whitman, B.Sc., C.E.(N.S. Tech. Coll)., of Halifax, N.S., instructor in surveying and structural drawing and design., Soldiers' Civil Re-Establishment at N.S. Tech. Coll.; Wilfred Arthur Winfield, of Halifax, N.S., general supt. of plant, Maritime Telephone and Telegraph Co.; William Irving Young, B.Sc. (Univ. of N.B.), of St. John, N.B., resident engr., St. John and Quebec Ry.

Juniors

Arthur Leonard Bishop, of St. Catharines, Ont., director, Coniagas Mines, Ltd., Cobalt, Coniagas Reduction Co., Ltd., Thorold, British-American Shipbuilding Co., Ltd. and Electric Steel and Engineering Co., Ltd., Welland; William Elfric Plumber, of St. Catharines, Ont., Assistant engr., section No. 1, Welland Ship Canal.

Transferred from Class of Associate Member to that of Member

Augustus Rowley Archer, B.Sc., (Mining) (McGill Univ.), of Port Washington, N.Y., with Jacobs & Davies, Inc.; John Taylor Farmer, B.Sc., M.Sc. (Liverpool Univ.), B.A.Sc., Ma. E. (McGill Univ.), conslt. engr. in mech. and hydraulic engr., also sales engr. and representative of various engineering concerns; Joseph Pollard Hodgson, (A.M.E.I.C.), of Vancouver, B.C., river protection work on Fraser River for Dominion Government.

Transferred from Class of Junior to that of Associate Member

Joseph Georges Caron, of Montreal, P.Q., engr. for Laboratoire Central, Canadian Aniline Oil Co.; Major George Hutton Kohl, B.Sc. (Elec.) (McGill Univ.), of Hamilton, Ont., 1914-19 with R.E., At present, engineer Spanish River Pulp and Paper Co., Ltd.; Wilbert Henry Norrish, B.Sc. (Queen's Univ.), D.L.S., O.L.S., of Ottawa, Ont., in charge of D.L.S. party in Alberta.

Transferred from Class of Student to that of Associate Member

Lieut. Raymond Gardner Bangs, B.Sc. (McGill Univ.), of St. Catharines, Ont., Assistant engr., Welland Ship Canal; Lieut. Alan Keith Hay, B.Sc. (C.E.) (McGill Univ.), of Ottawa, Ont., resident engr., northern section of Ottawa-Prescott Provincial Highway; Charles Franklin Szammers, S.P.S., of Toronto, Ont., since 1916, chief of constrn. and maintenance of Can. Corps Tramways in France and Flanders; Frank Whitham Taylor-Bailey, B.Sc. (C.E.) (McGill Univ.), of St. John, N.B., resident engr. for N.B. eng. branch, S.C.R.,

Transferred from Class of Student to that of Junior

Ralph Allingham, of Grenville, Que., with Foundation Co., Ltd., as resident engr. on constrn. At present on constrn. of power house at Sydney, N.S.; George Haddon Chalmers, B.Sc. (C.E.) (Queen's Univ.), of Turbine, Ont., asst. to E. L. Pettingill, High Falls, Ont. Capt. Charles Harvey Rogers Fuller, B.A.Sc. (Univ. Tor.), of Toronto, Ont., (1915-19 with C.R.T.). Member of firm Fuller & Ferry; Lieut. Edward Caruthers Little, B.Sc. (McGill Univ.), of St. Catharines, Ont., 1916-19 with C.F.A., At present, instrumentman, Welland Ship Canal; Lieut. John Earle Pringle, B.A.Sc. (Univ. Tor.), of Hamilton, Ont., since 1915 with Allied Armies. Returned to Canada, June 12th, 1919. At present unemployed.

BRANCH NEWS

Halifax Branch

F. R. Faulkner, M.E.I.C., Sec.-Treas.

C. E. W. Dodwell, M.E.I.C., entertains the Prince.

As President of the Studley Quoit Club a prominent member of the Halifax Branch had what is no doubt the unique distinction amongst the engineers of Canada, of entertaining the Prince at the Club of which he is President, and of delivering an address of welcome to His Royal Highness. Those who have had the pleasure of visiting the Studley Quoit Club, and more particularly of being there as guests of President Dodwell will appreciate the enjoyment which the Prince no doubt experienced as a guest of this unique and hospitable Institution. In reply to President Dodwell's address which was followed by singing; of "He's Jolly Good Fellow," the Prince made a happy speech expressing his pleasure with his visit, and stating that he would tell the King on his return, who had also as well as King Edward been guests of the Club, that the Studley Club was still going strong.

After the Prince registered his name in the Club's book, former President Howard Murray called the gathering together and proposed the health of President Dodwell, referring to the splendid speech which he had made, which was a credit not only to himself but to the club, and extending on their behalf the heartiest congratulations on the splendid manner in which he had represented them.

President Dodwell's speech is as follows:—

Our little club has been in existence over threescore years. To be precise, we began playingion these grounds just 61 years and 14 days ago, or on the 4th of August, 1858. But the club was formed some two or three years before. In all that time this is the reddest letter day in our history.

The visit of His Royal Highness, which honors and delights us more than I can express, and for which we offer His Royal Highness our heartiest and most respectful tanks, reminds us that a number of years ago we had the honor of no less than three visits from His Royal father, King George V. Once in 1883, 36 years ago, when he was a midshipman in the Canada, and twice in 1890, when he was in command of the Thrush. But at the time of these visits His Majesty was not the heir to the Throne. Our present distinguished visitor is the heir to the Throne, therefore this is, as I said before, the reddest letter day in our history, Q.E.D.

We also recall with pride and pleasure the visit of His Royal Highness the Duke of Connaught in 1912, and that of His Serene Highness Prince Louis of Battenburg in 1905.

A week or two ago I saw in our papers a long list of His Royal Highness' names and titles prescribed for recital in the preparation of loyal and patriotic addresses. But that list was, after all, but partial and incomplete, for His Royal Highness has many other titles and distinctions. He is a full blown or honorary member of nearly every learned, professional and scientific society in London. For instance, it may not be generally known that His Royal Highness is not only a lawyer, but also a judge; for on the second of last month he was made a barrister, in London, and a few minutes later he was raised to the bench; a progress in legal honors and advancement rarely archieved by even our most brillant legal luminaries.

He is a member of many of the City Guilds; the Patron of many others. But the office or title that must give His Royal Highness the greatest pride and gratification is of a different sort; it is one of such towering eminence as to be beyond the reach of most of us mere mortals. It is apparently of a theological, ecclesiastical or religious character, making His Royal Highness not only the envy and despair of mere Bishops, Archbishops, Cardinals and Popes, but out of sight their superior officer. I refer to an announcement in the London papers of a few weeks ago to the effect that His Royal Highness had been raised to the sublime degree of Elder Brother of the Trinity.

Lest this should shock the religious susceptibilities of those of our members who have Sunday school classes, I hasten to explain that the Trinity Board, of which His Royal Highness was made a member, is a very ancient, honourable and important body, in which is vested the function of the construction, maintenance and operation of all the lighthouses of the coasts of the United Kingdom.

For the omission of all these, His Royal Highness' titles, names and distinctions, I can only throw myself on the Royal clemency and pray that His Royal Highness will hold me and the Club guiltless of the crime of Lese Majeste. In extenuation, I hasten to assure His Royal Highness that we are not going to present him with any loyal and idiotic — beg pardon, I mean patriotic — address.

These few words, so feebly expressive of the honor and pleasure that his visit gives us, are the only address that he will be called upon to suffer here this afternoon.

Nor are we going to ask His Royal Highness to further tax his oviparous talents and energies in the laying of another corner-stone, or to turn a first sod, or to unveil a monument, or to perform any other of those numerous and varied duties that he has so conscientiously been carrying out ever since he set foot on our shores and which await him in such terrifying numbers during the rest of his Canadian tour.

Speaking of corner-stones; a mere hen can lay eggs, but it takes Princes and that sort of people to lay corner-stones.

I trust that some duly constituted body will be prepared to assume the responsibility of hatching out all the corner-stones that his Royal Highness will drop all over Canada in the next few weeks, and that in the fulness of time a vigorous brood of noble public buildings and institutions will result from the incubatory process.

In further extenuation of the informal and unceremonious character of our reception of His Royal Highness, let me say that it is our hope that he will regard his all too brief stay with us this afternoon as a sort of interlude or respite from the numerous and possibly more or less irksome formal duties inseparable from a Royal progress, and which he is so courageously facing. We hope that on his return to England he will be able to relieve His Majesty's anxieties by telling him not only that the Studley Quoit Club is still going strong but that this little function was one, at least, of those at which His Royal Highness was not bored stiff.

Now, gentlemen, charge your glasses, and when we have drained them to the health and happiness of His Royal Highness, we will lift up our tuneful voices and tell him what we think of him; what all the world thinks of him; what he has proved himself to be; a man, a soldier, a gentleman and a jolly goodfellow, in the very best sense of all those terms.

We have heard of His Royal Highness in the trenches. A captain in the Grenadier Guards, the idol of his regiment. Deeply chagrined that obvious considerations of State debarred him from leading his men over the top to share their chances of a German bullet or a Victoria Cross, he had to be content with less brillant, less hazardous, but none the less honorable, important and praise-worthy duties; cheering and encouraging his men; comforting and consoling the wounded in many a hospital, and with a reluctant but dutiful compliance with the precautionary injunctions of the High Command, who, with an overwhelming sense of their responsibility for his safety, realized that even a casual meeting between His Royal Highness and a German bullet might result in an appalling calamity for the vast Empire of which His Royal Highness is the hope.

Gentlemen, I have the honor to propose health, happiness and long life to His Royal Highness the Prince of Wales, the Heir-Apparent to the Throne. God bless him.

ADDRESSES WANTED

The records of *The Institute* show that the present addresses of the following members are missing. It is highly desirable that as many of these addresses as possible be in the hands of the Secretary before the middle of October. Members who know the addresses of any of the men whose names are given will confer a favor on *The Institute* by sending in any information they may have.

Associate Members

Adam, Wm. Alexander, Capt., M.C. (military address only)
Amireault, Camille
Annereau, Louis, Capt.
Archibald, Harry P.
Ashton, Arthur Ward
Badger, Henry S.
Barton, Robert A., Lieut.
Beck, Herbert Philip
Bergman, W. Dan
Bergoust, O. J.
Bishop, Reginald W.
Bourassa, L. Wilfrid
Bowie, Jas.
Bradt, Augustine
Bristol, Charles F.
Carroll, John
Chatigny, Albert
Cinq-Mars, Marius
Collier, Ernest V.
Cumming, Austin L., Lieut.
Davy, Harold Mortimer
Dibblee, Harold Bruce
Dyer, W. E. L.
Dyke, Frederick Stanly, Capt.
Earl, James F.
Elliot, John S.
Elliot, William
Ells, Sydney Clark
Erikson, Albert
Farran, Fred'k. St. Clair
Ferguson, Alexander D.
Fiegehen, Edward George
Findlay Allan D.
Flannagan, Oliver L.
Flood, John Garner, M.A.
Fortin, J. Joachin
Fuce, Edward Oilver
Galbraith, J. S. Lieut, M.C.
Gammell, Hector Hatch
Garbi, L. Jr.
Gardner, Clarles T.
Glover, F ank Wesley, Lieut.
Goodall, John A.
Gough, Richard T. B.Sc.
Gunn, Luther Collins
Hare, Wm. Almon, B.A.Sc.
Harper, Wm. B.
Harrison, Roy L.
Hawkins, Leonard K.
Howes, Earl B.
Johnson, Gordon B.
Johnson, H. B.
Johnston, Harold S. B.Sc.
Johnston, W. J.
Keefer, Edward C.
Krellwitz, Diedrich W.
LaForest, G.B., B.Sc.
Laing, Peter A.
Langlais, Zachée
Lefebvre, J. V. Stanislas
Lemire, J. T.
Lightfoot, Francis A.
Livingston, Douglas C.
Lumsden, Harry
Macaulay, Rupert M.
Mackay, Angus G.
MacKenzie, Jas. W.
MacNeil, Hector
Martin, Edward N.
Martin, Louis A.
Massey, A. W. K.
McArthur, Reginald E.
McIntosh, Frederick J.
McIntosh, John Stuart, B.Sc.
McLean, John Rose, Lieut.
McNiven, James
Melanson, Hector W.
Moodie, Kenneth, B.A.Sc.
Moore, Franklin Alfred
O'Leary, H. Gordon
Oborn, Stanley Mill
Ortiz, H. T. B.A.Sc.
Paget, Russel E.
Pardee, Henry M., Lieut.
Patton, John McDonald
Payne, Caleb
Peters, Grosvenor Miles
Phelps, George
Phillips, J. B.
Phillips, George
Raymond, Douglas Chas., B.A.Sc.
Ricketts, Duncan G. W.
Ross, Charles Raymond
Ross, Hendry, J. D.
Sahlstrom, Gustaf
Scott, Henry Maurice, B.Sc., Lieut.
Sharpe, Albert Ernest
Shaw, Herbert H., B.Sc.
Smith, F. Noble
Smith, Stanley G.
Soorma, T. S.
Stirling, Robert A.
Sutherland, Alex. Angus
Taylor, Reginald F., B.Sc.
Timbrell, Alan, Lieut, C.E.
Todd, James Reid
Townsend, Chas. J. H., B.A.Sc.
Tyrrell, Wm. Grant, Major (R.E.)
Van Every, Wm. Wishart
Walker, Horace J., B.A., B.Sc.
Watts, Inverness W.
Whitman, Jacob Bailey
Wilkie, Wm. McLaren, B.A.
Williams, George Kay
Younger, H. R.

Juniors

Allan, John
Allen, B.
Allen, Leonard E.
Arsenault Albert
Bathen, Johan
Boese, Paul R.
Booth, Charles, D. G.
Bourque, L. L.
Bowman, Fred
Brakeley, Philip Howell
Brown, James Carleton
Bryant. Earlham
Buck, Cameron Alexis
Bunting, Henry L.
Burnett, G. K.
Burton, Elliot Crim
Cadieux, Hector
Campbell, Charles Donald
Clendinning, James
Cockburn, Leslie S.
DaCosta, W. R.
DeCardaillac Galliot
Dansereau, Joseph Adolphe
Deslauriers, Louis W.
Dixon, G. B.
Dodd, G. J.
Donnelly, Cecil B.
Dougherty, John J.
Edwards, Herbert Lawrence
Forest, Albert
Fortier, Albert V.
Fulnecky, Chas. Geo.
Gauvreau, J. Romeo
George, W. B.
Goudie, Walter D.
Greening, Edward O.
Gernier, Eugene P.
Heywood, Herbert P.
Houston, James Alex.
Johnston, Geo. B.
Junkin, R. L.
Laliberté, J. Albert
Legris, J. A.
Leishman, J. A.
Lyon, Ernest Norman
Macleod, George Kerr
MacQuarrie, E. MacG.
Martin, Walter H.
McKnight, Robert
Millican, Alonzo, G.

Milne, John Evans
Monkman, Geo. H. N.
Morrison, H. K.
Noonan, W. F.
O'Neill, H. J.
Osler, Charles E.
Perron, Hermel Marie
Pickard, Herbert G.
Poitras, Eugene
Ross, H. T.
Roy, Alfred
Shawcross, R. H.
Shepherd, Hugh W. R.
Stanley, H. P.
Swift, Cyril J.
Tooker, Guy
Watson, F. E.

Students

Adrian, Robert W.
Allan, Edward Blacke, Lieut.
Anderson, Alex. Gordon
Aykroyd, M. J.

Bayne, Chas. MacV.
Beaudry, Romeo
Bennett, Percy
Binns, P. V., Lieut.
Birchard, E. Russel
Bremner, Frank, E. A.
Brown, Chas. K., Capt.
Brown, Leo B., Lieut.
Browne, Ernest Frank

Cameron, John Reginald
Campbell, Gerald Louis
Cann, Frederick Lorne
Carnsew, C. N. T.
Cashdan, Hyman
Chambers, H. D., Lieut.
Circe, J. A.
Crealock, A. B.
Cressman, Horace B.
Culshaw, John G.

Davidson, Robert B.
Derrer, Louis H.
Desmaisons, O.
Deverall, E. V.
Dickson, Wm. J.
Dubuc, Edward
Dunbar, Donald Gray
Dunlop, H. J., Lieut.

Edmonds, Chas.
Emray, D. J.

Fairweather, S. W.
Ferguson, G. H.
Forgues, J. Arthur
Fortier, H.
Fraser, D. C.
Fraser, Walter L.

Gage, Chas. E., Lieut.
Gagnon, Ernest
Gerez, Jose Manuel
Gerrie, William Houston
Giguère, O.
Glover, T. S.
Goorevitch, Abraham S.
Graham, E. J.
Grant, W. R.

Hammer-Shou, J.
Harris, R. W.
Harvey, John Percival
Hawkins, S. H., Lieut.
Hughes, B. H.
Hugli, E. E. H.

Innes, C. W.

Jack, Henry Claud.
Janin, Alban
Julien, J. R.

Kennaugh, Wm. J.
Kirk, Edward W. H.

Laffoley, L. H.
Lamarche, C. E.
Laporte, J. Armand
Larochelle, J. L. E.
Laroy, A. P.
Laverdure, J.
Lavigueur, F. X.
Lee, Ronald G.
Lemay, Venance
Lepage, Damase
Leslie, J. Frank

MacDonald, Charles A.
Macheras, Joseph P.
MacKenzie, B. H. T.
Manseau, Joseph
Marien, Joseph
Marien, O.
Maurice, R.
McCaghey, Norman F.
McDonald, John Nicholson
McFarlane, M. L. D.

McGinn, Francis
McIntosh, William Lyon
McIntyre, James R.
Meitz, W. H.
Merston, William C.
Michaud, A. A.
Miller, Albert Sherman
Moon, Walter
Moore, Wm. McL
Morency, George Elie

Neville, Herbert G. H.
Noecker, Claude

Parke, Chas. S.
Picher, R. H.
Poitras, Paul E.
Potvin, G.
Purcell, John Metcalfe
Pym, J. S.

Rankin, Garnet
Rochester, L. B.
Rosenorn, Paul E. M., Capt.
Ryan, Charles C.

Scott, N. M.
Scott, Wm. Douglas
Singers, George
Smith, H. E.
Spears, D. C.
Spence, Wm. Archibald
Staples, Grenville James, Lieut.
Steele, Samuel C.
Stephenson, George Elgin

Taylor, E. R.
Teulon, Cedric Maurice
Tillson, L. B.
Tom, J. A.
Tremblay, T. H. A.
Twinberrow, J. O.

Vohl, Henri.

Walcott, W. Daniel
Wallace, George Arthur
Wase, George
Weir, Francis E.
West, Frank Leslie
Williscroft, George M.
Wilson, A. L.
Wilson, Harry Perey
Winfield, Edwin George

Personals

Dr. F. D. Adams, Hon. M.E.I.C., Dean of the Faculty of Applied Science, McGill University, is now acting as Head of the University, and will continue to do so until the new Principal, Sir Eric Geddes, is free to resume the duties of his office.

*

Major Roy A. Spencer, M.C. and Bar, Jr. E.I.C., who was overseas with the 3rd Div. Can. Engineers, returned to Canada in August, 1919, and has accepted a position as Professor of Engineering, Dalhousie University, Halifax, N.S.

*

Lt. H. G. Welsford, S.E.I.C., engineer officer of the No. 1 Reception Park Royal Air Force, France, which is the main supply depot for the R.A.F. in France, returned to Canada in September and is visiting his home in Winnipeg. Lt. Welsford plans to return to London this Fall to become associated with a firm of architects in London.

*

John W. leB. Ross, M.E.I.C. Superintending Engineer Sault Ste. Marie Canal, took a prominent part in entertaining the Prince of Wales during his visit to Sault Ste. Marie. Several published photographs of the Prince inspecting the locks show that His Royal Highness was being directed by the Chairman of the Sault Ste. Marie Branch of *The Institute.*

*

Capt. Charles Antony Ablett, O.B.E., M.E.I.C., who was formerly General Manager and Director of The Siemens Company of Canada, previous to the war, has decided to remain in England, and has formed a partnership with Edward Barrs under the style of Barrs & Ablett, with offices at London, Cardiff and Newcastle-on-Tyne.

*

M. J. Butler, C.M.G., M.E.I.C., past president of *The Institute,* who for many years past has occupied a high position in the engineering and industrial life of Canada, and who more recently has been associated with the Armstrong-Whitworth Company Limited, of Canada, as Managing Director, has retired from business, having left Montreal recently to reside at Oakville, Ontario.

*

A. W. Campbell, M.E.I.C., Dominion Highways Commissioner, attended the meeting of the Union of Nova Scotia Municipalities held at Yarmouth August 27th where he delivered an address on "Federal Assistance in Roads Improvement." At this meeting J. W. Roland, M.E.I.C. Chief Engineer of the Nova Scotia Highways Board spoke on the activities of the Board in connection with the roads of the Province.

L. R. Brown, B.A.Sc., A.M.E.I.C., who was one of the leaders in establishing a Branch of *The Institute* at Sault Ste. Marie, Ont., and who acted as its Secretary-Treasurer, at which time he was engineer and superintendent of the Toronto Chemical Company in that city, has accepted the position of road engineer with the Dominion Tar & Chemical Company, and will devote his entire time to that important branch of engineering service.

*

Professor John N. Finlayson, M.Sc., A.M.E.I.C., who until recently has been engaged as professor in Civil Engineering in Dalhousie University, besides doing

Prof. John N. Finlayson, M.Sc., A.M.E.I.C.

consulting engineering work, has received the desirable appointment to the chair of civil engineering in the University of Manitoba. Mr. Finlayson takes to his new work the qualities and experience which will insure for him a successful outcome in his new field.

*

Lieut.-Col. A. E. Dubuc, D.S.O. and Bar. Chevalier de la Légion d'Honneur, M.E.I.C., whose distinguished career as commander of the Twenty-second Battalion, has been a matter of pride to all of the engineering profession in Canada, has been appointed by the Dominion Government to the position of superintending engineer of canals for the Province of Quebec, which was made vacant by the death by the late Treasurer of *The Institute,* Past President, Ernest Marceau.

A. S. Clarson, A.M.E.I.C., who a few months ago accepted the Secretaryship of the Association of Canadian Building and Construction Industries has resigned his position, J. C. Reilly, B.A. acting as secretary for the Association for the time being. Two representatives of the National Federation of Construction Industries of the United States, attended the National Industrial Conference at Ottawa, Ernest T. Trigg, President, National Federation of Construction Industries of the United States, and Director of Chamber of Commerce of the United States, and John C. Frazee, Executive Secretary, National Federation of Construction Industries of the United States, where they met a number of the officers of the Association and discussed matters relevant to the building industry in America.

*

Prof. R. S. L. Wilson, B.Sc., A.M.E.I.C.

R. S. L. Wilson, B.Sc., A.M.E.I.C., succeeds the late Professor Muir Edwards, M.E.I.C., as head of the Faculty of Engineering in the University of Alberta, the appointment having been recently confirmed by Prof. Tory. In 1913, Professor Wilson was engaged as a General Contractor in Saskatchewan. Later for four years he was with the Department of Railways and Canals engaged in designing on the Welland Canal. Recently he has been associated with McGill University and was consulting engineer for a large firm of contractors in Montreal.

*

At the National Industrial Conference at Ottawa a number of the prominent members of *The Institute* represented various industries and interests:—T. R. Deacon, M.E.I.C., of Winnipeg, representing manufacturers in general; G. Gordon Gale, M.E.I.C., of

Col. T.V. Anderson, D.S.O., A.M.E.I.C., who returned on the SS. Melita, Aug. 23.

Ottawa, the street railway interests of Canada; E. G. Henderson, M.E.I.C., chemicals and allied products; S. J. Hungerford, M.E.I.C., Toronto, railway transportation and telegraphs; David Kyle, M.E.I.C., Sault Ste. Marie, iron and steel industries; D. H. McDougall,

S. J. Hungerford, M.E.I.C.

M.E.I.C., New Glasgow, mining; Hon. Geo. R. Smith, Thetford Mines, Mining; F. L. Wanklyn, railway transportation and telegraphs; F. P. Jones, A.E.I.C., Montreal, clay, glass and stone products; and C. A. Magrath, M.E.I.C., representing the International Joint Commission, was also vice-chairman and was chairman of the problem committee of the conference.

*

Lt.-Col. L. W. Gill, M.Sc., M.E.I.C., has resumed his professorial duties, as head of the electrical engineering department, faculty of applied science, Queen's University. Professor Gill's war service is interesting and highly meritorious. At the beginning of 1915 he enlisted in the Canadian Engineer Services with rank of Lieutenant, being attached to the 5th F.C.C.E. Kingston. On November of the same year he was granted provisional rank of Captain, Canadian Field artillery when he recruited and organized the 46th Battery, C.F.A., being promoted to the rank of temporary Major, February 1916, proceeding overseas in command of the battery. After five months training the battery at Bramshott and Witley, he proceeded to France. After the taking of Vimy Ridge, in which action he was engaged, he was gassed and sent to hospital for three months. He was then given command of a battery of the Canadian Reserve Artillery at Witley Camp. His expert services, however, were required by the Ministry of Munitions, and the greater part of the year 1918 was spent with that board. November 1918 he was appointed director of educational services with the Canadian forces in England, later being promoted to the rank of Lieutenant-Colonel.

C. A. Magrath, M.E.I.C., Chairman, International Joint Commission, Chairman, Honorary Advisory Board, The Highway Branch, Dominion Government, Vice-Chairman, National Industrial Conference, and Chairman of the Organization Committee.

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Young man required for large industrial organization who has had technical training and experience in mechanical lines to take charge of new department, and develop this department from the sales and manufacturing standpoints. A fair salary and splendid prospects. Apply Box 55.

Junior draughtsman wanted for mechanical manufacturing company for a small industrial centre in Quebec province. Salary $20.00 a week. Apply Box 54.

Licensing of Engineers

According to a circular received from Alfred D. Flinnn, Secretary of Engineering Council eleven states have laws on their statue books for licensing of engineers, viz:—Wyoming, 1907; Louisiana, 1908, (Amended 1914); California, 1909; South Dakota, 1913; Illinois, 1915; Iowa, 1919; Idaho, 1915; Florida, 1917; Oregon, 1919; Colorado, 1919; Michigan, 1919.

As yet Engineering Council have taken no stand on the desirability of licensing or registering of engineers, but the license committee is working on a draft of a typical bill, which, it is intended, can be used if necessary in states proposing new legislation on this subject, or in those proposing revisions, so that laws enacted for licensing engineers may be uniform or nearly so throughout the country.

This same procudure is being carried out in Canada in order that the various provinces may have uniform laws in connection with engineering legislation. This subject will no doubt occupy a very prominent place in the discussions among engineers throughout Canada during the coming winter.

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Preliminary Notice

of Application for Admission and for Transfer

20th September, 1919.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in September, 1919.

FRASER S. KEITH, Secretary.

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*The professional requirement are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific requirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

AITKEN—HAROLD PONSFORD, of London, Ont. Born at London, Ont., Apr. 1st, 1895. Educ., 3 yrs. London Coll. Inst. 1915 (7 mos.) with C.P.R.; 1916-19, rod and inst' work, G.T.R., London, Ont.; Feb. 1919 to date, in city engrs' office, London.

References: H. A. Brazier, F. M. Brickenden, F. S. Rosseter, D. Soper, W. E. Stephens.

ARMSTRONG—HAROLD MURRAY (Lieut.) of Chipman, N.B. Born at Cody's, N.B., June 10th, 1888. Educ., Public school, civil eng. course, I.C.S. 1905, rodman, 1906-09, inst'man, N.T.R.; 1909-14, res. engr., N.T.R.; 1915-19, with C.E.F., lieut., 1st Tramway Coy., Can. Engrs.; at present, div. engr., St. J. & Que. Ry.

References: R. H. Cushing, C. O. Foss, B. M. Hill, H. Phillips, L. H. Wheaton.

BLANCHARD—CHARLES HALIBURTON, of Winnipeg, Man. Born at Winnipeg, Sept. 21st, 1879. Educ., Coll. Inst.; eng. course, Amer. School of Corr. 1900, rodman, etc., Prov. Govt., drainage work; 1901, with C. F. Aylesworth, on land survey; 1902, inst'work, etc., with C. Carroll, D.L.S.; 1903, outside chg. of location and constrn. on Wpg. Selkirk Elec. Ry.; 1903-04, levelling and topographical work on location, G.T.P. Ry.; 1904-05, with C. A. Millican & Co., conslt. and municipal engrs., Wpg., in chg. of field work, etc.; 1906, with Stevenson & Patterson, engrs. and surveyors, in chg. of gen. municipal eng.; 1907-08, chg. of dsgning, drafting, etc., with Vaughan & Mullins; 1908-09, in chg. of drainage and triangulation surveys, etc.; 1910, municipal eng. for municipality of Springfield, Man.; 1911-13, in chg. of dsgn. and constrn. of gen. munic. and town eng., Vaughan & Mullins; 1914 to date, with P.W.D. (Manitoba) as engr-in-chg. Dist. No. 2, on gen. public works.

References: H. A. Bowman, W. Burns, F. A. W. MacLean, C. A. Millican, T. Turnbull.

COLE—RICHARD ERNEST, of Vancouver, B.C. Born at Rochester, Eng., April 28th, 1875. Educ., Member, Inst. of Municipal & County Engrs., England. 1892-95, articled pupil with city engr., Rochester, Eng.; 1895-96, asst. in quantity surveyors dept., Holland & Havner, contractors, London; 1897-98, res. engr., Somerton and dist. waterworks and Milverton waterworks, John Taylor Sons & Sants Crimp; 1898-1901, eng. asst., Edmonton Council, London, gen. work of dept.; 1901-02, eng. asst. Tiverton Corp.; supervision of main drainage works and survey for water undertaking; 1902-06, contractors engr. with Clift Ford, London, sewer constrn., power station, light rys. and road work, river dredging, etc.; 1906-08, ch. draftsman, city engr's dept. York, responsible for preparation of all plans and laying out all works, plan for city tramways and sewage disposal works; 1908-13, deputy city engr. and waterworks engr., Darlington, Eng., gen. administration of dept., etc.; 1913-18, contractors engr. and estimator, Vancouver, B.C., at present, contractor.

References: P. P. Brown, D. Cameron, A. D. Creer, H. Rindal, R. Snodgrass C. C. Worsfold.

CORBETT—CHARLES FOSTER (Lieut.) of Cardston, Alta. Born at Truro, N.S., April 19th, 1882. Educ., 2 yrs. science, Queen's Univ., 1907-08. 1902-05, apprentice, Robb Eng. Co., Amherst, N.S.; 1909-10. draftsman, Darling Bros., Montreal; 1911-12, inst'man, city engr's dept., Edmonton; 1912-15, supt., Edmonton filtration plant; 2½ yrs. in France with Can. Engrs., gazetted lieut. Nov. 1918; at present, dist. hydrometric engr., Cardston dist., Reclamation Service, Dept. of Interior.

References: J. Chalmers, C. J. Fox, R. J. Gibb, A. W. Haddow, L. Malcolm R. H. Parsons, F. H. Peters, P. M. Sauder.

DECARTERET—SAMUEL LAURENCE, of LaTuque, P.Q. Born at Auckland, New Zealand, Nov. 24th, 1885. Educ., Ph.B. (C.E.) Yale Univ., 1909. 1908-09, in chg. of party making topog. and forest surveys, Riordon Paper Co.; 1909-10, in chg. of office work of foregoing, under direction of C. A. Lyford; 1910 to date, organized and in chg. of field eng. dept., Brown Corp., which dept. supervises surveys and attends to water supply and storage for power purposes on St. Maurice River; 1913-15, in chg. constrn. of dams and piers, etc.; 1918 to date in chg. constrn. of steel tug, scows, etc., also chg. of operation and maintenance of 20 miles of private ry., etc.

References: A. E. Doucet, A. Ferguson, J. E. Gibault, C. L. Hervey, A. B. Normandin, D. S. Scott, J. C. Smith.

DILL—CHARLES WILLIAM, of Regina, Sask. Born at Bracebridge, Ont., Aug. 27th, 1870. Educ., grad. S.P.S., Toronto, 1891. 1891-92, asst. to W. Chipma; 1893, asst. engr., Lake Shore & Michigan Southern Ry., Toledo, Ohio; 1894, res. engr. on street improvement work, Tonawanda, N.Y.; 1895-96, private practice; 1896-98, on constrn. of steel bridges, Niagara Falls, N.Y.; 1899-1900. constrn. engr., on waterworks, sewers, etc., Nelson, B.C.; 1901-04, asst. city engr., Toronto, in ch. of roadway dept.; 1905-07, mgr., Constructing & Paving Co., Toronto; 1907-11, contracting works, including Toronto Filtration Plant; 1912, member of Board of Highway Comm'rs., Sask.; 1913-18, gen. mgr., National Paving & Contracting Co., Winnipeg; 1917 ch. engr., Highway Dept.; 1919, supt. of highways, Saskatchewan.

References: H. S. Carpenter, T. R. Deacon, J. N. deStein, G. D. Mackie, W. M. Macphail, L. A. Thornton.

EVANS—CLARENCE THORNE, of Windsor, Ont. Born at Windsor, Jan. 16th, 1888. Educ., 2½ yrs. mech. eng., Univ. of Michigan. 1905-06, tracer, Packard Motor Car Co., Detroit; 1907-08, tool designer, Cadillac Motor Car Co.; 1908-09, with G.T.P. Ry.; vacations 1909-11, squad-boss, tool designing dept., Cadillac Motor Car Co.; 1911, checker, chassis dept., Packard Motor Co.; 1911-12, designer, General Motors Co., experimental dept.; at present, mech'l draftsman, Can. Steel Corp., Ojibway, Ont.

References: J. G. Campbell, R. Carlyle, J. S. Nells, J. E. Porter, H. Thorne.

FLETCHER—WILLIAM JESSIMEN (Lieut.) of Windsor, Ont. Born at Fletcher, Ont., Educ., B.Sc., Queen's Univ., 1910. O.L.S. 1909 (6 mos.) prospecting for silver, Gowganda dist.; 1910 (8 mos.) in chg. of topog. plane table party, under div. engr., C.P.R. irrigation dept.; 1911, with J. J. Newman,O.L.S., chg. of survey party, inst'man, etc.; 15 mos., draftsman, Can. Bridge Co., Walkerville; 1914, under articles, O.L.S.; till Jan. 1918 in partnership with McColl & Fletcher, in chg. of subdiv. surveys, laying out drainage work, reports, reinforced bridges, design and pavements in Sandwich, Tilbury, etc., assoc. town engr., Sandwich, Ont.; lieut. in 16th Field Coy., Can. Engrs., returned form Siberia June 1919, had chg. of all. eng. work, bridges, etc., at Gonostai Barracks, Siberia; July 1919 to date, eng. and surveying office, Windsor, at present on surveys, sidewalks and drainage works.

References: M. E. Brian, L. W. Gill, A. Macphail, C. R. McColl, O. MacKay, J. J. Newman, J. E. Porter, G. C. Williams.

FORBES—JOHN HUNTER (Major) of Smiths Falls, Ont. Born at Montreal, Que., Mar. 3rd, 1888. Educ., B.Sc., McGill Univ., 1908. 1907-08, rodman, municipal eng., Montreal; 1908-13, rodman, inst'man, C.P.R.; 1913-16, res. engr., C.P.R., Montreal and Smiths Falls, in chg. of maintenance and constrn. of track; Jan. 1916, enlisted in Can. Engrs. as lieut., promoted to capt.; 1918-19, major 5th Batt., Can. Ry. Troops, France, in chg. of company bldg. standard and narrow gauge lines, discharged Mar. 1919; May 1919 to date, div. engr., C.P.R.

References: J. E. Beatty, A. A. Belanger, J. M. R. Fairbairn, C. C. Kirby, H. L. Trotter.

HALL—ERASTUS KELLS (Capt.) of Edmonton, Alta. Born at Penetanguishene, Ont., Aug. 18th, 1884. Educ., B.A.Sc., Toronto Univ., 1907. 1909 (4 mos.) draftsman, C.P.R.; 1909-10, inst'man, G.T.R.; 1910-15, res. engr., C.N.R.; Dec. 1915, enlisted, served 2 yrs. as capt., 2nd in command of a coy. on constrn. of narrow and standard gauge rys.; May 1919 to date, div. engr. of constrn. C.N.R.

References: D. J. Carter, A. W. Haddow, E. M. M. Hill, R. W. Jones, W. R. W. Parsons, A. J. Sill.

LAFERME—LEOPOLD, of Ottawa, Ont. Born at Paris, France, Mar. 6th, 1891 (naturalized Br. Subject) Educ., Surveyors Inst., Christ's Coll., New Coll., Heine Bay, Eng. 1908-11, pupil, G. P. Knowles, A.M.I.C.E., London, Eng.; 1911-14, rodman, inst'man, etc., C.P.R.; 1914-15, inst'man, Montreal West, P.Q.; 1917-19, inst'man 2nd Batt., Can. Ry. Troops; 1919, transitman, International Boundary Comm., Dept. of Interior.

References: F. Clarke, F. F. Clarke, J. D. Craig, C. A. D'Abbadie, W. A. Ewing, L. J. M. Howard.

LYNCH—HENRY ARTHUR (Lieut.) of Ottawa, Ont. Born at St. John, N.B., June 18th, 1889. Educ., 2 yrs., Univ. of N.B., 1909 (6 mos.) rodman, International Waterways Comm. survey, N.B.; 1910 (6 mos.) dredging surveys, St. John River; 1912-14, inst'man, St. J. & Que. Ry., responsible for grades, etc.; 1914-18, draftsman, Marine Dept.; 1916-17 (4 mos.) acting dist. engr., for N.B. in chg. of dredging and submarine blasting; 1918-19, lieut., Can. Engrs.; at present, draftsman, Marine Dept.

References: W. P. Anderson, L. E. Cote, B. H. Fraser, F. G. Goodspeed, E. M. Longtin, H. Phillips.

LYNN—HAROLD RIVIERE (Major) of Edmonton, Alta. Born at Victoria, B.C., Nov. 17th, 1890. Educ., 3 yrs. training under late Wm. L. Lynn, C.E., M.E., inst'man, etc.; 1912-14, gen. eng. work in sewer dept., under city engrs., Edmonton; 1915-16, in command of eng. troops (Pioneers) France; 1917, capt. in command of Ry. Constrn. Troops, light ry. and standard gauge; 1918-19, major; at present, res. engr. on constrn. of dam on Kleanza Creek, Usk, B.C., installation of hydro elec. power plant.

References: D. J. Carter, R. H. Douglas, R. J. Gibb, A. W. Haddow, C. C. Sutherland.

MACDONALD—WILLIAM BRODIE, of Mount Joy, Ont. Born at Glasgow, Scotland, in 1874. Educ., Glasgow Tech. Coll. 1890-97, apprentice with Caledonian Ry. Co., 3 yrs. as machinist; 1897, sailed 3rd and 4th engr. (4 mos.); 3½ yrs., 2nd. engr.; 1901-03, as ch. engr.; 1904-08, marine work designing; 1908-10, conslt. engr.; 1911-12, supt., Robinson Bros. Cork Co., Port Colborne; 1912-16, designing mech. engr., Welland Ship Canal; 1916-17, mgr., Wilsons Munitions Ltd., Toronto; Aug. 1917, March 1919, plant engr., Canadian Aeroplanes Ltd., Toronto.

References: A. A. Bowman, E. G. Cameron, C. L. Hays, R. W. Leonard, D. W. Robb, W. H. Sullivan, J. L. Weller.

MELLING—HERBERT TOM, of Regina, Sask. Born at Liverpool, Eng., July 7th, 1874. Educ., Mansfield House, Private School, Lancashire, course in mech. eng., Manchester School of Technology, England. 1890-05, apprentice with J. H. Wilson & Co., Liverpool; 1895-1904, with Crossley Bros. Ltd., Manchester, mfrs. of gas and oil engines, as engr. in experimental and research dept.; 1904, appointed ch. engr., Mazapel Copper Co., Mexico, to superintend erection of plant; later, on staff of Power & Mining Machinery Co., Milwaukee, responsible for erection of various large gas engine installations; 1908, was engaged by Crossley Bros. to go to Strait Settlements to supervise installation of gas engines, producers and pumps for hydraulic work at Salak South Mines; 1910, supt. of gas power producer plant, Edmonton; 1916 to date, mgr., Canadian branch of Williams & Robinson, makers of steam turbines and diesel engines, Rugby, England.

References: J. W. Calder, H. S. Carpenter, W. J. Francis, H. R. MacKenzie, R. H. Parsons, L. A. Thornton, M. L. Wade.

MORRISON — JOHN WILLIAM, of Dane, Ont. Born at Oldham, N.S., Jan. 21st, 1880. Educ., B.Sc. (mining eng.) Dalhousie Univ. 4 yrs. gen. mining and milling practice in N.S.; 8 yrs., gen. mining and metallurgical practice, 6 yrs. in B.C. and 2 yrs. in northern Ontario. 1913, supt., ore dressing plant, Lucky Cross Mines Ltd., Swastika, Ont., including installation of metallurgical machinery and operation of plant; 1913-14, engr. and mill supt., Miller Lake O'Brien Mines, Gowganda, Ont.; 1914-18, mgr. and engr., Lake Shore Mines Ltd., Kirkland Lake, Ont., including working out metallurgy of a refractory ore and erecting and completing plant for its treatment; 1918-19, conslt. engr., Elliott-Kirkland Gold Mines Ltd.; 1918 (3 mos.) examining engr., American Zinc Co., in northern Ont.; Mach-July 1919, res. engr., Krikland-Hudson Bay Gold Mines Ltd. and Buffalo-Kirkland Mines Ltd., Kirkland Lake, Ont., also acting as engr.; at present, mgr., Argonaut Gold Ltd., Dane, Ont.

References: E. E. Brydone Jack, J. G. Dickenson, J. E. Hardman, E. W. Neelands, J. A. Reid, J. Sinton.

ROBERTS—PERCY BRAMBLE, of London, Eng. Born at London, Eng., Jan. 10th, 1877. Educ., Portsmouth Grammar School. 1894-97, pupil, and 6 mos., asst. with C. W. Bevis, surveyor, Portsmouth; 1897-98, draftsman in works dept., His Majesty's Dockyard, on preparation of drawings for magazines, docks, etc.; 1898-1900, surveyor's asst. in Royal Engrs. office on fortification and barracks constrn.; 1900-06, surveyor and ch. asst. to commanding office at Bulford Camp, Salisbury, on constrn. of barracks with complete drainage, roads, etc.; 1906-07, inspector, with Burke & Horwood, Toronto, in chg. of all outside works, including considerable reinforced concrete work; 1907-15, with G.T.Ry., 2 yrs. as inspector in chg. of erection, 2½ yrs., ch. draftsman, and 3 yrs., eng. architect in chg. of all new bldg. work; 1915 to date, surveyor on staff in Royal Arsenal, Woolwich, Eng.

References: M. S. Blaiklock, F. L. C. Bond, A. Crumpton, J. Griffith, F. H. Grose, W. McNab.

ROBLIN—HERBERT LESLIE (Capt. M.C.) of Red Deer, Alta. Born at London, Ont., Sept. 28th, 1890. Educ., B.A.Sc., Toronto Univ. 1913. Summers 1909, mining, straw boss, Can. Copper Co.; 1910-12, ry. maintenance, inst'man, etc., C.P.R.; 1910 (2 mos.) topog. survey and plan of new prov'l prison farm, Guelph, Ont.; 1913-14, asst. engr., water power and irrigation investigation, Water Rights Branch, Dept. of Lands; enlisted with 111th South Waterloo Batt.; Feb. 1917-May 1919, Captain, 5th Batt., Can. Engrs. awarded M.C.; Aug. 1919, to date, res. engr., C.N.R., constrn. dept.

References: F. W. Cooper, H. E. T. Haultain, A. Macphail, W. A. McLean, W. R. Pilsworth, F. B. Tapley.

SMITH—PAUL MOODY, of New Westminster, B.C. Born at Victoria, B.C., Oct. 22nd, 1886. Educ., Victoria high school, engr. course, Scranton School and private study. 1904-05, clerk, div. engr's office, C.P.R., Vancouver; 1905-07, various positions including res. engr. of constrn., N.V. Ry.; 1907 (5 mos.) inst'man ,prelim. survey, Alberni extension, E. & N. Ry.; 1907-09, transitman and masonry inspector, C.P.R., at Nelson, B.C., during reconstrn.; 1909-10, special engr. at Vancouver; 1910, res. engr. on location and constrn., Port Moody branch; 1910-11, special engr.; 1911-14, res. engr., Vancouve Terminals, C.P.R.; 1914-15,mgr.Hynes Stone and staff company; 1917, inst'man with 3rd C.R.T., C.E.F., France; 1917-18, (some months in England with injury) coy. engr. officer, 11th C.R.T., France; May 1919 to date, engr. with Sumas Reclamation Project.

References: C. Brakenridge, C. E. Cartwright, E. A. Jamieson, R. E. Price, H. Rindal.

WILLS—DOUGLAS C. (Lieut.) of St. Catharines, Ont. Born at Bexhill, Eng., Feb. 17th, 1887. Educ., private school, Upper Norwood, Surrey, Eng. 1912-15, with F. N. Rutherford, O.L.S., on prelim. surveys, transit, plotting, subdivs., constrn. of concrete roads, etc.; 1915, joined C.E.F., lieut., 2nd Batt., Can. Ry. Troops, France, supt'g constrn. of board and narrow gauge rys., also maintenance, bridge constrn., etc.; Apr. 1919 to date, junior eng., Welland Ship Canal, transit and level, surveys, etc.

References: F. F. Clarke, J. B. McAndrew, J. C. Moyer, F. N. Rutherford.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

FINLAYSON—JOHN NORISON, of Winnipeg, Man. Born at Merigomish, N.S., Aug. 27th, 1880. Educ., B.Sc., 1908, M.Sc., 1909, McGill Univ. 1906, prelim. survey with H.E. Ry.; 1907, asst. to res. engr., C.P.R.; 1908-11, lecturer in McGill Univ.; 1910-13, with Waddell & Harrington, conslt. engrs., Kansas City and Vancouver, as detailer, inspector and res. engr. on erection of bridges; 1913-19, prof. of civil eng., Dalhousie Univ., also conslt. engr., Halifax, dsgning and supt'g constrn. of steel and reinforced concrete structures; at present, prof. of civil eng. Univ. of Manitoba, Winnipeg.

References: E. Brown, F. S. Keith, R. S. Lea, H. M. MacKay, R. McColl, W. H. Powell, R. B. Stewart.

FISHER—SEYMOUR JOST, of Montreal. Born at Halifax County, N.S., July 6th, 1880. Educ., B.Sc., McGill Univ., 1910. 1898-1905, machinist, Robb Eng. Co., Amherst, N.S., part of time as asst. foreman; 1907-08, prof. of mech'l eng. at Mount Allison Univ., Sackville, N.B.; summers 1908-09, draftsman, Waterous Engine Works, Brantford, Ont.; 1910-16, travelling sales engr., Babcock & Wilcox Ltd., doing large steam power plant design and consulting and advising on same; 1916 (9 mos.) eng. dept., Imperial Munitions Board, Ottawa, in chg. of inspection of component parts of shrapnel shells; 1916-18, with Imperial Ministry of Munitions, asst. officer in chg. of Gauges and Standards, also supt. of gauge shop, in. chg. of maintenance of all inspection gauges and checks, etc.; at present, asst. mech. supt., Caron Bros., pistol plant, Montreal, full chg. of all tool, gauge, fixture work, etc.

References: F. B. Brown, J. Chalmers, R. J. Durley, J. T. Farmer, G. R. MacLeod, C. A. Robb, D. W. Robb, R. A. Ross.

GREIG—ALEX. R., of Saskatoon, Sask. Born at Montreal, Que., Dec. 18th, 1872. Educ., B.A.Sc., McGill Univ., 1895. 1895-1902, ch. draftsman, Can. Atlantic Ry., Ottawa; 1902-06, ch. draftsman and mech. engr., C.N.R., Winnipeg; 1906-09, prof., agricultural eng., Man. Agr. Coll.; 1909, to date, prof. of agric. eng., Univ. of Sask.

References: E. E. Brydone-Jack, H. S. Carpenter, W. G. Chace, J. N. deStein, J. B. McRae, G. A. Mountain, L. A. Thornton, H. McL. Weir.

HERRIOT—GEORGE HENRY, of Winnipeg, Man. Born at Centreville, Ont., Feb. 23rd, 1883. Educ., B.Sc. (C.E.) Queen's Univ., 1907. D.L.S., M.L.S., A.L.S. 1907 (8 mos.) transitman in chg. of track centering party, C.P.R.; 1908 (10 mos.) articled pupil and asst. on D.L.S. work under H.S. Holcroft; 1909 (2 mos.) engr. and supervisor of fire protection lines of pipe in Souris, Man.; 1 mo. asst. on subdiv. surveys; 2 mos., computer, Topographical Surveys branch, Dept. of Interior; winter 1909-11, lecturer in applied math., School of Mining, Kingston; summer 1910, in chg. of field party as res. engr. on constrn., G.T.P.; 1911-12, chg. of field party making topog. survey of land and preparing map; 1912-16, on base line and meridian surveys; winter 1917-18, lecturer in app. math. and astronomy and 1918-19, asst. prof. in civil eng., Univ. of Manitoba; at present in chg. of party gathering data for revision of Winnipeg sheet of Dominion Map, etc.

References: L. W. Gill, J. C. Gwillim, A. W. Haddow, J.A.Heaman, A.Macphail, L. A. Thornton.

SWAN—WILLIAM GEORGE (Major) of Vernon, B.C. Born at Kincardine, Ont., Sept. 27th, 1884. Educ., B.A.Sc., C.E., Toronto Univ., 1906. 1903 (6 mos.) asst. engr. Dom. hydrographic survey, Lake Superior; 1905 (5 mos.) transitman C.N.Q. Ry.; 1906 (6 mos.) bridge engr., C.N.R.; 1906-09, res. and div. engr., 1910-15, div. engr., C.N.P.; 1916-19, overseas, as O.C. coy. C.R. Troops and later light rys. engr., 2nd British Army, France; April 1919 to date, dist. engr., C.N.R., in chg. of mainland constrn. for B.C.

References: J. B. Challies, D. O. Lewis, E. W. Oliver, A. F. Stewart, T. H. White.

TAPLEY—FREDERICK BYRON, of Moncton, N.B. Born at St. John, N.B., Onct. 17th, 1876. Educ., private studies, ry. eng. course, I.C.S. 1903-16, with C.P.R. as follows—1903-05, rodman; 1905-07, transitman, maintenance of way; 1907-11, res. engr. Brownville Jct., Me., in chg. of track, bridge work, etc.; 1911-13, res. engr., London, Ont., in chg. of maintenance of way and structures; 1913-16, asst. engr., Montreal, office of gen. mgr.; 1916 to date with Can. Govt. Rys., as follows;—1916-17, asst. engr., ch. engr's office; 1917 to date, asst. engr. of maintenance.

References: C. B. Brown, C. T. DeLamere, J. M. R. Fairbairn, A. L. Hertzberg, C. C. Kirby.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

ELLIS—DOUGLAS STEWART (Lt. Col., D.S.O., M.C.) of Kingston, Ont. Born at Cobourg, Ont., Mar. 16th, 1885. Educ., M.A., 1908, B.Sc. (C.E.) 1910, Queen's Univ. D.L.S., O.L.S. 1906-07, asst. geol. survey; 1909, asst. to city engr., Guelph; 1910, asst. to J. R. Akins, D.L.S.; 1910-14, asst. prof. mathematics, School of Mining; 1911, engr. in chg. boundary survey on Detroit and St-Clair Rivers, International Waterways Comm.; 1912, engr. in chg. hydraulic investigation of Livingston Channel, Hydrographic Survey; 1913-14, engr. for Commission, on St-Lawrence Ship Channel; 1915, lieut., 1915-17, capt., 1917, major and O.C., 6th Field Coy. C.E.; 1918, Bde. Maj., Can. Engrs. Training Center, Seaford, Eng., 1918, June 1919, Lt. Col. and ch. instructor, Can. School of Military Eng.; at present, asst. prof. civil eng., Queens Univ.

References: T. V. Anderson, V. F. W. Forneret, A. Macphail, W. L. Malcolm, W. J. Stewart, W. P. Wilgar.

GALLAHER—OSCAR GESNER (Capt.) of Kamloops, B.C. Born in Frontenac Co., Ont., July 16th, 1886. Educ., B.Sc., Queen's Univ., 1910. 1905, with G.T.R.; 1906, N.T.C. Ry.; 1907-08, geological survey; 1910, King Edward Mine, Coblat, also mining development, Porcupine; 1911, party, topographic and magnometric survey, Mines Branch; 1913-16, tech. clerk, townsite planning and instructions to surveyors, Topog. Surveys Branch; 1916-19, capt., 207th Batt., C.E.F.; 1917, seconded for duty with Imperial Ministry of Munitions, asst. inspector of cartridge cases, primers, etc.; at present, asst. to div. engr., constrn. dept., C.N.R.

References: A. L. Cummings, S. C. Ells, J. C. Gwillim, H. W. Jones, W. L. Mal, W. G. Swan.

HIBBARD—FRANCIS HENRY, of Sherbrooke, Que. Born at Ottawa, Ont., Aug. 9th, 1888. Educ., Montreal High School and private tuition. 1907-12, with T.C. Ry. as followes:—1907-08, draftsman, etc.; 1908 (3 mos.) rodman on constrn., and 3 mos., leveller on survey work; 1908-09, asst. engr. on constrn., St. Anselme, P.Q.; 1909-12, asst. engr. on constrn. of Quebec Bridge Yard and Quebec Terminals; 1912 (3 mos.) res. engr. in chg. of constrn.; 1912-13 (8 mos.) with Thomson & Hibbard, contractors, St. John Valley Ry., Fredericton, in chg. of constrn.; 1913 (2 mos.) asst. engr. on constrn., Lake Erie & Northern Ry., Glen Morris, Ont.; June 1913-1916, engr. in chg. of constrn., Que. Central Ry.; July 1916 to date, asst. to ch. engr., Q.C. Ry.

References: A. E. Doucet, A. Ferguson, F. A. Hibbard, E. A. Hoare, H. E. Huestis, J. O. Montreuil, J. T. Morkill.

MacKINNON—KENNETH ROYAL (Capt.) of New Glasgow, N.S. Born at New Glasgow, May 15th, 1888. Educ., B.Sc. (mech.) McGill Univ., 1909. 1903-05, apprentice in boiler and machine shop; 3 mos. on ry. prelim. survey; 6 mos. in mech'l drafting office; 2 mos. on constrn. of steel schooner (all during vacations), 1909, inspector with Smith, Kerry & Chace, Toronto, on hydraulic machinery being manufactured at various works; 1909-11, inspector for same firm in England and Sweden on hydraulic and elec. works; 1911 (3 mos.) testing hydro elec. plants in Ontario, with Smith, Kerry & Chace; 1911 (5 mos.) erecting mach'y in power house, Trenton, Ont., and gen. constrn. work; 1911-13, res. engr. in chg. of constrn. of power plant, Frankford, Ont.; 1913-14, res. engr., Halifax Power Co.; Nov. 1914, enlisted in Can. Engrs., May 1915, overseas, discharged July 1919.

References: W. S. Ford, N. R. Gibson, H. Holgate, J. G. G. Kerry, C. H. Mitchell

SHACKELL—SAMUEL WILLIS (Lieut.) of Lachine, P.Q. Born at Montreal, Sept. 17th, 1884. Educ., private study of civil eng. 1903-08, rodman, leveller and transitman on location, constrn. and maintenance of rys.; 1908-10, inst'man, Hull Elec. Co.; 1910 (6 mos.) res. engr. in chg. of ry. extensions, Hull Elec. Co.; 1910-12, transitman, maintenance of way, C.P.R.; 1912 (5 mos.) res. engr., C.P.R., Chapleau, Ont.; 1913-14, transitman, C.P.R., Smiths Falls and Montreal; Nov. 1914, enlisted in Can. Engrs., Sept. 1915, went to France, Oct. 1916, granted commission Nov. 1917, wounded, 1918, asst. instructor, fieldworks, Can. School of Military Eng., Seaford, Eng., Mar. 1919, returned; at present, short engagements on eng. work.

References: W. W. Benny, J. M. R. Fairbairn, G. G. Gale, F. H. McKechnie, J. W. Orrock.

TAYLOR—GORDON ROBERTSON (Major) of Grafton, Ont. Born at Christchurch, New Zealand, April 29th, 1886. Educ., grad., Central Tech. Coll., London, Eng., 1906, 3 yrs. course, civil and mech'l eng. 1907-08, office asst., A. Drew, conslt. engr., London, Eng.; 1908 (2 mos.) survey, Hamilton Powder Co.; 1908-09, inst'man on location, C.N.R.; 1909-12, res. engr. on constrn. C.N.R.; 1912-13, contracting for installations of private water and elec. light plant and sewage disposal; 1913-14, with Hydro Elec. Power Comm., on radial Eng. location, cost and traffic estimates, etc.; Dec. 1914, lieut. with 33rd Batt., C.E.F.; 1917-19, major in command of coy., 10th Batt., C.R.T., work in France consisted of location, constrn. and maintenance of light ry. and standard gauge lines and bridges, etc.; returned to Canada Aug. 1919, awaiting demobilization.

References: F. L. C. Bond, H. L. Bucke, G. P. MacLaren, R. P. Rogers, A. F. Stewart.

WELLS—ERIC EDWARD, of Toronto, Ont. Born at London, Eng., June 27th, 1884. Educ., Polytech. School of Engr., London, Eng., B.Sc., Oskaloosa, Iowa, 1918. 1900-02, drafting and estimating dept., British Schuckert Elec. Co., London, Eng.; 1903-04, gen. asst. in office and on work, Jas. Mills, contractor, Toronto; 1904-05, gen. asst. in office and experimental workshop, H. Dixon, mech. engr.; 1905-06, gen. fieldwork, Speight & Van. Nostrand, land surveyors; 1906-08, draftsman and land description writer, legal dept., C.N.R.; 1908-09, draftsman, 1909-17, ch. draftsman, dept. surveys and location, C.N.R., in full chg. of office and all field work in Toronto vicinity; 1917, chg. of complete survey of surface and underground workings of Rosedale Coal & Clay Co., Rosedale, Alta., also designing and laying out mine bldgs.; 1918, ry. betterments and gen. development scheme in Que. and northern Ont.; at present, ch. office asst., dept. surveys and location, C.N.R.

References: E. T. Agate, H. T. Hazen, J. R. MacKenzie, H. G. Smith, H. K. Wicksteed.

YOUNGMAN—WALTER (Capt. M.C.) of Winnipeg, Man. Born at London, Eng., Jan. 19th, 1883. Educ., private tuition and Bournemouth School of Science. 1905, on N.T.C. ry. surveys; 1906, rodman, 1907-09, inst'man, N.T.C. constrn. and location surveys; 1909-13, res. engr., N.T.C.; 1913-14, res. engr., C.P.R.; 1914-15, dist. engr., Manitoba Highways; Sept. 1915, joined C.E.F., captain, Can. Engrs., France; 12 mos., instruction of eng. in England, Can. Pioneers Training Depot, returned June 1919; at present, dist. engr., Man. Highways Dept.

Fefereneces: P. Burke-Gaffney, T. W. Clarke, M. A. Lyons, F. A. W. MacLean, N. B. MacTaggart, A. McGillivray, G. C. P. Montizambert.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

ALBERGA—ALBERT MILLER, of Montreal. Born at Black River, Jamaica, Jan. 1st, 1894. Educ., B.Sc. (C.E.) McGill Univ., 1916. 1916 (5 mos.) inspector, munitions dept., Canada Cement Co.; Sept. 1916-March 1919, No. 2 Constrn. Batt., C.E.F., engaged on light rys. and gen. constrn.

References: E. Brown, D. L. Derrom, A. J. Gayfer, H. M. MacKay, A. C. Tagge.

CAVANACH—ARTHUR LEE (Capt.) of Winnipeg, Man. Born at Elkhorn, Man., Apr. 27th, 1889. Educ., B.E.E., Man. Univ., 1911. Summers 1909, rodman, 1910, inspector and inst'man, and 1911, inspector in chg. of cost work, with Smith, Kerry & Chace; winter 1911, draftsman, bridge dept., C.N.R.; 1912-13, res. engr; and supt. of constrn. on hydro elec. plant at Dryden, Ont., with Harris & Harris' 1913 (6 mos.) head inspector on constrn. of reinforced concrete reservoir, Winnipeg, 1913-16, asst. in city engr's dept., Wpg.; 1916-May 1919, with C.E.F., capt., 3rd Batt., Can. Engrs., at present, asst. engr., in city engr's dept., Wpg., in chg. of waterworks constrn. and all bridge work.

References: W. P. Brereton, E. E. Brydone-Jack, W. G. Chace, E. P. Fetherstonhaugh, C. S. Landon.

EDMONDS—CHARLES WILLIAM, of Toronto, Ont. Born at Simcoe, Ont., Feb. 24th, 1894. Educ., B.A.Sc., Univ. of Toronto, 1919. 1913, with G. R. Marston, Simcoe, on municipal work; rodman, draftsman, irrigation work, Dept. of the Interior, Calgary; 1918, inst'man, in chg. of party on ry. location survey, C.H. & P.H. Mitchell, Toronto; draftsman, Hydro-Elec. Power Comm.; at present, draftsman, C.H. & P.H. Mitchell; was overseas 3 yrs. with Can. Artillery.

References: P. Gillespie, C. H. Mitchell, P. H. Mitchell, W. J. Smither.

KNIGHT—JAMES ARCHIBALD (Capt. M.C.) of Toronto, Ont. Born at Toronto Junction, Sept. 17th, 1892. Educ., B.A.Sc., Toronto Univ., 1914. Vacations 1910-14, asst. to J. J. Knight, contractor, estimating and constrn. of Muskoka Lakes; 1916-18, eng. officer, 2nd Can. Tunnelling Coy., France, driving and sinking in quicksand and heavy clay, etc.; 1918-May 1919, section com'd'r, 11th Batt., Can. Engrs., bridging road bldg. and mine extracting, awarded M.C. Sept. 1918; at present, hydraulic design, Hydro Elec. Power Comm.

References: P. Gillespie, T. H. Hogg, C. H. Mitchell, J. R. Montague, W. F. Richardson, M. V. Sauer.

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RAILROAD ENGINEERING

FOREIGN

African Railways. African Railway System (La gran red de ferrocarriles africanos), D. Enrique Morales. Revista de Obras Publicas, vol. 67, no. 2283, June 26, 1919, pp. 305-309. Economic significance of establishing direct railway service bertween Europe and Africa through Strait of Gilbraltar. (Concluded). Paper read before Spanish Inst. of Civil Engrs.

British Railway Shops. British Railway Workshops in War Time — IV, Engineer, vol. 128, no. 3318, Aug. 1, 1919, pp. 104-105, 3 figs. Insulated meat van designed for use overseas.

French Railways. The Reconstruction Program for French Railways, II, Robert E. Thayer. Ry. Age., vol. 67, no. 6, Aug. 8, 1919, pp. 251-255, 9 figs. Standards for types of material and equipment used on railroads, developed by Ministry of Public Works.

Venezuela. The Railways of Venezuela, Charles W. Jones. Ry. Rev., vol 65, no. 6, Aug. 9, 1919, pp. 181-185, 7 figs. Survey of adverse conditions to be encountered makes it manifest, in writer's opinion, that Venezuela offers small inducements of investment of foreign capital in new railway lines, except under strict governmental guarantees faithfully fulfilled.

CONSTRUCTION

Bridges. Elevating Illinois Central Tracks and Building the New Bridges, W. T. Christine. Eng. World, vol. 15, no. 3, Aug. 1, 1919, pp. 15-19, 9 figs. Fill necessary aggregated more than 550,000 cu. yd. Bridges are of reinforced concrete construction.

Track Work. Track Special Work of the Municipal Railways of San Francisco, Leslie W. Stocker. Elec. Traction. vol. 15, no. 8, Aug. 1919, pp. 500-503, 3 figs. Development of standards of material and workmanship.

Labor-Saving Devices for Railway Track Work. Can. Ry. and Mar. World, no. 258, Aug. 1919, pp. 421-424, 5 figs. Committee report presented at annual meeting of Roadmasters' and Maintenance of Way Assn.

Track Elevation on the Indianapolis Union Railroad. Eng. News-Rec., vol. 83, no. 6, Aug. 7, 1919, pp. 265-266, 2 figs. Methods necessitated in consequence of traffic of 165 trains daily.

Kanawha & West Virginia. The Kanawha & West Virginia Builds a New Line. Ry. Age, vol. 67, no. 7, Aug. 15, 1919, pp. 297-299, 5 figs. Remarking specially heavy grading involved.

ELECTRIC RAILROADS

Drop in Voltage. Drop in Volts for Track or Steel Conductors, E. Goolding. Tramway & Ry. World, vol. 46, no. 3, July 17, 1919, pp. 16-18, 5 figs. Tables for simplifying calculations.

Generator Suspension. Why One Road Changed Its Generator Suspension, J. H. Burcham. Ry. Elec. Engr., vol. 10, no. 8, Aug. 1919, pp. 271-272, 4 figs. Modifications in method of suspending Bliss truck.

History of Development. Electric Railway Development, H. C. Eddy. Area, vol. 7, no. 12, July 1919, pp. 1187-1194, 19 figs. Historical account.

Locomotives. Electric Locomotives in the Express Service of Trunk Lines (Studien über elektrische Lokomotiven im Schnellzugsdienste der Vollbahnen). Elektrotechnische Rundschau, vol. 36, nos. 5-6 and 7-8, Feb. 5 and 19, 1919, pp. 18-20 and 27-28, 2 figs. Comparison between steam and electric service on line between Tours and Paris.

ELECTRIFICATION

Argentine. Electrification of Central Argentine Railway (La traction électrique sur le chemin de fer central argentin). Revue Générale de l'Electricité, vol. 6, no. 3, July 19, 1919, pp. 77-83, 3 figs. Comprises central station of 15,000 kw. and 60 miles of high-tension transmission lines, 5 sub-stations and electric equipment for 100 miles of single track. A. c. generated at 20,000 volts and converted to d. c. at 800 volts for traction purposes.

Electrification. Railroad Electrification (Electrification de ferrocarriles), Jose Luis Valenti y Dorda. Revista de Obras Publicas, vol. 67, nos 2284 and 2286, July 3 and 17, 1919, pp. 317-321 and 344-349. Technical advantages and comparison with steam operation. Economical advantages.

Railroad Electrification Facts and Factors, A. J. Manson. Ry. Elec. Engrs., vol. 10, no. 8, Aug. 1919, pp. 277-279, 2 figs. Auxiliary apparatus required in the locomotive in addition to the main driving motors.

Electrification of Federal Railways (Electrification des chemins de fer fédéraux). Bulletin Technique de la Suisse Romande, vol. 45, no. 14, July 12, 1919, pp. 133-136, 8 figs. Tests of Hoeter concrete poles. (Concluded).

Great Britain. The Electrification of British Railways, F. W. Carter. Electrical Review, vol. 85, no. 2173, July 18, 1919, pp. 68-69. Included in program of reconstruction drawn up by Minister-designate of Ways and Communications not merely because "of the service it can render or of the saving it can effect," but because "electrical operation can show advantages over all other methods". (To be concluded).

Operation. Some Possibilities of Steam Railway Electrification as Affecting Futur Policies. Ry. Gaz., vol. 31, no. 2, July 11, 1919, pp. 56-57. Electrification is considered as offering a fundamentally different method of train propulsion because it is said limitation of steam locomotive disappears and the strictly limited motive power is replaced by one that is practically unlimited. Consequent modifications in railroad operation are visualized.

Overhead Construction. Overhead Construction in Electric Railways (Elektrische Bahnen). Elektrotechnik u. Maschinenbau, vol. 37, no. 1, Jan. 5, 1919, pp. 11-12, 6 figs. German and Austrian patents relating to catenary suspension.

Sweden. Electrification Work to be Pushed Forward in Sweden. Elec. Ry. Jl., vol. 54, no. 5, Aug. 2, 1919, pp. 225-227. Government aid for water-power development.

EQUIPMENT

Loading Table. A Standard Loading Table for British Railway Bridges, Conrad Gribble. Ry. Gaz., vol. 31, no. 4, July 25, 1919, pp. 116-118, 2 figs. Establishes that a complete loading table for bridges should consist of a series of tables giving (1) equivalent uniformly distributing loads for bending moment, (2) maximum shears at center and end of spans, and (3) maximum concentrations on cross-girders of various spacings.

Turntables. New Turntable for the Pennsylvania Railroad. Ry. Rev., vol. 65, no. 4, July 26, 1919, pp. 117-121, 12 figs. Three-point-supporting turntable with vertical adjustable center bearing.

LOCOMOTIVES

Locomotive Failures. Injuries from Locomotive Failures, John L. Mohun. Ry. Mech. Engr., vol. 93, no. 8, Aug. 1919, pp. 458-463, 2 figs. Suggestions for their reduction based on examination of Interstate Commerce Commission locomotive inspection reports.

Mallet Heavy. Carolina, Clinchfield & Ohio Freight Locomotives. Ry. Age, vol. 67, no. 7, Aug. 15, 1919, pp. 317-319, 4 figs. Mallet heavy 2-8-8-2 type with tractive effort of 103,560 lb. and total weight in working order of 523,600 lb. on drivers.

Heavy Mikado and Mallet Type Locomotives, Ry. Rev., vol. 65, no. 4, July 26, 1919, pp. 122-123, 2 figs. Comparison of Carolina, Clinchfield & Ohio Ry. types with similar ones of the U. S. Railroad Administration standards.

Pensylvania Mallet Compound Locomotive. Ry. Rev., vol. 65, no. 5, Aug. 2, 1919, pp. 157-159, 4 figs. Capable of exerting 100,000-lb. tractive power and designed to operate over maximum grades of 5 per cent and around curves of 18 deg. radius.

Rail Loads. Internal Disturbing Forces and Variations in Rail Load. Ry. Gaz., vol. 31, no. 2, July 11, 1919, pp. 63-65, 3 figs. Forces due to cylinder incline and finite connecting-rod length, with particular reference to three-cylinder locomotives.

Spark Arresters. Prevention of Forest Fire Losses, Smith Riley. Am. Forestry, vol. 25, no. 308, Aug. 1919, pp. 1260-1263, 7 figs. Form of spark arrester which has been employed with success on locomotives in Colorado.

Stoking, Mechanical. Mechanical Stoking of Locomotives, W. S. Bartholomew. Ry. Mech. Engr., vol. 93, no. 8, Aug. 1919, pp. 465-469, 6 figs. Factors determining necessity of applying stokers; operating results secured by stoker firing.

Valve Gears. The Metamorphosis of the Locomotive — II, III, H. Holcroft. Engineer, vol. 128, no. 3318-3319, Aug. 1 and Aug. 8, 1919, pp. 103-104 and 126-129, 6 figs. Valve gears for variable-expansion and compound locomotive

MAINTENANCE

Piles, Creosoted. An Unusual Record for Creosoted Piles. Ry. Maintenance Engr., vol. 15, no. 8, Aug. 1919, pp. 278-280, 1 fig. Over 14 000 creosoted piles said to have been in service in Southern Pacific Long Wharf at Oakland, Cal. for periods ranging from 22 to 29 years. Notes on their condition and treatment they received.

Terminal Tracks. The Correct Maintenance of Terminal Tracks J. B. Baker. Ry. Maintenance Engr., vol. 15. no. 8, Aug. 1919, pp. 275-276, 1 fig. Methods and practice of Pennsylvania Railroad.

Track Chisel. The Use and Abuse of the Track Chisel, Howard C. Mull. Ry. Maintenance Engr., vol. 15, no. 8, Aug. 1919, pp. 264-265, 5 figs. Suggestions in regard to handling so as to prolong life of tools.

OPERATION AND MANAGEMENT

Asphalt Shipping. The Advantages of Tank Car Shipments of Asphalt, Charles E. Murphy. Eng. & Contracting, vol. 52, no. 6, Aug. 6, 1919, pp. 160-161, 3 figs. Claims tank-car shipments have proved to be economical, have reduced labor of transportation and have effected quicker, safer and easier handling of materials. Rules for unloading are suggested.

Engineering Side of Operation. The Operation of Railways as an Engineering Problem, V. I. Smart. Jl. Eng. Inst. Can., vol. 2, no. 8, Aug. 1919, pp. 539-550, 9 figs. Enphasizes that actual use of means of transportation is just as much an engineering problem as is design, construction and care of means of transportation, and suggests that railroads utilize, in Transportation Department, men from these two recognized engineering departments.

Fair Value. Determining "Fair Value." Elec. Ry. Jl., vol. 54, no. 5, Aug. 2, 1919, pp. 222-225. Items to be considered in estimating fair value for rate making, as outlined by Com. of Am. Elec. Ry. Assn.
Principles Underlying Determination of "Fair Value." Eng. News-Rec., vol. 83, no. 9, Aug. 28, 1919, pp. 425-428. Report of Committee on Valuation of Am. Elec. Ry. Assn. defining bases for appraising public-utility properties for rate making.

Junction Operation. Single Line working at Double Line Junctions. Ry. Gaz., vol. 31, no. 2, July 11, 1919, pp. 60-62, 9 figs. Examples of junction working during obstruction.

Passenger Traffic Analysis. Methods of Observing and Analyzing Passenger Traffic, R. H. Horton. Aera, vol. 7, no. 12, July 1919, pp. 1174-1181, 13 figs. Practice of Philadelphia Rapid Transit Co.

PERMANENT WAY AND BUILDINGS

Ashpits. Double-Track Water-Type Ashpit, Pennsylvania Railroad. Eng. News-Rec., vol. 83, no. 9, Aug. 28, 1919, pp. 408-410, 4 figs. Noting special consideration given to safety of men working at pit.

Embankments Sliding. Has the Real Cause of Sliding of Railroad Embankments Been Found? (De eigenlyke eorzaak van den spoorwegdam-afschuiving verklaard), J. M. K. Pennink. Ingenieur, vol. 34, no. 26, June 28, 1919, pp. 488-490. Writer criticizes conclusions arrived at by special committee appointed for this purpose by Dutch Government Dept. of Building and Hydraulics, and states his hypothesis.

Oil-Storage Tanks. The Storage of Railway Fuel Oil. Ry. & Locomotive Eng., vol. 32, no. 8, Aug. 1919, pp. 227-229, 1 fig. Dimensions and location of storage tanks.

Subgrade Construction. Concrete in Subgrade Construction. Ry. Maintenance Engr., vol. 15, no. 8, Aug. 1919, pp. 282-285, 12 figs. Installation in service under steam-railway tracks and results secured.

Terminal Tunnels. Montreal Terminal Tunnel from an Economic Point of View, H. K. Wicksteed. Ry. Rev., vol. 65, no. 5, Aug. 2, 1919, pp. 145-151, 7 figs. Paper read before Eng. Inst. of Canada.

Track Maintenance. War-Time Progress in Maintenance of Way, John B. Tinnon. Elec. Ry. Jl., vol. 54, no. 5, Aug. 2, 1919, pp. 220-221. Writer believes that better track will result if less money is spent on construction and more on maintenance. Paper presented before Illinois Elec. Ry. Assn.
Maintenance of Permanent Way — II. Ry. Engr., vol. 40, no. 475, Aug. 1919, pp. 163-168, 2 figs. Concerning reballasting, relaying, resleepering and widenings. (Continuation of serial).

Track Supports, Concrete. Concrete Track Supports Cut Railway Maintenance Costs, A. C. Irwin. Concrete, vol. 15, no. 2, Aug. 1919, pp. 63-68, 16 figs. Types of construction proposed. Paper presented before Am. Concrete Inst.

RAILS

Rail Fissures. Limiting of Transverse Rail Fissures, Paul Kreuzpointner. Iron Age, vol. 104, no. 6, Aug. 7, 1919, pp. 360-362. Effect of non-diffusion of elements. Factors contributing to formation of fissures.

ROLLING STOCK

Box Cars. C. P. R. Double Sheathed Box Cars, Ry. Mech. Engr., vol. 93, no. 8, Aug. 1919, pp. 475-477, 3 figs. Also Ry. Age, vol. 67, no. 6, Aug. 8, 1919, pp. 257-259, 4 figs. Length is 36 ft.; weight 39,500 lb.; have steel underframe, wood superstructure and metal roof.

Box-Car Reconstruction. Reconstruction of 5-ft. Gauge Box Car Equipment to Suit the Indian State Railway 5-ft. 6-in. Gauge. Ry. Gaz., vol. 31, no. 3, July 18, 1919, pp. 92-94, 4 figs. Quoted as example of possibilities of converting rolling stock from one gage to another.

Instruction Car. New Instruction Car for the Southern Pacific. Ry. Age, vol. 67, no. 8, Aug. 22, 1919, pp. 365-366, 2 figs. Equipmnt includes apparatus for presenting operating problems graphically to employees.

SAFETY AND SIGNALING SYSTEMS

Accident in Holland. Railroad Accident near the Bridge over the Merwede Canal on September 13, 1918 (Het verzakken van den spoorwegdijk by de brug over het Merwedekanaal nabij Weesp op 13 September 1918), van den Thoorn. Ingenieur, vol. 34, no. 30, July 26, 1919, pp. 540-549, and (discussion) pp. 549-577, 11 figs. Report of Commission appointed by State Department of Building and Waterways Construction.

Block-Signaling Practice. Block Signaling Practice on a British Railway, F. B. Holt and A. B. Wallis. Ry. Signal Engr., vol. 12, no. 8, Aug. 1919, pp. 277-280, 2 figs. Use of electrically controlled ground frames, fouling bars, telepohne and telegraph communication, automatic signaling, electrically operated switches and locomotive cab signaling on Midland Railway of England.

Statistics on Signals. I. C. C. Statistics and Tables on Signals. Ry. Signal Engr., vol. 12, no. 8, Aug. 1919, pp. 270-274, 1 fig. Annual report pertaining to block signals and telegraph and telephone transmission of orders.

SHOPS

Firebox Repairs. Jacobs-Shupert Firebox Repairs, H. Louis Hahn. Ry. Mech. Engr., vol. 93, no. 8, Aug. 1919, pp. 485-487, 5 figs. Methods and tools used to repair stay sheets and craked and distorted sections.

Milling Practice. Milling Practice in Locomotive Shops, Edward K. Hammond. Machy, (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1122-1125, 7 figs. Methods of milling heavy forgings for the side rods, connecting rods and side frames of locomotives.

Repair Shops. The Design of Modern Locomotive Repair Shops, Gustave E. Lemmrich. Ry. Age, vol. 67, no. 6, Aug. 8, 1919, pp. 261-265, 3 figs. Study of considerations entering into an efficient layout for maintenance of engines.

Springfield Shops. New Springfield Shops of the Ohio Electric Railway. Elec. Traction, vol. 15, no. 8, Aug. 1919, pp. 473-478, 18 figs. Reinforced-concrete structures.

SPECIAL LINES

Lines with Steep Gradients. Safety Devices for Lines with Steep Gradients (Sicherungsvorrichtungen an Steilbahnen), Siegfried Abt. Zeitschrift für Kleinbahnen, vol. 26, no. 2, Feb. 1919, pp. 53-63, 26 figs. Anchors and brake tongs for cable railways on trestles, also anchors and guides for rack railways.

Narrow-Gage Railway Statistics. Statistics of Narrow-Gage Railways During 1915-1916. (Statistik der schmalspurigen Eisenbahnen für das Betriebsjahr 1915-1916), F. Zezula. Zeitschrift für Kleinbahnen, vol. 26, no. 2, Feb. 1919, pp. 64-94. Tables showing length of roadbed, capital invested per kilometer, type of railway, capacity and fuel consumption of locomotives (steam and electric) for Norwcian, Swiss, and German railroads.

STREET RAILWAYS

Battery Exchange. Electric Vehicle Standardization, Hilding Lubeck. Jl. Soc. Automotive Engrs., vol. 5, no. 2, Aug. 1919, pp. 131-141, 7 figs. Particularly with a view to establishing system of battery exchange.

Coasting. Coasting Results on the Chicago Elevated, H. A. Johnson. Elec. Ry. Jl., vol. 54, no. 6, Aug. 9, 1919, pp. 277-279, 2 figs. Coasting has been increased to 35 per cent. First year of operation said to have shown saving of 21,162,217 kw.-hr.

Fare Handling. Mechanical Aids in Handling Fares. Elec. Ry. Jl., vol. 54, no. 5, Aug. 2, 1919, pp. 217-220, 6 figs. Detroit United Ry. uses labor-saving device which is said to permit sorting and counting of receipts with 25 per cent of force required for hand operation.

Fare Systems. Revolutionary Change in Public Service Railway Fare System. Elec. Ry. Jl., vol. 54, no. 6, Aug. 9, 1919, pp. 282-284. Mile zones, low initial zone charge and the elimination of transfers are important elements in new system.
Tramway Fares and Services, Wm. L. Magden, Electrical Review, vol. 85, no. 2175, Aug. 1, 1919, pp. 132-134. Discussing conditions in the United Kingdom, writer points out how it appears to him that controlling bodies have considerable responsibility for failure of tramway systems to roduce adequate financial return to proprietors.

Rolling Stock. New Cars for Baltimore, A. T. Clark. Elec. Traction, vol. 15, no. 8, Aug. 1919, pp. 495-497, 3 figs. Arranged to operate in one, two or three-car units.

Telephone Traffic Control. Telephone Traffic Control for Tramways, Tramway & Ry. World, vol. 46, no. 3, July 17, 1919, pp. 9-14, 8 figs. Central control station in telephone touch with officials all over the system.
A System of Railway Traffic Control by Telephone, T. F. Lee, Post Office Elec. Engrs. Jl., vol. 12, no. 2, July 1919, pp. 105-115, 7 figs. System used by one of largest English companies and which is said to be independent of "earth" connections and therefore not to any considerable extent affected by "earth" faults.

Zone Fares. The Zone Fare in Practice. London County Council, I & II, Walter Jackson. Elec. Ry. Jl., vol. 54, nos. 5 and 6, Aug. 2 and 9, 1919, pp. 210-215 and 270-275, 15 figs. Lines said to be earning 40 cents per car mile. Fares were increased in May and June 1918 chiefly by introducing a three-section penny stage, averaging 1.8 miles and by abolishing children's and fractional fare tickets. Forms of Ticket Dept. Works.

TERMINALS

Terminal Power Plants. Power-Plant Operation on an Efficient Basis, Paul R. Duffey. Power, vol. 50, no. 9, Aug. 26, 1919, pp. 330-331. Deals principally with power plant of railroad terminal.

MARINE ENGINEERING

SHIP

Barges. Construction of Steel Barges, Thomas Leach. Proc. Engrs. Soc. Western Pa., vol. 35, no. 5, June 1919, pp. 273-274 and (discussion) pp. 275-282, 24 figs. Details of types being built for U. S. Railroad Administration for Erie Canal service.

Bulkhead Stiffeners. Investigation into Bulkhead Stiffeners — II, Int. Mar. Eng., vol. 24, no. 8, Aug. 1919, pp. 554-557 & 561, 1 fig. Calculation of stresses in bulkheads which form boundaries in trimming tanks, peak tanks or deep ballast tanks.

Cargo Vessels. S. S. Poughkeepsie, Standard 8,800-Ton Deadweight Cargo Vessel built by Newburgh Shipyards, Inc. Int. Mar. Eng., vol. 24, no. 8, Aug. 1919, pp. 531-535, 7 figs., partly on supp. plates. Two-deck, single-screw steamship fitted with water-tube boilers and geared turbines. Arranged for both coal and oil fuel.

New Type American Freighters. Mar. Rev., vol. 49, no. 9, Sept. 1919, pp. 413-414 and 437, 2 figs. Luckenback steamers of 12,500 deadweight tonnage commandeered by U. S. Government.

SS. "Kediri." Shipbuilding & Shipping Rec., vol. 14, no. 3, July 17, 1919, p. 68, 2 figs., partly on supp. plates. Cargo vessel having capacity of 6,300 tons d.w. on 21 ft. 6 in. draft. Built in Holland.

Concrete Ships. The U. S. Shipping Board's Work with Concrete, J. Glaettli. Concrete, vol. 15, no. 2, Aug. 1919, pp. 69-72. In connection with designing concrete ships. Paper read before Am. Concrete Inst.

Concrete Ships, J. W. Sadler. Jl. Electricity, vol. 43, no. 3, Aug. 1, 1919, pp. 122-123, 2 figs. Greater weight of concrete hull, and consequent need for lighter equipment indicate, writer believes, that electrical drive will be preferred for concrete ship.

Structural Action of Concrete Ship Members, W. A. Slater. Contract Rec., vol. 33, no. 32, Aug. 6, 1919, pp. 749-753. Laboratory investigations and problems in design of concrete vessels, undertaken by Concrete Ship Section of Emergency Fleet Corpn. in co-operation with U.S. Bur. Standards. Paper read before Am. Concrete Inst.

Electric Propulsion. A General Description of the Electric Propulsion of the U. S. S. California. Pacific Mar. Rev., vol. 16, no. 8, Aug. 1919, pp. 131-136, 12 figs., partly on supp. plates. Machinery is to consist of two turbo-generators, operating four motors, one connected with each line of shafting.

The Electric Plant of the Battleship Tennessee, R. L. Weber. U. S. Naval Inst. Proc., vol. 45, no. 198, Aug. 1919, pp. 1397-1408, 5 figs. Discussion is confined to ship's propelling machinery.

Freighters. *See Cargo Vessels.*

Mother Ships for Airplanes. H. M. S. "Furious." Engineering, vol. 108. no. 2798, Aug. 15, 1919, pp. 203-204, 6 figs. Partly on two supplement plates, Adopted as floating platform for flying ships. Dimensions and particulars.

Motor Ships. Italian Motorship Ansaldo San Giorgio I, Arthur Benington. Int. Mar. Eng., vol. 24, no. 8, Aug. 1919, pp. 525-529, 7 figs. Vessel is of single-deck type and is designed to leave cargo holes entirely unobstructed by pillars or stanchons.

Motor Tugs. Motor Tug. "Grove Place," Shipbuilding & Shipping Rec., vol. 14, no. 7, Aug. 14, 1919, pp. 181-182, 3 figs. Length, 55 ft.; breadth, 14 ft.; depth, 8 ft. Used for Thames service.

Ore Carriers. Ore Carriers for Ocean Service, V. G. Iden. Mar. Rev., vol. 49, no. 9, Sept. 1919, pp. 420-423, 5 figs. Being built by Bethlehem Steel Corporation. They are 11,669 dead-weight tons each, are equipped with geared turbines capable of 2,400 shaft hp., and are specially designed to facilitate loading.

Oil-Fuel Installation. Oil Fuel Installation in Passenger Steamships. Shipbuilding & Shipping Rec., July 31, 1919, vol. 14, no. 5, pp. 123-124. Instructions issued by British Board of Trade.

Sediment in Marine Boilers. Sediment in Marine Boilers, W. R. Austin. Int. Mar. Eng., vol. 24, no. 8, Aug. 1919, pp. 552-553, 1 fig. Quotes three instances where sediment may cause trouble.

TERMINALS

Motor Trucking. Motor Trucks and the Problem of Efficient Marine Freight Terminal Operation — I, Merrill C. Horine. Int. Mar. Eng., vol. 24, no. 8, Aug. 1919, pp. 518-524, 9 figs. Survey of terminal operation field. Interrelation of carriers, railroads, transfer drays and steamship.

VARIA

Charts. The World's Air and Ocean Routes, B. J. S. Cahill. Pacific Mar. Rev., vol. 16, no. 8, Aug. 1919, pp. 90-92, 2 figs. Illustrating illusion of distance and direction on Mercator's chart.

Japanese Shipbuilding. 1853 — A Brief History of Japanese Shipbuilding — 1919. Andrew Farrell. Pacific Mar. Rev., vol. 16, no. 8, Aug. 1919, pp. 71-79, 19 figs, Particularly as affected by policy of Japanese Government.

YARDS

Concrete Shipyards. Layout and Equipment of Government Concrete Ship Yards, A. L. Bush. Concrete, vol. 15, no. 2, Aug. 1919, pp. 73-77, 4 figs. Noting specially standardized schemes adopted for various structures.

Cost Accounting. Uniform Cost Accounting in Ship Building, J. L. Jacobs, Int. Mar. Eng., vol. 24, no. 8, Aug. 1919, pp. 539-543. Plan adopted by Atlantic Coast Shipbuilders' Assn. for uniform methods of cost accounting in steel shipbuilding.

A Cost System for Shipyards — II, Creighton Churchill. Int. Mar. Eng., vol. 24, no. 8, Aug. 1919, 545-548. Symbols used in collecting cost data.

Fore River. Shipbuilding Equipment and Methods at Fore River II—Shop Routing and Group Labor Systems. Eng. News-Rec., vol. 83, no. 8, Aug. 21, 1919, pp. 362-365, 2 figs. Features specially noted are shop routing system which schedules and keeps track of hull material from mold loft to berth, and special group labor system which has been applied to many of outside departments, chiefly the fitting-out and trial departments.

The Fore River Plant of Bethlehem Shipbuilding Corporation, Ltd., Austin E. Potter. Rudder, vol. 35, no. 8, Aug. 1919, pp. 358-362, 9 figs. Details of organization.

MECHANICAL ENGINEERING

AIR MACHINERY

Air Chambers. Installation and Use of Air Chambers, H. D. Fisher. Power, vol. 50, no. 6, Aug. 5, 1919, pp. 209-210, 6 figs. Arrangement which is said to have the advantage that by throttling valve it can be arranged to deliver just the quantity of air required and that it will work indefinitely without attention.

Air Receiver. The Air Receiver, Frank Richards. Compressed Air Mag., vol. 24, no. 8, Aug. 1919, pp. 9251-9256. Suggestions in regard to design and installation.

Fans. Centrifugal Fans, Frank S. Townsend. Popular Engr., vol. 12, no. 2, Aug. 1919, pp. 13-15, 3 figs. Their application in gas engineering practice. Paper read before Midland Junior Gas Association, England.

Transportation-

The Utilization of Compressed Air in Transportation (Die Verwendung der Pressluft in der Verkehrstechnik). Kasten, Zeitschrift f. komprimierte u. flussige Gase, Vol. 19, no. 11, 1917-18, pp. 97-100, 4 figs. Pneumatic mail tubes in Burlin.

Wind Motors. Wind Motors: Their Possibilities and Limitations, Faville C. Poulton. Jl. Roy. Soc. Arts, vol. 67, no. 3480, Aug. 1, 1919, pp. 590-594. Argues that there is room for wind motor in these days of super-economy because a modern wind motor properly installed gives 15 per cent efficiency while a modern steam plant using coal of 15,000 B.t.u. per lb. gives 13 per cent only.

CORROSION

Copper. Corrosion of Copper — VII, G. F. Bengough and O. F. Hudson. Metal Industry, vol. 15, no. 2, July 11, 1919, pp. 26-28. Tables giving results of immersion tests in both distilled water and sea water. From fourth report of Corrosion Committee of Inst. of Metals.

Earth Currents. Corrosion through Earth Currents from Electric Traction (Die Korrosion durch Erdstrome elektrischer Bahnen). Elektrotechnik u. Maschinenbau, vol. 37, no. 6, Feb. 9, 1919, pp. 56-57. Report of the Swiss Electrotechnical Soc. regarding corrosion of gas and water mains.

Rustproofing. Metallic Coatings for Rustproofing. Brass World, vol. 15, no. 8, Aug. 1919, pp. 242-245. Methods of testing coatings. Recommendations concerning coatings.

FORGING

Drop Stamping. Drop-Stamping, Drop-forgings, etc.— VI, Joseph Horner. Mech. World, vol. 66, no. 1700, Aug. 1, 1919, p. 55, 5 figs. Example in which entire forging must be stamped at one time in order to produce recessed form of web. (To be continued).

FOUNDRIES

Casting Machine. New Casting Machine for Pig Iron (Neue Masselgiessmaschine). Zeitschrift f. die gesamte Giessereipraxis, vol. 40, no. 9, Mar. 1, 1919, pp 109-110, 3 figs. Consists of two turntable holding cast-rion molds; while the specially constructed ladle pours a regulated amount into mould of first table, the second table automatically advances one mold. It is claimed that ingots made by this process are of even size and weight.

Chinese Foundries. Chinese Iron Foundries, F. A. Foster. Am. Mach., vol. 51, no. 8, Aug. 21, 1919, pp. 345-352, 30 figs. Notes the specially remarkable thinness and smooth finish of products in spite of crudeness of method of production.

Condensers. Making and Casting Cylindrical Condensers.— I, Ben Shaw. Mech. World, vol. 66, no. 1700, Aug. 1, 1919, pp. 54-55, 3 figs. Illustrating instances where company built cast-iron condenser "as one means of reducing the work required to be done by riveters."

Electric Casting. Electric Casting and Welding (Elektrisches Giess — und Schweissverfahren). Zeitschrift f. die gesamte Giessereipraxis, vol. 40, no. 7, Feb. 15, 1919, pp. 81-83. With special reference to Dr. Zerener's method.

Engine Cylinder Casting. Marine Gasoline Engine Cylinders, R. H. Palmer. Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 567-568, 5 figs.Foundry problems encountered in marine-engine shop.

Gating. Method of Gating Test Bars Affects Results, A. W. Sorgenz, Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 559-560, 4 figs. Double annealing recommended.

Ingot Mold Foundry. Bethlehem's Ingot Mold Foundry. E. C. Kreutzberg. Iron Trade Rev., vol. 65, no. 8, Aug. 21, 1919, pp. 495-498, 7 figs. Capacity is 10,000 tons of ingot molds, stools and bottom plates per month. Attention is particularly called to arrangement for storing and charging coke and method of pouring molds from long platform.

Layout. A Dayton Foundry of Progressive Design. Iron Age, vol. 104, no. 6, Aug. 7, 1919, pp. 355-356, 3 figs. Method of distributing air for heat and ventilation, use of transferable jib crane, and storage of sand in pits below foundry floor level quoted as interesting features.

Malleable Iron. Insure the Integrity of Malleable, Enrique Touceda. Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 551-552. Writer believes that soundness of metal in castings is secured by eliminating chills and strict adherence to use of feeding heads to furnish metal at proper pressure. Paper presented before American Foundrymen's Assn.

Molding. Long Castings From Short Patterns, R. R. Clarke. Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 561-564. Hints on molding light and heavy bushings.

Molding Machines. Molding Machine That Throws Sand, Pat Dwyer. Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 535-538, 6 figs., also in Iron Trade Rv., vol. 65, no. 9, Aug. 28, 1919, pp. 567-579, 6 figs. Device in which projectile principle is employed for ramming sand. Sand is thrown by rapidly revolving head.

Patterns. Gear Patterns, Joseph A. Shelly. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1133-1137, 10 figs. Methods of laying out and constructing patterns for spur and bevel gears and wormwheels.

Ship Castings. Castings for Ship Construction — VIII, Ben Shaw and James Edgar. Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 540-544, 15 figs. Concerning care necessary in preparing mold for propeller shaft brackets to insure proper allowances for contraction of metal. Writers hold that large flasks are not necessary.

Standardization. Standardization of Foundry Practice, S. W. Wis. Mech. World, vol. 66, no. 1701, Aug. 8, 1919, pp. 69-70. Tabulated records of different conditions under which various foundry operations are conducted are presented as evidence to justify writer's belief that it is well-nigh impossible to approach anything like uniform practice. He suggests idea of a foundry equivalent to National Laboratory. Paper read before Newcastle Branch of British Foundrymen's Assn.

FUELS AND FIRING

Alcohol. Alcohol Motor Fluid. Engineer, vol. 128, no. 3314, July 4, 1919, pp. 17-18. Also in Jl. Soc. Chem. Industries, vol. 38, no. 13, July 15, 1919, pp. 250 R-252 R,, and in Eng. & Indus. Management, vol. 2, no. 3, July 17, 1919, p. 67. Report of committee appointed by British Government to consider and report upon available sources of supply, methods of manufacture and cost of product; suitability, either alone or in admixture with other combustibles, for use in internal-combustion engines, and modifications of existing types of such engines which may be necessary to attainment of efficiency, and question of denaturing alcohol, and alterations to be made in present excise arrangements.

Fuel Saving. Fuel Saving in Industrial Plants. John F. Tinsley. Mech. Eng., vol. 41, no. 9, Sept. 1919, pp. 750-751. Manner in which Worcester, Mass. Fuel Conservation Committee conducted campaign during war.

Gaseous Fuel. Utilization of Gaseous Fuel in Commercial Practice, F. W. Epworth Metal Industry, vol. 15, no. 2, July 11, 1919, pp. 21-25, 9 figs. With consideration of types of gas-fired furnaces and methods for their control.

Low-Grade Fuel. The Production of Steam from Low Grade Fuel and a Chemical Works Power Plant P. Parrish. Chem. Industry, vol. 38, no. 14, July 31, 1919, pp. 234T-239T and (discussion) 239T-241T, 5 figs. Details of Crosthwaite's patent forced-draft air tubes.

Metallurgical Furnaces. Fuel for Metallurgical Furnaces, Rose Demorest. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 386-389. Bibliography of oil fuel for metallurgical furnaces complied from chief sources of technical literature.

Powdered Coal. The Use of Pulverized Coal — II, Leonard C. Harvey. Engineer, vol. 128, no. 3315, July 11, 1919, pp. 26-28, 5 figs. Notes on various types of burners.

Waste-Heat Boilers and Pulverized Fuel in Chemical Factories, C. J. Goodwin. Chem. Industry, vol. 38, no. 14, July 31, 1919, pp. 213T-220T and (discussion) 220T-222T, 6 figs. Typical installations at various English works.

High Efficiency of Powdered Coal as Fuel — I. Coal Trade Jl., vol. 50, no. 33, Aug. 13, 1919, pp. 981-982, 1 fig. Quigley system. (To be continued).

The Use of Pulverized Coal, L. C. Harvey. Engineering, vol. 108, no. 2796, Aug. 1, 1919, pp. 160-164, 13 figs. Systems of Locomotive Pulverized Fuel Co. and Powdered Coal Engineering Co. (Concluded). Paper read before Iron and Steel Inst.

The Use of Pulverized Coal, L. C. Heavey. Engineering, vol. 108, no. 2795, July 25, 1919, pp. 125-128, 11 figs. Particulars of various systems. (Continuation of serial). Paper read before Iron and Steel Inst.

Pulverized Coal as a Fuel for Boilers, Edward R. Welles and W. H. Jacobi. Mech. Eng., vol. 41, no. 9, Sept. 1919, pp. 744-749 and p. 787, 5 figs. General study of its characteristics and the operating conditions met with in its commercial applications; also a discussuon of the nature of flame, types of burners and of a design of pulverized-fuel furnace for a 500-hp. boiler.

High Efficiency of Powdered Coal as Fuel — II. Coal Trade Jl., vol. 50, no. 34, Aug. 20, 1919, pp. 1018-1019, 2 figs. Description of controller and burner. Comparison of other fuels.

FURNACES

Heat-Treating Furnaces. Heat Treating Furnaces for Heavy Artillery, William J. Harris, Jr. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 378-380, 2 figs. Vertical steel shell-type furnace installed at U. S. Government arsenal at Watertown, Mass., for heat treatment of gun tubes and other parts of heavy artillery.

Heating Furnaces and Annealing Furnaces — VIII, W. Trinks. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 390-393, 9 figs. Diagram for determining generator size.

GAGES

Grinding Gages. Producing Screw Thread Gauges by Grinding, C. Edgar Allen. Machy, (Lond.), vol. 14, no. 356, July 24, 1919, pp. 504-507, 9 figs. Method which utilizes disintegration of wheel during grinding to yield ultimate thread form.

Newall Gages Newall Measuring Machines and Gauges, Engineering, vol. 108, no. 2795, July 25, 1919, pp. 104-105, 12 figs., partly on two supplement plates. Details of test room specially noted.

Taft-Pierce Measuring Machine. Taft-Pierce Measuring Machine, E. J. Bryant. Inspector, vol. 1, no. 3, Aug. 15, 1919, pp. 9 and 17, 1 fig. For checking dimensions of plug gages and similar objects.

Tolerances. Tolerances as Affected by Workshop Conditions, A. Whitehead. Engineering, vol. 108, no. 2798, Aug. 15, 1919, pp. 201-203, 1 fig. Article deals with shafts and holes such as occur in motor chassis and smaller works under conditions associated with intensive production.

GAS ENGINEERING

Cleaning Gas. Cleaning Gas By Effective Method, George B. Cramp. Iron Trade Rev., vol. 65, no. 8, Aug. 21, 1919, pp. 506-507, 4 figs. Corrugated baffle plates built on interior of gas washer said to give large cleaning area and uniform condition throughout washer.

Distribution Unner Pressure. Report on the Distribution of Gas under Pressure at a Distance (Rapport sur la distribution du gaz sous pression à distance), M. A. Schmidt. Bulletin de la Société Industrielle de Mulhouse, vol. 84, no. 6, June-July-Aug.-Sept. 1914, pp. 453-460, 1 fig. Question of economical distribution studied with reference to Monnier-Pohl expression. Diameter of conduit, pressure and quantity delivered.

Gas-Main Connection. Standardized Method for Connecting Gas Mains, Duncan D. Randsdell. Gas Age, vol. 44, no. 4, Aug. 15, 1919, pp. 137-139, 2 figs. Experience of Washington Gas Light Co. in cutting in sections of cast-iron gas mains.

Gas Production to Standards. Fuel Economy at the Apedale Works of the Midland Coal, Coke and Iron Company, Limited, William Hill and J. A. Cork. Iron & Coal Trades Rev., vol. 99, no. 2682, July 25, 1919, pp. 106-107. Special attention is said to be given to gas purification, regular heating value of gas, constant pressure of gas at engine stop valves, provision of circulating water at constant pressure and free from impurities, and means to enable foregoing conditions to be automatic. Paper read before North Staffordshire Inst. of Min. Engrs.

Great Britain. Present Conditions in the British Gas Industry, D. Milne Watson. Gas Age, vol. 44, no. 3, Aug. 1, 1919, pp. 97-98. Address delivered to British Board of Trade.

Low-Temperature Distillation. Low Temperature Distillation of Coal, C. M. Garland. Power, vol. 50, no. 7, Aug. 12, 1919, pp. 248-251, 4 figs. Recommends for power plants with constant load burning over 50 tons of coal per day, combination of low-temperature process with by-product gas producer to recover greater percentage of ammonium sulphate. Claimed economical advantages are pointed out.

Measurement of Gas. Electrical Method for Commercial Measurement of Gases, G. A. Sharland. Iron & Coal Trades Rev., vol. 99, no. 2680, July 11, 1919, pp. 37-38, 4 figs. Meter gives in standard units graphic record of actual amount of gas passing during any specific interval of time.

Natural Gas. Methods for More Efficiently Utilizing Our Fuel Resources — XXX, Samuel S. Wyer. Gen. Elec. Rev., vol. 22, no. 8, Aug. 1919, pp. 636-648, 11 figs. Natural gas.

Providence Gas Company. Manufacturing Plant of the Providence Gas Co.— III, Walter M. Russell. Chem. & Metallurgical Eng., vol. 21, no. 3, Aug. 1, 1919, pp. 147-153, 8 figs. Installation and operation of battery of 40 Koppers cross-regenerative, combination, by-products ovens. Coal and coke-handling apparatus. Paper read before Am. Inst. Chemical Engrs.

HANDLING OF MATERIALS

Coal Handling. Insuring Adequate Coal Supply with the Least Expenditure, George E. Wood. Elec. Ry. Jl., vol. 54, no. 7, Aug. 16, 1919, pp. 312-315, 10 figs. Layout of coal-handling equipment and storage facilities of Conn. company at New Haven.

HEAT-TREATING

Steel. Some Remarks concerning the Heat Treatment of Steel and Their Application to the Treatment of Steels Used for Airplane Motors, Albert Sauveur, Jl. Franklin Inst., vol. 188, no. 2, Aug. 1919, pp. 189-197. Distinguishing between three treatments — softening treatment, strengthening treatment and hardening treatment.

Notes on Heat Treatment of Steel, T. D. Lynch. Proc. Engrs. Soc. of Western Pa., vol. 35, no. 5, June 1919, pp. 215-237 and (discussion), pp. 238-242, 11 figs. Materials of design; standardized treatments; results of standard heat treatment.

HEATING AND VENTILATION

District Heating System. The Transmission of Steam in a District Heating System by Means of High-Velocity Feeders, Norman W. Calvert. Heat & Vent. Mag., vol. 16, no. 8, Aug. 1919, pp. 32-35, 3 figs. Notes connection for reducing flow velocity at end of feeder.

Fan Heating System. A Fan Heating System Installed Without the Use of Galvanized Iron, F. B. Rowley and John R. Allen. Heat & Vent. Mag., vol. 16, no. 8, Aug. 1919, pp. 17-23, 11 figs. Temporary work at Univ. of Minn. while preparing building for prospective registration of 5,000 men in S. A. T. C.

Farm-Building Ventilation. Farm Building Ventilation, W. B. Clarkson. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 51-57. Asserts that there is need for more specialization on subject by those who will assume responsibility for good results.

Homes. Coal and Electricity Compared for the Heating of Homes. Heat & Vent. Mag., vol. 16, no. 8, Aug. 1919, pp. 24-28. From report of Hydro-electric Power Commission of Ontario.

Oil Elimination from Condensation. Removing Oil from Condensation, Charles L. Hubbard. Domestic Eng., vol. 88, no. 7, Aug. 16, 1919, pp. 301-303 and 332. Devices eliminating oil from condensation in steam-heating systems. Their installation and operation.

Radiating Surface. Placing Hot Water Radiators Below Boiler Level, Wm. Hutton. Domestic Eng., vol. 88, no. 7, Aug. 16, 1919, pp. 297-299, 2 figs. Method of proportioning radiating surface to promote circulation at various levels.

SCHOOLS. The Mechanical Equipment of Washington School, Bayonne, New Jersey, Donald G. Anderson. Am. Architect, vol. 116, no. 2278, Aug. 20, 1919, pp. 251-256, 8 figs. Heating, ventilating and electric wiring.

TESTING. Testing Modern Plumbing Installations, Robert J. Gordon. Domestic Eng., vol. 88, no. 8, Aug. 16, 1919, pp. 294-296, 5 figs. How to test sewers, drains, soil, waste and vent piping by water, air and smoke.

HOISTING AND CONVEYING

CONVEYOR CONTROL. The Curtis Bay Pier of the B. & O. R. R.— II. Coal Trade Jl., vol. 50, no. 33, Aug. 13, 1919, pp. 985-986, 3 figs. Automatic control of conveyor and balancing pin described.

CONVEYOR, PORTABLE. Modernizing Freight-Handling Methods. Iron Trade Rev., vol. 65, no. 6, Aug. 7, 1919, pp. 351-355, 6 figs. Illustrating uses of portable conveyors.

CRANE, BREAKDOWN. 35-Ton Steam Breakdown Crane, Great Northern Railway, H. N. Gresley. Ry. Gaz., vol. 31, no. 4, July 25, 1919, pp. 118-119, 3 figs. Locomotive portion and job supported upon ten-wheeled carriage; wheelbase of engine truck is 21 ft.; engine is equipped with two high-pressure cylinders.

CRANE, REINFORCED CONCRETE. Travelling Crane of Reinforced Concrete, Eng. & Contracting, vol. 52, no. 5, July 30, 1919, p. 137, 1 fig. Capacity, three tons; span, 32.8 ft. Translated from Génie Civil.

CRANES, FLOATING. The World's Largest Floating Cranes, Coal Trade Jl., vol. 50, no. 32, Aug. 6, 1919, pp. 956-957, 1 fig. Cranes with lifting capacity of 150 tons at radius of 105 ft. recently completed and installed at Navy Yards at Norfolk, Va., and Mare Island, Cal.

CRANES FOR STEEL WORKS. Special Cranes with Electric Drive for Steel Works (Beispiele neuer elektrisch betriebener Spezialkrane für Stahlwerke), Ernst Blau. Elektrotechnik u. Maschinenbau, vol. 37, no. 9, Mar. 2, 1919, pp. 81-86, 7 figs. Scrap-iron loading crane with lifting magnet and tray arrangement and trough-charging crane of the Ardelwerke, Berlin.

CRANES, QUARRY. Ship Cranes for Quarrying Operations. Rock Products, vol. 22, no. 16, Aug. 2, 1919, pp. 21-24, 13 figs. Features of pit-type quarry and crushing plants in Montreal.

ELEVATORS, ELECTRIC. Future Possibilities of Push Button Control for Electric Elevators, Alexander Marks. Am. Architect, vol. 116, no. 2276, Aug. 6, 1919, pp.187-194, 8 figs. Possibilities opened up by removal of mandatory restrictions against such type of operation, notably at New York City.

GRAIN ELEVATOR. Portable Pneumatic Grain Elevator; Duckham System, George Frederick Zimmer. Engineering, vol. 108, no. 2797, Aug. 8, 1919, pp. 191-192, 7 figs., partly on two supplement plates. Mounted upon railway rolling stock.

Portable Grain Elevator. Engineering, vol. 108, no. 2796, Aug. 1, 1919, p. 145, 5 figs. Consists of hopper supported by three columns from wagon-type body.

GRAVITY RUNWAYS. The Utility of Gravity Runways. Ry. Gaz., vol. 31, no. 3, July 18, 1919, pp. 87-88. Notes on their application and operation.

ORE UNLOADER. An Automatic Iron-Ore Unloader. Eng. & Min. Jl., vol. 108, no. 8, Aug. 23, 1919, pp. 305-307, 3 figs. Wellman-Seaver-Morgan electrically driven machines used for the moving of cargoes from lake steamers to cars or stock-piles ready for shipment to furnaces.

ROCK CONVEYORS. Roe's Patent Rope Conveyor, George Frederick Zimmer. Eng. & Indus. Management, vol. 2, no. 3, July 17, 1919, pp. 89-91, 5 figs. Total length is 1800 ft. It consists of two endless ropes running around a pair of edge sheaves at either terminal, the drive being taken through one pair while the other pair is mounted on a low trolley attached to tensioning arrangement.

TIPPING BUCKET. Refuse Tipping Bucket. Colliery Guardian, vol. 118, no. 3058, Aug. 8, 1919, pp. 373, 3 figs. Consists of bucket supported on angle-iron rings which rest on rollers fixed in frame provided with wheels that run upon track or roller to top of bing.

HYDRAULIC MACHINERY

ONTARIO POWER COMPANY'S PLANT. Extension to the Ontario Power Company's Plant. Elec. News, vol. 28, no. 16, Aug. 15, 1919, pp. 23-30, 15 figs. Features are wood-stave pipe 13½ ft. in diameter and 6700 ft. long, differential surge tank of 60 ft. outside diameter and 78 ft. high, and power house with walls designed to withstand 40 ft. rise in tail water. Added capacity is 30,000 kva.

SEEWER REGULATING SYSTEM. *See Turbine Governors.*

TURBINE DESIGN. Progress in Water-Turbine Design, A. H. Wilson and A. J. McDougall. Can. Engr., vol. 37, no. 8, Aug. 21, 1919, pp. 241-242. From annual report of Can. Elec. Association's Committee on Prime Movers.

TURBINE GOVERNORS. Seewer's Universal Regulating System for High-Pressure Pelton Turbines (Universal-Regulierung System Seewer für Hochdruck Pelton Turbinen), Franz Prasil. Schweizerische Bauzeitung, vol. 73, no. 23, June 7, 1919, pp. 263-267, 9 figs. Curves, tables and tachograms of tests made.

TURBINE TESTING STATION. Turbine Testing Station of Mechanical Works at Vevey, S.A.Bulletin Technique de la Suisse Romande, vol. 45, no. 15, July 26, 1919, pp. 145-150, 2 figs. Built specially for connecting Francis types under all running conditions.

WATER HAMMER. Water Hammer in Conduits under Pressure (Note sur le calcul du coup de bélier dans les conduites sous pression). Bulletin Technique de la Suisse Romande, vol. 45, nos. 15 and 16, July 26 and Aug. 9, 1919, pp. 153-155 and 161-166, 12 figs. July 26: Application of theory to various examples. Aug. 9: Illustrating application of formulæ in actual computations.

INTERNAL-COMBUSTION ENGINES

CARBURETORS. Mathematical Study of Operation of Spray Constant-Level Carburetors (Etude mathématique du fonctionnement des carburateurs à giclage et à niveau constant), M. Carbonaro. Génie Civil, vol. 75, no. 5 and 6, Aug. 2, 1919 and Aug. 9, 1919, pp. 96-99 and pp. 120-124, 7 figs. Laws of flow of gasoline through capillary passages. Relation between gasoline-air ratio and depression caused by motor in admission pipe. (To be continued).

The Zephyr Carburetter Autocar, vol. 43, no. 1240, July 26, 1919, pp. 131-132, 4 figs. Operates on submerged jet principle.

ENGINE TESTS. Some Experiments on a Small Engine. Harry R. Ricardo. Automobile Engr., vol. 9, no. 129, Aug. 1919, pp. 236-240, 6 figs. Tests to investigate performance of Continental engine as fitted to Morris-Crowley car.

HOT SPOT. Accessibility and Hot Spot Device for Vaporizing of Fuel Feature New Gray Truck Engine. Commercial Vehicle, vol. 21, no. 1, Aug. 1, 1919, pp. 28-29, 3 figs. Engine is of valve-in-head type.

MARINE OIL ENGINES. The Ansaldo-San Giorgio Marine Oil Engine. Engineering, vol. 108, no. 2794, July 18, 1919, pp. 80-82, 1 fig. Four-cylinder two-cycle type with valve-controlled port scavenging.

ROTARY AND RADIAL ENGINES. Rotary and Radial Engines, T. L. Sherman. Automobile Engr., vol. 9, no. 129, Aug. 1919, pp. 248-249. Comparative review of dynamic and various minor problems as they effect these two types.

STARTERS. A New Development in Motor Starters. Engineer, vol. 128, no. 3315, July 11, 1919, pp. 32-33, 7 figs. " Navy " type starter designed for submarine work.

TARS, RAW, AS FUEL. The Use of Raw Tars as Fuels for Diesel Engines, Harold Moore. Engineering, vol. 108, no. 2797, Aug. 8, 1919, pp. 167-168. Summary of chemical and physical properties of tar oils and of practical experience of their behavior in Diesel engines.

THERMAL EFFICIENCY, LIMITS. The Limits of Thermal Efficiency in Internal Combustion Engines, Dugald Clerk. Engineering, vol. 108, nos. 2794, 2795, 2796, July 18, 26 and Aug. 1, 1919, pp. 77-79, 130-132 and 157-159, 22 figs. July 18: Technical discussion of present position and future possibilities of obtaining motor power by gas and liquid fuel in most effective manner. July 25: Variation of engine weight with increasing dimensions. Aug. 1: Determination of heat loss and varying specific heat of flame and products of combustion in engine cylinder by Clerk zigzag diagram. Also abstracted in Engineer, vol. 128, no. 3315, July 11, 1919, pp. 40-42, 1 fig.

LUBRICATION

BEARING LUBRICATION. Oiling and Lubricating Devices, Otto Abdt. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1146-1147, 4 figs. Some methods of lubricating inaccessible bearings.

MACHINE ELEMENTS AND DESIGN

CRANK ANALYSIS. An Analysis to Distinguish Between a Crank and an Eccentric as Driving or Driven Elements, H. S. Dickinson. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 96-124, 18 figs. Formula and diagrams comparing resultant moments.

RIVETED JOINTS. Riveted Joints for Steel Penstocks and Tanks, H. A. Babcock and J. R. Montague, Can. Engr., vol. 37, no. 6, Aug. 7, 1919, pp. 195-200 and 209, 8 figs. Formula and tables of their design. Examples of solution of maximum joint efficiency.

ROLLER BEARINGS. Roller Bearing Types and Applications. Raw Material, vol. 1, no. 5, July 1919, pp. 265-267, 7 figs. Construction features of various makes of roller bearings and their applications to various types of machinery and machine tools. (To be continued).

SCREW GRADING. A Pitch Engagement System of Grading Screws. Machy. (Lond.), vol. 14, no. 357, July 31, 1919, pp. 529-532, 5 figs. Screw threads graded on number of threads in engagement.

MACHINE SHOP

GEAR-CUTTING MACHINES, SETTING OPERATIONS. Setting Operations on Gear-Cutting Machines, Fred Horner. Machy. (Lond.), vol. 14, no. 357, July 31, 1919, pp. 521-527, 29 figs. As practiced at various English shops and at works of Oerlikon Machine Tool Co. of Switzerland.

GRINDING CUTTERS. Latest Practice in Cutter Grinding — III, IV and V. Am. Mach., vol. 51, nos. 6, 7 and 8, Aug. 7, 14 and 21, 1919, pp. 251-254, 323-325 and 369-371, 24 figs. Angular cutter grinding and grinding of form cutters and taps Modern practice in hand and chucking reamer grinding for steel, cast iron and bronze. Tables are included which give vertical adjustment for above-center for both cutting clearance and second clearance. Methods used by Cincinnati milling Co. in grinding hand reamers for steel and also chucking reamers for cast iron, bronze, or steel, both roughing and finishing. Concluding installment.

MOTOR-TRUCK REPAIR WORK. Equipment Required for Upkeep of 54 Gasoline Trucks, George Heron. Commercial Vehicle, vol. 21, no. 2, Aug. 15, 1919, pp. 52-55, 8 figs. Itemized list of machines used for repair work.

PLANO-MILLING PRACTICE. Plano-Milling Practice in Automobile Plants — II. Machy. (Lond.), vol. 14, no. 355, July 17, 1919, pp. 461-465, 9 figs. Milling operations on cylinder blocks and heads of typical American engines.

SMALL-SHOP WORK. General Work in the Small Shop — XXII. Mech. World, vol. 66, no. 1698, July 18, 1919, pp. 26-27, 6 figs. Cutting of wormwheels to suit V-thread worms. (Continuation of serial).

Standardized Part Production. Jigs, Tools, and Special Machines with Their Relation to the Production of Standardized Parts, H. C. Armitage. Mech. World, vol. 66, no. 1699, July 25, 1919, pp. 39-40, 4 figs. Comparative cost results between threes chemes—small production, large production and maximum production. (Concluded).

MACHINERY, METAL-WORKING

Chucking and Turning Machines. Semi-Automatic Chucking and Turning Machine. Machy. (Lond.), vol. 14, no. 355, July 17, 1919, pp. 472-474, 7 figs. Swing of 12¾ in. diameter over bed or 8 in. diameter over cross-slide is possible and turning limit is 8 in. diameter with standard tools supplied.

Crankshaft Lathe. A Record-Smashing Crankshaft Lathe, Ethan Viall. Am. Mach., vol. 51, no. 9, Aug. 28, 1919, pp. 395-399, 8 figs. For machining sides of webs and turning ends of crankpins on all of throws at the same time. Machining time is claimed to be reduced from thirty to two days.

Drill Heads. Novel Portable Electrical Drill Heads, Frank C. Perkins. Can. Machs., vol. 22, no. 7, Aug. 14, 1919, pp. 177-178, 4 figs. Operation of English and German types illustrated.

Grinding Machines. Machine and Fitting Shop Practice, Fred Horner. Mech. World, vol. 66, no. 1699, July 25, 1919, pp. 38-39, 5 figs. Types used in internal grinding machines. (Continuation of serial).

Hand Tools. Portable Motor-Driven Hand Tools for Wood and Metal Working. Elec. Rec., vol. 26, no. 2, Aug. 1919, pp. 91-97, 33 figs. Details concerning construction and operating features.

Lathes. Recent Machine Tool Developments — II and III, Joseph Horner. Engineering, vol. 108, no. 2794 and 2797, July 18 and Aug. 8, 1919, pp. 70-73 and 172-176, 46 figs. Forms or beds, legs, standards, framings, slides, and tool and work supports. Illustrating typical example of longitudinal outlines of lathe beds, legs and equipment.
See also Crankshaft Lathe.
The Design and Construction of a 4½-in. Lathe Tail-stock. Model Eng. & Elecn., vol. 41, no. 951, July 17, 1919, pp. 61-64, 4 figs. Operations required in construction and fitting of tailstock to old lathe. (To be continued).

Milling Machines. Tilted Rotary Milling Machine. Machy, (Lond.), vol. 14, no. 355, July 17, 1919, pp. 481-484, 5 figs. In addition to allowing machine to be used as continuous rotary miller, provision is made for using it as indexing machine.

Tooling Equipment for Piston Rings. Tooling Equipment for an Automobile Piston Ring. Machy. (Lond.), vol. 14, no. 355, July 17, 1919, pp. 475-477, 7 figs. Performing two operations — splitting on each side and peening until strung together — at one time.

Vice. "Fland" Machine Vice. Engineering, vol. 108, no. 2796, Aug. 1, 1919, pp. 140-141, 13 figs. Constructed on "three point of suspension" principle, usually two jaws of vice being replaced by three sliding blocks.

MACHINERY, SPECIAL

Farm Machinery. A Study of the Plow Bottom and Its Action upon the Furrow Slice, E. A. White. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1919, pp. 42-50, 13 figs. Machine for studying mathematical action of plow bottoms.
See also Equalizers and Hitches.

Draft Tests of Fram Machinery, E. J. Stirniman. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 9-25. Result of series of drawbar test and power required to operate various power machines.
Plow Bottom Design, C. A. Bacon. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 26-40, and (discussion) pp. 40-42, 10 figs. It is observed that search for material that would withstand erosive influence of silicon led to manufacture of chilled plow. Reference is made to experiments with different shaped plow bottoms.
Standardization of Farm Machinery, A. B. Dinneen. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 151-159. Review of accomplishments.

Gimbals. Gimbal Stabilization V. Bush. Jl. Franklin Inst., vol. 188, no. 2, Aug. 1919, pp. 199-215, 9 figs. Analysis of effectiveness of gimbals of various designs for maintaining horizontal platform on shipboard and of gyroscopic stabilizing of such devices.

Gun, Machine, Tripod. High-Production Tooling Methods as Applied to the Machine-Gun Tripod, Model 1918 — II, Albert A. Dowd and Donald A. Baker. Am. Mach., vol. 51, no. 9, Aug. 28, 1919, pp. 401-407, 7 figs. Tools for machining pintle.

Pintle Machining. *See Gun, Machine, Tripod.*

Plow Bottoms. *See Farm Machinery.*

Sine Bars. Universal Sine Bar for the Toolmaker, J. B. Gray. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1159-1162, 8 figs. Also Machy. (Lond.), vol. 14, no. 357, July 31, 1919, pp. 533-535, 8 figs. Method of making, and application to various classes of precision work.

Steam-Hammer Work. Hand Tools for Steam Hammer Work, A. S. Hesse. Am. Mach., vol. 51, no. 6, Aug. 7, 1919, pp. 247-250, 19 figs. Auxiliary equipment needed for such operations as flanging, pressing, stamping, bending, shearing, drop forging, etc.

Tube-Shaping Machine. Forming Machine for Shaping Steel Tubes. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 369-372, 2 figs. Work is spun while applied against nest of three rolls. Machine for forming various shapes of noses in steel cylinders and tanks suitable for commercial transportation of explosive gases and liquids.

Vacuum Evaporators. Industrial Vacuum Evaporators — X, Frank Coxon. Mech. World, vol. 66, no. 1698, July 18, 1919, p. 30, 2 figs. Concerning sizes of steam and vapor pipes. (Concluded.)

MACHINERY, WOODWORKING

Pattern Manufacture. Wood Patterns Made in a Factory. Iron Trade Rev., vol. 65, no. 7, Aug. 14, 1919, pp. 429-431, 4 figs. How shop was organized for quantity production.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

Boiler Plates. Physical Tests of Boiler-Steel Plates, Frederick Biggam. Power, vol. 50, no. 7, Aug. 12, 1919, pp. 252-253. Instances quoted to show that despite persistence with which bending tests recur in amended rules of inspection societies, "these tests . . . have not the finality that such persistence would seem to imply."

Exposure Tests of Sheeting Material. Exposure Tests of Sheeting Material, Samuel L. Hoyt. Chem. & Metallurgical Eng., vol. 21, no. 3, Aug. 1, 1919, pp. 142-144, 7 figs. Tests are interpreted as indicating that best sheeting material is copper-bearing steel with 0.20 to 0.25 per cent copper.

Fatigue in Metals. Fatigue Phenomena in Metals. Mech. Eng., vol. 41, no. 9, Sept. 1919, pp. 731-738, 7 figs. Summary of available facts and theories relating to fatigue failure and discussion of some unsolved problems. Progress report of Committee on Fatigue Phenomena in Metals, which is acting under joint auspices of Eng. Foundation, and Div. of Eng of Nat. Research Council.
A Fatigue Testing Machine, F. M. Farmer, Am. Mach., vol. 51, no. 6, Aug. 7, 1919, pp. 271-273, 4 figs. Apparatus developed at electrical testing laboratories for Research Sub-Committee of Welding Committee of the Emergency Fleet Corporation. Purpose was to obtain information in regard to relative durability of electrically welded joints in ½-in. ship plates when subjected to repeated reversed stresses.

Firebrick Testing. A Machine for Testing the Hot-Crushing Strength of Firebricks, H. G. Schurecht. Jl. Am. Ceramic Soc., vol. 2, no. 8, Aug. 1919, pp. 602-607, 7 figs., partly on supp. plate. Designed by Bureau of Mines.

Foundry Materials. Foundry Materials (Die Materialien der Giesserei), E. Schutz. Zeitschrift f. die gesamte Giessereipraxis, vol. 40, no. 6, Feb. 8, 1919, pp. 66-68. Vanadium, ferrovanadium. Specific weights and analysis.

Hardness Measurement. Some Recent Advances in the Measurement of Hardness in Metals, F. C. Thompson. Jl. Soc. Chem. Indus., vol. 38, no. 13, July 15, 1919, pp. 241R-243R. Account of recent investigations, noting tendency to modify Brinell best by working with constant deformation.

Malleable Iron. What is Modern Malleable Iron, H. A. Schwartz. Ry. Mech. Engr., vol. 93, no. 8, Aug. 1919, pp. 479-481. Sketch of methods of manufacture and characteristics of material.

Manganin. Manganin, M. A. Hunter and J.W. Baacon, Thirty-six General Meeting of Am. Electrochem. Soc., Sept. 23, 1919, advance copy paper no. 2, pp. 9-21, 3 figs. Experiments for measuring effect of small variations in percentage of manganese, nickel and iron and electrical resistivity and on temperature coefficient of resistivity. Writers conclude that small variations in manganese affect resistance but not its temperature coefficient and that small quantities of iron affect temperature coefficient considerably.

Notched-Bar Resistance. Resistance of Notched Bars to Shock (Sur les essais de flexion par choc de barreaux entaillés), André Cornu-Thénard. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 26, June 30, 1919, pp. 1315-1318. Tests cited as having shown that within limits of testing machines generally used in France, action of velocity may be considered as practically negligible.

Paper, Waterproofed. The Industrial Possibilities of Waterproofed Paper Products, Judson A. DeCew. Jl. Eng. Inst. Can., vol. 2, no. 8, Aug. 1919, pp. 558-559. It is considered as very difficult to make a paper product that will not absorb moisture and thus expand and contract to some extent. It is asserted, however, that paper and board can, without difficulty, be made so that it will resist further penetration or absorption of water after their fibres have taken up a quantity of moisture equal to about one-fifth their weight. This is considered sufficient for commercial uses.

"Stainless" Steels. Corrosion Proof Steels, F. Rowlinson. Sci. Am., vol. 121, no. 7, Aug. 16, 1919, p. 156. Present uses of nickel steels, copper steels, nickel-copper steels and chromium "stainless" steels.

Steel, Mechanical Properties of. The Various Mechanical Properties of Steel, W. H. Hatfield. Can. Machy.. vol. 22, no. 8, Aug. 21, 1919, pp. 204-205, 2 figs. Takes up consideration of question of brittleness, together with investigation of failures of various kinds. (Continuation of serial).
Mechanical Properties of Steel and Iron. Iron Age, vol. 104, no. 9, Aug. 28, 1919, pp. 565-568. Compilation made public by Bur. of Standards to secure criticism for purposes of revision.

MEASUREMENTS AND MEASURING APPARATUS

Acceleration Determination. An Apparatus for the Direct Determination of Accelerations, B. Galitzin. Proc. Roy. Soc., vol. 95, no. A-673, July 15, 1919, pp. 492-507, 8 figs. Instantaneous value of acceleration due to any arbitrary function determined by means of simple pendulum.
See also Accelerogroph.

Accelerograph. Accelerograph (Sur un accélérographe), Auclair and Boyer-Guillon. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 1, July 7, 1919, pp. 24-26, 3 figs. For measuring periodic movement without having fixed points of reference, for example, vibrations of a ship's deck.

Air Meters. *See Meters.*

Calibration of Instruments. The Calibration Function in Indicating Instruments, Frederick J. Schlink. Engineering, vol. 108, no. 2798, Aug. 15, 1919, pp. 204-206, 4 figs. The relation of apparent to virtual calibration function.

CALORIMETERS. An Adiabatic Bomb Calorimeter, E. B. Holland, J. C. Reed, and J. P. Buckley. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 190-191, 1 fig. Adapting Berthelot-Mahler-Kroecker calorimeter to control of temperature required in adiabatic work by fitting it with double-walled copper jacket.

COAL WEIGHING. Weighing Methods for Boiler Plants. Coal Trade Jl., vol. 50, no. 34, Aug. 20, 1919, pp. 1015-1017, 2 figs. Descriptions of various methods and devices for use in weighing coal consumed at boiler plants.

DYNAMOMETERS. Commercial Dynamometers — XIII, P. Field Foster. Mech. World, vol. 66, no. 1699, July 25, 1919, pp. 43-44, 8 figs. Bevis and Gibson flash-light meter built on optical principle. (Continuation of serial.)

GAS METERS. *See Meters.*

INDICATORS. Indicator and Indicator Diagram (Der Indikator und das Indikator-diagramm), W. Wilke. Prometheus, vol. 27, no. 30, Apr. 22, 1919, pp. 472-476, 11 figs. Construction of recent types, with special reference to those made by Rosenkranz, Schaffer & Budenberg, Lehmann & Michels and Maihak.

METERS, AIR AND GAS. Differential Pressure Meters for Measuring Air, Gas and Steam Flows, John L. Hodson. Chem. Industry, vol. 38, no. 14, July 31, 1919, pp. 222T-228T, 8 figs. "Curved Tube" manometer developed by writre for use with pitot tube. It consists of reservoir containing oil, which is connected to upstream pressure hole and curved tube connected to downstream pressure hole, and so shaped that equal increments in velocity past pitot tip will cause equal movements of oil meniscus along its length.

MICROMETER, FLUID GAGE. The Prestometer Fluid Gage, Charles E. Coats, Inspector, vol. 1, no. 3, Aug. 15, 1919, pp. 5-8, 10 figs. Liquid micrometer gage. Deflection of center of diaphragm causes liquid to leap up in tubes Least count of instrument said to be 0.001 in.

PRESTOMETER GAGE. *See Micrometer, Fluid Gage.*

PYROMETERS. Temperature Indicating and Controlling Systems, Franklin D. Jones, Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1138-1145, 16 figs. Pyrometers for controlling furnace temperatures automatically and for recording the temperature variations in a single furnace or in several furnaces which are successively connected with the recording instrument. Second article.

Devices and Methods for Measuring High and Low Temperatures with Special Reference to Engineering Problems, Herman Henry Albers. Stevens Indicator, vol. 36, no. 2, April 1919, pp. 67-103, 31 figs. Classified and discussed according to basic principles upon which they operate. Recommendations offered for selecting instrument or method best suited for various specific purposes.

SCALES. *See Coal Weighing.*

MECHANICS

ACCELERATION, INFINITE. Infinite Acceleration, A. Johnson. Automobile Engr., vol. 9, no. 129, Aug. 1919, pp. 245-246, 1 fig. Technical illustration of serious character of stresses developed in mechanism notably of kind where operation of cams is involved, when velocity of part is suddenly changed from zero to some finite magnitude.

BEAMS, FERRO-CONCRETE. The Design of Continuous Beams in Ferro-Concrete, H. Brodrick. Soc. Engrs., vol. 10, no. 6, 1919, pp. 199-211, 8 figs., partly on supp. plate. Review of comparison of methods adopted by different designers particularly in dealing with question of minimum deformatioon.

CATENARY. The Catenary in Engineering (Die Kettenlinie im Ingenieurwesen), J. Brunner. Schweizerische Bauzeitung, vol. 74, no. 2, July 12, 1919, pp. 13-14, 5 figs. Practical application in constructions involving long stretched cables, chains or wires.

CENTRIFUGALS, SUGAR, PRESSURE IN. Pressure in Sugar Centrifugals, J. J. Munson. Sugar, vol. 21, no. 8, Aug. 1919, pp. 410-411, 1 fig. Calculation of factors which determine total pressure exerted on top of centrifugal.

COLUMNS, ENGINE. The Design of Engine Columns—I, W. K. Wilson. Mach. World, vol. 66, no. 1701, Aug. 8, 1919, p. 66, 2 figs. Calculation of bending stresses.

CRANKSHAFT, WHIRLING. The Whirling of a Crankshaft J. Morris, Aeronautics, vol. 17, no. 299, July 10, 1919, pp. 45-46, 2 figs. Illustrates method of determining whirling speed by application to case of single-cranked crankshaft.

Graphical Velocity of Shaft (Velocità critiche), P. E. Brunelli. Revista Marittima, vol. 52, no. 6, June 30, 1919, pp. 307-344, 6 figs. Calculations and formulæ.

EQUALIZERS AND HITCHES. Equalizers and Hitches, E. A. White. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 124-135, 11 figs. Mechanical analysis of distribution of pull between draft animals.
See also Farm Machinery.

HITCHES. *See Equalizers and Hitches.*

KNIFE EDGES UNDER PRESSURE. The Form of Knife Edges Under Pressure, C. A. Briggs. Scale Jl., vol. 5, no. 11, Aug. 10, 1919, p. 7, 3 figs. Experiments made with gelatin cubes placed against gelatin plate interpreted as representing on highly magnified scale what takes place with steel knife edges.

PLANE LAMINA, TWO-DIMENSIONAL MOTION. The two-Dimensional Motion of a Plane Lamina in a Resisting Medium, S. Brodetzky. Proc. Roy. Soc., vol. 95, no. A-673, July 15, 1919, pp. 516-532, 9 figs. Mechanics of problem.

SHAFTS, CRITICAL SPEED. *See also Crankshaft Whirling.*

STRESSES. *See Accelaration, Infinite.*

STRESS, COMBINED, THEORY. Practical Application of the Combined Stress Theory, N. Barnes Hunt. Machy, (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1171-1172. Formula based upon true stresses in structural members and applicable to cases where an axial tensile or compressive stress acts in combination with a transverse shearing stress. Reference is made to Mansfield Merriman's Mechanics of Materials, and discussion of combined stresses by A. Lewis Jenkins in Jl. Am. Soc. Mech. Engrs. for August 1917.

WET SAND, ANGLE OF REPOSE. On the Angle of Repose of Wet Sand, A. G. Webster Proc. Nat. Acad. Sciences, vol. 5, no. 7, July 1919, pp. 263-265, 1 fig. Experiments gave 33 deg. for dry sand and various other values for moist sand, including 12 deg. for composition of 10 lb. of sand and 5 lb. water.

MECHANICAL PROCESSES

ABRASIVE WHEELS. The Manufacture of Abrasive Wheels, S. C. Linbarger. Jl. Am. Ceramic Soc., vol. 2, no. 8, Aug. 1919, pp. 638-646. Account of process.

DRYING. Drying by Heat in Conjunction with Mechanical Agitation and Spreading, Eustace A. Alliott. Jl. Soc. Chem. Indus., vol 38, no. 13, July 15, 1919, pp. 173T-183T, and (discussion), pp. 183T-185T, 24 figs. Report of experiments performed to determine influence of both initial and final moisture on length of drying and other factors.

GLASS POTS. Note on the Casting of Porcelain Glass Pots, J. W. Wright and D. H. Fuller. Jl. Am. Ceramic Soc., vol. 2, no. 8, Aug. 1919, pp. 659-663. Mixtures used in Pittsburgh Laboratory by Bur. of Standards.

The Equipment of a Casting Plant for the Manufacture of Glass Pots, Frank H. Riddle. Jl. Am. Ceramic Soc., vol. 2, no. 8, Aug. 1919, pp. 647-658, 5 figs. Proposed plans for plant suitable for casting ten 600-lb. glass pots per day.

HOT-ROLLING. Theories of Hot-Rolling (Les théories du laminage à chaud), P. Maringer. Revue Universelle des Mines de la Métallurgie, vol. 1, no. 2, Feb. 1919, pp. 177-308, 105 figs. Physical study of phenomena which takes place in steel. (To be continued.)

INTERCHANGEABLE MANUFACTURE. Principles of Interchangeable Manufacturing—I, Earle Buckingham. Machy. (Lond.), vol. 14, no. 355, July 17, 1919, pp. 466-471. Economy of interchangeable manufacturing. Design as it affects success in interchangeable manufacturing. Manufacturing tolerances. Production problems as related to interchangeable manufacturing.

INTERNAL GEAR, WILLIAMS. The Williams Internal Gear, Reginald Trautschold. Am. Mach., vol. 51, no. 6, Aug. 7, 1919, pp. 255-258, 4 figs. Notes on manufacture of Williams gear and its comparison with other forms in regard to economy and simplicity.

MACHINERY, VARIOUS, MANUFACTURE OF. Manufacture of Machinery at Plant of C. F. Braun & Company. Metal Trades, vol. 10, no. 8, Aug. 1919, pp. 339-343, 18 figs. Company manufactures pumps, both reciprocating and centrifugal, heat exchanges, including condensers, feedwater heaters, oil coolers and heaters, cooling towers, evaporators, and smaller specialties.

MOTORCYCLES. Motorcycle Production has peculiar problems, P. M. Heldt. Automobile Industries, vol. 41, no. 6, Aug. 7, 1919, pp. 259-264, 17 figs. Methods of forming side-car panels and electroplating installation mentioned as peculiar to this industry.

ROLLER BEARINGS. Making Roller Bearings — I. Machy. (Lond.), vol. 14, no. 356, July 24, 1919, pp. 498-503, 13 figs. Methods of heat-treating and inspecting Timken roller bearings.

SHEET MANUFACTURE. Features of the Iron and Steel Sheet Industry. Raw Material, vol. 1, no. 5, July 1919, pp. 255-260, 6 figs. Recommends careful selection of base matal in sheet bars. (To be continued.)

Manufacture of Sheet Iron in South Russia (La Fabrication des tôles minces dans la Russie méridionale). Génie Civil, vol. 75, no. 2, July 12, 1919, pp. 34-36, 2 figs. Scheme showing arrangement of machines at work at Briansk and Taganrog. (Concluded.)

SPROCKET CHAIN. Making Diamond Sprocket Chain, Edward K. Hammond. Machy (N. Y.). vol. 25, no. 12, Aug. 1919, pp. 1165-1170, 9 figs. Operations involved in making no. 9 bicycle chain at works of Diamond Chain & Mfg. Co., Indianapolis. Number corresponds to standards prepared by Chain Standards Committee of Am. Soc. Mech. Engrs. and Soc. Automotive Engrs. First of two articles.

TURBO-GEAR MANUFACTURE. Turbo-Gear Manufacture, E. A. Suverkrop. Am. Mach., vol. 51, no. 8, Aug. 21, 1919, pp. 357-363, 22 figs. By Poole Eng. and Machine Co., of Baltimore. Mechanism is of planet internal-ring gear type and is comparatively light in weight.

TURBINE, SMALL STEAM, MANUFACTURE. Problems in Designing Small Turbines for Industrial Purposes, Sanford A. Moss. Gen. Elec. Rev., vol. 22, no. 8, Aug. 1919, pp. 620-630, 19 figs. Manufacture on quantity basis of type L turbines from standardized and interchangeable parts.

WHEELS, CAST-IRON. The Manufacture of Cast Steel Road Wheels. Engineer, vol. 128, no. 3314, July 4, 1919, pp. 5-6 and 12, 11 figs. Foundry at works of Thwaites Brothers, Ltd., of Bradford, England. It is said that during war material used for casting consisted of some 80 per cent of steel turnings, remainder being scrap.

WILLIAMS INTERNAL GEAR. *See Internal Gear.*

MOTOR-CAR ENGINEERING

ALBION. The Albion 30 Cwt. Chassis. Motor Traction, vol. 29, no. 750, July 16, 1919, pp. 47-48, 5 figs. Disign allowing of alternative gears to suit different purposes.

Austin. The New 20 h.p. Austin. Autocar, vol. 43, no. 1241, Aug. 2, 1919, pp. 161-165, 13 figs. Specifications: Four cylinders, 95 x 127 mm. bore and stroke (3601 cc.); unit construction, light balanced reciprocating parts; single-plate clutch; spiral bevel final drive; semi-elliptic springs.

British Tractors. Originality in Design Shown in New British Tractors. Automotive Industries, vol. 41, no. 6, Aug. 7, 1919, pp. 253-255, 4 figs. Notes on tractor exhibit at Annual Show of Royal Agricultural Society.

Caterpillar Vehicle, Steering, of. Steering of Caterpillar Vehicles (Das Steuern von Raupenfahrzeugen), E. Seiler. Motor-wagen, vol. 22, no. 9, Mar. 31, 1919, pp. 162-164, 4 figs. Difficulties in short curves considered as due to impossibility of entirely cutting out one of caterpillars and braking it efficiently, so that vehicle can turn when other caterpillar chain is accelerated.

Cleveland. Specially Designed Engine and Axle for Cleveland Car. Automotive Industries, vol. 41, no. 7, Aug. 14, 1919, pp. 304-306, 7 figs. Engine is six-cylinder, block-cast, with overhead valve; camshaft is in crankcase and valves in line in head assembly.

Darracq. The New 15 h.p. Darracq. Autocar, vol. 43, no. 1241, Aug. 2, 1919, pp. 177-178, 5 figs. Features of 1919 model of French firm.

Enfield-Allday. Unconventional Design of a British After-War Car. Automotive Industries, vol. 41, no. 7, Aug. 14. 1919, pp. 312-315, 7 figs. Enfield-Allday with five-cylinder, radial, air-cooled engine.

A British Light Car. Engines, vol. 128, no. 3315, July 11, 1919, pp. 40-41, 5 figs. Fitted with five-cylinder, radial air-cooled engine. Chassis weights 7 cwt.

Kerosene for Farm Tractors. Kerosene as a Fuel for Farm Tractors, John A. Secor. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 171-187. Summary of experiments and research, and conclusions in regard to possibilities and future developments.

Military Transport Chassis. Military Transport Chassis-XVI. Automobile Engr., vol. 9, no. 129, Aug. 1919, pp. 241-244, 5 figs. Performance of 40-hp. Pagefield W. D. type chassis under war condtions. Article refers to development of this type of heavy motor vehicle as interesting example resulting from the war.

Military Trucks, German. Extremely Heavy Frames for German Military Trucks-III, Arthur J. Slade. Automotive Industries, vol. 41, no. 8, Aug. 21, 1919, pp. 360-363, 5 figs. Sketches of most notable of frames handed over by Germans to A. E. F. Writer remarks that there was little effort at standardization and that some unimportant features required special dies.

No Standardization of Parts of the German Army Trucks-II, Arthur J. Slade. Automotive Industries, vol. 41, no. 7, Aug. 14, 1919, pp. 307-311, 12 figs. Tabulation of 47 types as to weight and drives. Attention is called to lack of standardization and difficulty in making repairs. Article based on study of German trucks delivered to A. E. F.

Morris. Morris 1919 Light Cars. Autocar, vol. 43, no. 1241, Aug. 2, 1919, pp. 169-172, 10 figs. Morris-Oxford and Morris-Cowley models. Specifications; 11.9 hp., four cylinders, 69 x 100 mm. bore and stroke (1495 cc.); engine and gear box in one unit; multiplate clutch; three speed and reverse gear box; spiral bevel final drive.

Radial-Engined Car. *See Enfield-Allday.*

Reo. Revised Manifold and Detachable Head among Reo Engine Changes, J. Edward Schipper. Automotive Industries, vol. 41, no. 6, Aug. 7, 1919, pp. 256-258, 4 figs. Changes in design claimed to provide greater vaporization of fuel, increased accessibility of intake valve assembly, increased engine speed and cleaner design.

Standardization. *See Military Trucks, German.*

Steering. *See Caterpillar Vehicle, Steering.*

Tire Substitutes. Tire Substitutes. Autocar, vol. 43, no. 1240, July 26, 1919, p. 120, 7 figs. Emergency spring wheels used by German transport vehicles.

Trailers. Trailer Lessons from the Allied Army Service, W. F. Bradley. Automotive Industries, vol. 41, no. 8, Aug. 21, 1919, pp. 354-359, 13 figs. Writer claims that automobile trailers in use with ordinary trucks having normal capacity of 1.5 to 5 tons proved valuable during war as means of economizing cost of road transportation.

Trucks, Electric. Electric Trucks, J. Humphrey. Iron & Coal Trades Rev., vol. 99, no. 2680, July 11, 1919, pp. 46-47, 2 figs. General features of types made by various firms.

Wheels, Steel Truck. Steel Truck Wheels, P. Klinger. Jl. Soc. Automotive Engrs., vol. 5, no. 2, Aug. 1919, pp. 160-161. Strength of wood and metal wheels compared.

PIPE

Concrete Sewage Pipe. Large Concrete Sewage Pipe, Eng. World, vol. 15, no. 3, Aug. 1, 1919, pp. 40-42, 9 figs. Units are 72 in. inside diameter, 8 ft. long, with wall thickness of 7 in., and are designed to carry sewage at pressure of 20 lb. per sq. in.

Fuel Pipeline. The Admiralty Oil Fuel Pipeline. Petroleum Times, vol. 2, no. 28, July 19, 1919, pp. 53-56, 4 figs. System is divided into three sections each approximately 12 miles in length. Details of line and of pumping stations are given.

Steel Pipe. Machinery and Pipe Arrangement-XIX, C. C. Pounder. Mech. World, vol. 66. no. 1698, July 18, 1919, pp. 31-32, 5 figs. Deciding on pipe lengths when designing steel pipes.

POWER GENERATION

Bavarian System. Central Station of Walchen Lake and Bavarian System of Electric Distribution at 100,000 (La station centrale du lac, Walchen et le réseau bavarois de distribution d'électricité à 100,000 volts). Génie Civil, vol. 75, no. 3, July 19, 1919, pp. 61-62, 2 figs. System extends over 250 miles; aluminum overhead conductors used. From Frankfurter Zeitung (technical supp.) April 18, 1919.

Water Power in Bavaria (Bayerns Wasserkrafte und die deutsche Volkswirtschaft), K. Meyer. Technik u. Wirtschaft, vol. 12, no. 4, April 1919, pp. 195-205. According to writer's calculations the total amount of power that could be used by German industries is around 1,800,000 hp. in Bavaria alone.

Canada. Hydro-Electric Development on the Seguin River. Can. Engr., vol. 37, no. 8, Aug. 21, 1919, pp. 231-234, 11 figs. Municipally-owned plant being constructed for town of Parry Sound Ont., designed to generate from 2200 to 2900 hp. Dam is of gravity type and is made of concrete.

Electric Power Collection. Electric Power Collection, Chas. P. Steinmetz. Gen Elec. Rev., vol. 22, no. 8, Aug. 1919, pp. 565-567. Proposes use of small generator installations with simple switches and fuses to make use of our small water powers and thus conserve our furl resources.

Foreign Water Power. Water Power on the Farm, J. S. Fitz, Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 88-96, 8 figs. Consideratious in regard to choosing a suitable site for water power development.

France, Laws. New Law Regarding Utilization of Hydraulic Energy (Le nouveau projet de loi sur les forces hydrauliques). Industrie Electrique, vol. 28, no. 651, Aug. 10, 1919, pp. 283-290. General conditions of exploitation and classification of hydraulic enterprises.(Continuation of serial.)

Legislation Relative to Utilization of Hydraulic Energy in France (Le régime légal des chutes d'eau en France), G. Tochon. Génie Civil, vol. 75, no. 3, July 19, 1919, pp. 51-56. Project adopted by Chamber of Deputies on July 10, 1919. (Concluded.)

Iowa. Utilizing Old Mills for Hydroelectric Power Plants, F. L. Clark. Elec. Rev., vol. 75, no. 5, Aug. 2, 1919, pp. 181-182, 2 figs. Iowa electric transmission lines supplying farming districts.

Japan. The Undeveloped Water Powers of Japan, Hachiji Higo. Jl. Electricity, vol. 43, no. 4, Aug. 15, 1919, pp. 163-164, 2 figs. Data presented in official report of Director-General of Bureau of Electrical Exploitation of Japan.

New England. New England Hydroelectric Developments. Eng. World, vol. 15, no. 3, Aug. 1, 1919, pp. 46-49, 5 figs. Includes description of expansion joints used at Rumford Falls, Me.

New Hampshire. Potential Waterpower and Coal Saving. Elec. World, vol. 74, no. 8, Aug. 23, 1919, pp. 401-404, 3 figs. U. S. Geol. Survey field investigations and engineering estimates place available utilization of additional storage sites in New Hampshire at 490,000,000 hp-hr. more yearly than is now produced in Connecticut and Merrimac Rivers.

New Zealand. Hydroelectric Development in Canterbury, New Zealand, L. Birks. Jl. Electricity, vol. 43, no. 4, Aug. 15, 1919, pp. 155-156, 2 figs. Outline of scheme to utilize outlet of lake, carrying normally 100 to 200 cusecs of water, at site 500 ft. below lake level.

St. Maurice River. Power Developments on the St. Maurice River, F. T. Kaelin. Can. Chem., Jl., vol. 3, no. 8, Aug. 1919, pp. 245-249, 3 figs. At Shawinigan Falls. Combined generating capacity is 330,000 hp. Further developments are excepted to raise this to over 600,000 hp.

POWER PLANTS

Ash Removal. The Mechanical Removal of Ashes from Power Houses, George Frederick Zimmer. Eng. & Indus. Management, vol. 2, no. 7, Aug. 14, 1919, pp. 217-222, 7 figs. Methods of handling ashes mechanically, independently of use of gravity buckets on similar conveyors.

Boilers, Heat Absorption. Factors Affecting Heat Absorption of Boilers, Robert June. Elec. Rev., vol. 75, no. 7, Aug. 16, 1919, pp. 270-273, 5 figs. Also Cement, Mill & Quarry, vol. 15, no. 4, Aug. 20, 1919, pp. 41-45, 5 figs. Advantages of machanical soot blowers.

Boiler-Plant Data. Exact Data on the Running of Steam Boiler Plants, D. Brownlie. Engineering, vol. 108, nos. 2795 and 2796, July 25, and Aug. 1, 1919, pp. 101-104 and 138-139, table on supplement plate. Working details of 100 typical colliery steam boiler plants in Great Britain presented as contribution to fund of specialized knowledge writer considers it is necessary to accumulate in order to undertake efficiently question of national coal economy.

Coal Analyses. Coal Analyses Made at the Power Plant, E. D. Hummel. Power, vol. 50, no. 9, Aug. 26, 1919, pp. 332-335, 5 figs. Proposed method with Parr standard calorimeter and Parr sulphur photometer.

Condensers. *See Turbines.*

Notes on Surface Condensing Plants, with Special Reference to the Requirements of Large Power Stations, R. J. Kaula. Jl. Instn. Elec. Engrs., vol. 57, no. 283, June 1919, pp. 440-446, and (discussion) pp. 447-464. Suggests use of parallel-flow principle on syphonic circulating-water systems; recommendations also made concerning selection of material for various units and in regard to operating practices.

Culm. The Puget Sound Traction, Light and Power Company's Pulverized Coal Plant. Stone & Webster Jl., vol. 25, no. 2, Aug. 1919, pp. 96-109. Results of tests and availability of culm dump of over 225,000 tons led to decision to use pulverized coal as fuel for plant.

Domes, Manholes and Nozzles. Domes, Manhole and Steam Nozzles, W. H. Wakeman. Power, vol. 50, no. 9, Aug. 26, 1919, pp. 338-339, 11 figs. Writer's experience with various forms in present use.

ECONOMIZERS. Performance Tests of Economizers, B. M. Baxter. Power, vol. 50, no. 8, Aug. 19, 1919, pp. 299-300. Suggested method of making and reporting economic tests.

FEED WATER. Curing Boiler Trouble Due to Impure Water, J. N. Helpenbringer. Elec. World, vol. 74, no. 6, Aug. 9, 1919, pp. 296-297, 2 figs. Experiments made in Kansas City plant that are said to have shown how to prevent priming in water-tube boilers of vertical tube type at an average cost of $645 per boiler.

GRATES. Fletcher's Rolling-Bar Furnace Grate. Engineering, vol. 108, no. 2798, Aug. 15, 1919, pp. 208-209, 3 figs. Intended to obviate difficulties experienced when burning coal containing high percentage of ash.

MANHOLES. *See Domes, Manholes and Nozzles.*

NOZZLES. *See Domes, Manholes and Nozzles.*

PLANT REVAMPING. Making Three Boilers Do the Work of Five, J. J. Spangler. Power, vol. 50, no. 6, Aug. 5, 1919, pp. 206-208, 6 figs. Accomplished, it is said, by revamping plaut.

STEAM ECONOMY. Steam Economy of Power Plants, James M. Taggart. Steam, vol. 23, no. 2. August 1919, pp. 36-37, 1 fig. Curves for efficiency and power equivalent. Initial pressure and back pressure are taken as constants.

STOKERS. The Functioning of the Chain-Grate Stoker, T. A. Marsh. Power, vol. 50, no. 9, Aug. 26, 1919, pp. 342-344, 5 figs. Including analysis showing why ash is always at bottom of fuel bed.

SUPERHEATERS. Superheaters at British Collieries, M. Meredith. Coal Age, vol. 16, no. 7, Aug. 14, 1919, pp. 267-268. Said to have resulted in effecting considerable economy in coal..

TURBINES. Turbines and Condensers. Power Plant Eng., vol. 23, no. 16, Aug. 15, 1919, pp. 718-721, 2 figs. Abstract of report of Committee on Prime Movers read before Nat. Elec. Light Assn.

VACUUM SYSTEM. Vacuum — I. Roger Taylor. Power Plant Eng., vol. 23, no. 16, Aug. 15, 1919, pp. 716-717, 2 figs. Technicalities of vacuum system in power-plant practice.

WASTE HEAT. Fuel Economy in Power Production, W. T. Lane. Proc. South Wales Inst. of Engrs., vol. 35, no. 1, July 18, 1919, pp. 171-210, 11 figs. Also Colliery Guardian, vol. 118, no. 30-38, Aug. 8, 1919, pp. 360-361, 2 figs. Description of Draper washer and discussion of utilization of waste heat in relation to carbonization and generation of steam.

POWER TRANSMISSION

BELTING. WhyBelting is Superior to Individual Electric Drives, Harrington Emerson. Belting, vol. 15, no. 4, Aug. 20, 1919, pp. 21-23. Electric drive described as luxurious magnificence, actual usage being cited to show economy of belting.

ROPE DRIVER. Manilla Rope Drives, H. T. Hesselmeyer. Metal Trades, vol. 10, no. 8, Aug. 1919, pp. 351-354, 3 figs. Advantages claimed care required in installation, and performance obtained.

PRODUCER GAS

SUCTION GAS TRACTION. Suction Gas Traction. Motor Traction, vol. 29, no. 753, Aug. 6, 1919, pp. 122-124, 2 figs. Report of Gas Traction Committee upon results or road tests of different producer-plant systems. Some of tests were conducted in conjunction with War Department.

PUMPS

CALUMET PUMPING STATION. Calumet Pumping Station and intercepting Sewer, W. T. Christine. Eng. World, vol. 15, no. 4, Aug. 15, 1919, pp. 23-27, 11 figs. Steel building with brick and stone finish, 80 x 185 ft. and about 56 ft. high. Pumping arrangement and features of plant outlined.

CENTRIFUGAL-PUMP TESTS. High Efficiency Pumping Units, F. W. Capellen. Power Plant Eng., 23, no. 16, Aug. 15, 1919, pp. 725-726, 2 figs. Official tests of motor-driven centrifugal pumps at Minneapolis are said to have shown high efficiency and low cost, using off-peak current.

History of the Principles of Centrifugal Pumps, J. H. Moore. Can.Machy., vol. 22, no. 6, Aug. 7, 1919, pp. 151-156, 10 figs. Description of Rees-Ro-Turbo type of water pump. Design comprises a single or a series of pressure drums (number depending on nature of work), rotating inside cast-iron casing at high speed.

PUMPING MACHINERY OF A. E. F. Pumping Machinery Used by the Service of Supply of the American Expeditionary Forces in France, W. B. Gregory. Proc. In Eng. Soc., vol. 5, no. 3, June 1919, pp. 208-215, Records of operation.

PUMP TROUBLES. Pump Troubles, Charles Labbe. Eng. & Min. Jl., vol. 108, no. 6, Aug. 9, 1919, pp. 217-222, 1 fig. Suggestions in regard to installation and operation of pumps.

QUARRY PUMPS. Pumps in Quarry Service — II. Stone, vol. 40, no. 8, Aug. 1919, pp. 361-362, 2 figs. Experiences at various quarries.

REFRACTORIES

CLAY. On the Effect of Extraction Upon the Plasticity of Clay, W. A. Homer and H. E. Gill. Jl. Am. Ceramic Soc., vol. 2, no. 8, Aug. 1919, pp. 595-601. It was found experimentally that a certain place after being treated with organic solvents was less plastic than original materials.

A Study of Some Light-Weight Clay Refractories, M. F. Beecher. Jl. Am. Ceramic Soc., vol. 2, no. 5, May 1919, pp. 336-350 and (discussion), 350-355, 3 figs. Experiments established that working prroperties and drying behavior of a fire clay mixture are affected by additions of sawdust in same manner as by additions of grog.

FIREBRICK. Preventable Defects on Fire Brick, C. E. Nesbitt and M. L. Bell. Iron Trade Rev., vol. 65, no. 7, Aug. 14, 1919, pp. 423-426, 9 figs. Illustrating how irregularities in bricks may be detected by careful visual inspection and by other means. Paper presented at meeting of Am. Soc. for Testing Materials.

PORCELAINS. A Study of High-Fire Porcelains, Chi C. Lin. Jl. Am. Ceramic Soc., vol. 2, no.8, Aug. 1919, pp.622-637, 3 figs. Results of investigation to determine effect of composition on strength.

Japanese Porcelains from Chemical Point of View, and How to Improve Them. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 183-185. Indicating ranges of chemical composition both in bodies and glazes, which analyses show to be much wider than has been believed by ceramists.

The Progress of Vitrification and Solution in Some Porcelain Mixtures, Arthur S. Watts. Jl. Am. Ceramic Soc., vol. 2, no. 5, May 1919, pp. 400-409, 7 figs. Microscopic examinations interpreted as indicating that development of sillimanite starts in feldspar grains and progresses as fusion progresses.

Special Spark-Plug Porcelains, A. V. Bleininger and F. H. Riddle. Jl. Am. Ceramic Soc., vol. 2, no. 7, July 1919, pp. 564-575. Experimental tests claimed to have shown injurious quality imparted to electrical porcelains by use of feldspar as flux, and desirability of replacing quartz by minerals or synthetically prepared materials which are more constant in volume when heated.

REFRIGERATION

COMPRESSORS, AMMONIA, RACING OF. Unusual Causes of Racing of Ammonia Compressors, E. W. Miller. Power, vol. 50, no. 8, Aug. 19, 1919, pp. 298-299. Following causes mentioned: Dry compressor valves sticking at extreme of travel; working loose of valve disk in section line shutting off flow of gas; breaking of springs holding false head in place.

ECONOMY. Refrigerating Plant Efficiency, George T. Taylor. Refrig. World, vol. 54, no. 8, Aug. 1919, pp. 27-28 & 35. Helpful rules and information of correct proportioning considered as one of essentials for maximum plant economy.

ICE MACHINES, DENSE-AIR. Experience with a Dense-Air Ice Machine, C. H. Willey. Power Plant Eng., vol. 23, no. 16, Aug. 15, 1919, pp. 732-734, 1 fig. Diagram of dense-air ice machine and suggestions in regard to its operation.

ICE PLANT. Electrically Driven Raw Water Ice Making Plant. Ice & Refrigeration, vol. 57, no. 2, Aug. 1, 1919, pp. 45-50, 8 figs. Plant is of 120 tons daily capacity, using 400-lb. stationary cans. The ice dumps are placed in center of tank room.

See also Ice Machines, Dense-Air; Methyl Chloride Ice Machines.

METHYL CHLORINE ICE MACHINES. Methyl Chloride Ice Machines, Charles H. Herter. Refrig. World, vol. 54, no. 8, Aug. 1919, pp. 12-14. Data concerning chemical action of ethyl and methyl chlorides upon cast iron.

NON-CONDENSIBLE GASES. Non-Condensible Gases, John E. Starr. Refrig. World, vol. 54, no. 8, Aug. 1919, pp. 11-12. Reasons and suggested remedies for troubles experienced with non-condensible gases in absorption machinery.

PACKING-HOUSE REFRIGERATING PLANT. Making a Packing-House Refrigerating Plant Carry Its Load, J. C. Moran. Power, vol. 50, no. 9, Aug. 26, 1919, pp. 328-329, 2 figs. Unable to put more coil surface in the coolers, brine circulation over the direct-expansion coils was provided and the temperatures lowered and maintained.

SHIPS, REFRIGERATOR. Equipped Nine Refrigerator Ships. Mar. Rev., vol. 49, no. 9, Sept. 1919, pp. 417-418, 4 figs. How nine ships of 6400 deadweight tons each, which were commandeered by Shipping Board at outbreak of the war, were fitted out with insulating material and cooling coils.

VAPOR REFRIGERATION PROCESSES. Vapour Refrigeration Processes, P. Ostertag. Cold Storage, vol. 22, no. 256, July 17, 1919, pp. 177-180, 8 figs. Entropy diagrams. From Schweizerische Bauzeitung.

RESEARCH

HIGH VOLTAGE LABORATORY. *See Purdue University.*

LAUSANNE UNIVERSITY. Mechanical, Physical and Chemical Testing Laboratory of Engineering School of Lausanne University (Le laboratoire d'essais mécaniques, physiques et chimiques de l'école d'ingénieurs de l'Université à Lausanne). Bulletin Technique de la Suisse Romande, vol. 45, nos. 14 and 15, July 12 and 26, 1919, pp. 137 and 148-151, 6 figs. July 12: Torsion machine, July 26: Apparatus for taking photomicrographs of metals.

NATIONAL PHYSICAL LABORATORY. The National Physical Laboratory. Engineering, vol. 108, no. 2795, July 25, 1919, pp. 107-108. Thermometer-testing; radium and X-ray work. (Concluded.)

PURDUE UNIVERSITY. High-Voltage Laboratory at Purdue University, C. Francis Harding. Elec. World, vol. 74, no. 6, Aug. 9, 1919, pp. 284-285, 2 figs. Design and layout of equipment intended for investigation and testing with potentials up to 600,000 volts.

RESEARCH WORK RESULTS. How Research Work Brings Results, H. E. Diller. Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 545-549, 10 figs. Experiments at laboratories of General Elec. Co. undertaken primarily to develop control system for electric furnaces brought benefits in unexpected directions.

WORKS TESTING LABORATORY. Equipment of a Works Testing Laboratory, H. S. Primrose. Metal Industry, vol. 15, no. 3, July 18, 1919, pp. 41-44, 4 figs. Recommendations in regard to selection of equipment and co-ordinating work.

Money Saved by Testing Laboratory, H. R. Simonds. Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 556-559, 9 figs. Practice of Eastern Malleable Iron Co. in watching compositions of pig iron and of finished product in order to prevent undue irregularity of metal in castings.

SPECIFICATIONS

Plates for Tank-Car Construction. Specifications for Plates for Forge-Welding in Tank-Car Construction. Ry. Mech. Engr., vol. 93, no. 8, Aug. 1919, pp. 477-478. From report of sub-committee II of committee A-1 on steel, presented at annual meeting of Am. Soc. of Heat Treating Materials.

STANDARDS AND STANDARDIZATION

Machine Parts. Standardization of Machine Parts (Die Normalisierung der Maschinenelemente). Zietschrift f. die gesamte Giessereipraxis, vol. 40, no. 10, Mar. 8, 1919, pp. 121-122. Standardization Committee appointed by Soc. of German Engineers has already started to publish standard specifications for such articles as split couplings, flange couplings, wall brackets, boiler rivets, etc.

STEAM ENGINEERING

Alignment Chart for Steam. Alignment Chart for Finding the Properties of Saturated and Superheated Steam, Clinton E. Pearce. Power, vol. 50, no. 6, Aug. 5, 1919, pp. 224-227, 1 fig. Construction of chart explained and its application to various problems illustrated.

Boiler Horsepower Chart. Boiler Horsepower, R. L. Wales. Natl. Engr., vol. 23, no. 8, Aug. 1919, pp. 392-396, 3 figs. Graph for computing horsepower.

Boilers, Surface Combustion. Recent Developments in Surface Combustion Boilers, William A. Bone. Chem. Industry, vol. 38, no. 14, July 31, 1919, pp. 228T-233T and (discussion) 233T-234T, 10 figs. Experiments which led to introduction of Bonecourt system of surface combustion.

Steam Chart. *See Alignment Chart.*

Turbine Machinery for Destroyers. Development of Turbine Machinery for Torpedo-Boat Destroyers. Engineering, vol. 108, no. 2796, Aug. 1, 1919, pp. 139-140 and 148, 4 figs. on two supplement plates. Progress in (1) reduction of weight of plant and space occupied, (2) more economical generation of power, and (3) improvement in manœuvring and sea-keeping capabilities of vessel.

VARIA

Chemical Federation, Inter-Allied. Inter-Allied Chemical Federation, William Pope. Chem. Industry, vol. 38, no. 14, July 31, 1919, pp. 208T-211T and (discussion) 211T-212T. Its motives and objects.

Engineering Societies, Rand, South Africa. Notes on the Closer Working and Joint Housing of Technical and Scientific Societies on the Rand, Percy Cazalet. Jl. of Chem. Metallurgical and Min. Soc. of South Africa, vol. 19, no. 11, May 1919, pp. 228-238 and (discussion) pp. 238-240. Proposed scheme provides freedom of action for each society together with possibility of full amalgamation when time is ripe and evolution of some scheme of federation resulting "from the mere fact of joint and harmonious action over a period."

Engineers in Public Affairs. Civic Duties and Opportunities of the Engineer, Howard C. Parmelee. Eng. & Min. Jl., vol. 108, no. 8, Aug. 23, 1919, pp. 318-320. Value of scientific societies to Government. Advisability of utilizing services of engineers in public affairs.

Engineer's Work in South America. The Engineers' Part in the International Situation, Charles Lyon Chandler. Monad, vol. 4, no. 7, Aug. 1919, pp. 11-13. Examples of successful engineering enterprises in South America conducted by American engineers.

Fractional Notation. Fractional Notation. Automobile Engr., vol. 9, no. 129, Aug. 1919, pp. 246-247, 1 fig. Standard dimensions table suggested for use in conjunction with fortieth scales.

Government Machine Tools, Fixing Prices. Fixing Prices of Government Machine Tools. Iron Age, vol. 104, no. 6, Aug. 7, 1919, pp. 377-379, 3 figs. How selling prices are determined. Method and conditions of making sales of stocks of standard machines, both used and unused.

Instructional Factory, Loughborough Technical College. Loughborough Technical College Instructional Factory. Iron & Coal Trades Rev., vol. 99, no. 2684, Aug. 8, 1919, pp 172-174, 6 figs. Education of institution combining technical with practical training.

Interchangeable Manufacturing,Terminology. Terms Used in Interchangeable Manufacturing, Earle Buckingham. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1118-1121, 5 figs. Definitions of terms and illustration of meaning of some of them.

Patents. Patents in Relation to Industry. Elecn., vol. 83, no. 2151, Aug. 8, 1919, pp. 150-153. Conference held at British Sci. Products Exhibition.

Photometric Scale. The Photometric Scale, Herbert E. Ives. Jl. Franklin Inst., vol 188, no. 2, Aug. 1919, pp. 217-235, 3 figs. Compilation of data and practices relative to definitions, standards and photometric measures, with particular reference to work of Bureau of Standards.

WELDING

Arc Welding. *See Electric Welding.*

Electric Welding. Notes and Regulations for Arc Welding, H. M. Sayers. Eng. & Indus. Management, vol. 2, no. 4, July 24, 1919, pp. 107-109, 1 fig. Regulations for ship building practice drawn up by Admiralty Committee from records of experience in England and communications received by Admiralty from U. S. Research Committee.

Electric Arc Welding Methods, H. L. Unland. Elec. Ry. Jl., vol. 54, no. 7, Aug. 16, 1919, pp. 343-344, 4 figs. Function and practical operation of various types of equipment for carbon and metal-electrode welding.

Electric Arc Welding Equipment, H. L. Unland. Metal Trades, vol. 10, no. 8, Aug. 1919, pp. 355-359, 1 fig. Table showing approximate kilowatt-input required for various systems; also classification of different types of welding equipment and discussion of uses of each.

Electric Welding: Its Theory, Practice, Application and Economics, H. S. Marquand. Elecn., vol. 83, nos. 2149, 2150 and 2151, July 25, Aug. 1 and 8, 1919, pp 91-92, 116-118 and 139-141, 29 figs. July 25: Tests to determine strength of electrically welded flanges. Aug. 1: Examples of welding an anchor and locomotive frames. Aug. 8: Example of repairing main drive wheel of Atlantic type locomotive, in which three of spokes gave way by craking in neighborhood of coupling rod crankpin boss.

Electrodes. Composition of Electrodes. Iron Age, vol. 104, no. 8, Aug. 21, 1919, pp. 503-504, 8 figs. Tests to determine effect of chemical composition on physical characteristics of weld made by Wilson Welder and Metals Co., New York City.

Effects of Chemical Composition of the Electrode on the Welded Material, Decey Welder. Welding Engr., vol. 4, no. 8, Aug. 1919, pp. 42-44, 9 figs. Results of analysis.

Fusion Welding. Fusion Welding as Applied to Drop-Forging, S. W. Miller. Am. Mach., vol. 51, no. 8, Aug. 21, 1919, pp. 378-382, 29 figs. Consideration given to both electric-arc and oxy-acetylene processes. Physical effects that may occur in weld and in adjoining sections of metal due to heat developed and method of application of processes illustrated with photomicrographs.

Hydraulic-Press Cylinder, Welding of. Welding a Badly Broken Cylinder of a 200-Ton Capacity Hydraulic Press, Nels Johnson. Welding Engr., vol. 4, no. 8, Aug. 1919, pp. 34-36, 2 figs. Work done at Soo Line Railroad shops at Minneapolis, Minn.

Liberty Engine Welding Plant. Liberty Engine Welding Plant, Otis Allen Kenyon. Elec. World, vol. 74, no. 8, Aug. 23, 1919, pp. 396-399, 9 figs. Closed-circuit arc-welding system used to eliminate distortion. Description of joints which are adapted to this process. Special control boards and their operation.

Malleable-Iron Welding. Some Considerations Affecting the Welding of Malleable Iron, H. A. Schwartz. Welding Engr., vol. 4, no. 8, Aug. 1919, pp. 21-23, 9 figs. Photomicrographs illustrating various kinds of welds.

Oxy-Acetylene Welding. Filling Cavities and Putting on Parts by the Oxy-Acetylene Process, J. F. Springer. Ry. & Locomotive Eng., vol. 32, no. 8, Aug. 1919, pp. 233-234. Cases in which cavities in castings may be filled and thus save expense of recasting.

Oxy-Acetylene Welding Investigation, J. H. Davies. Can. Manufacturer, vol. 39, no. 8, Aug. 1919, pp. 33-34. Concerning conditions for securing good results; also results of carbon-steel experiments. Paper read before Instn. Mech. Engrs.

Building Special Work with an Oxygen-Acetylene Cutting and Welding Outfit, Montelle C. Smith. Elec. Ry. Jl., vol. 54, no. 7, Aug. 16, 1919, pp. 317-319, 8 figs. Construction of frogs, switches, switchmates, and similar work jobs.

Preparing Work. Preparing Work for Electric Arc Welding E. Wanamaker and H. R. Pennington. Ry. Elec. Engr., vol. 10, no. 8, Aug. 1919, pp. 265-270, 20 figs. Methods used for welds of various kinds, noting precautionary measures taken for expansion and contraction.

Wrought-Iron Welding. Welding Wrought Iron and Steel, H. L. Unland. Welding Engr., vol. 4, no. 8, Aug. 1919, pp. 52-56, 7 figs. Suggestions in regard to operating details. Also Iron Age, vol. 104, no. 6, Aug. 7, 1919, pp. 365-367, 3 figs.

WOOD

Wood Preservative Treatment. Modern Developments and Practical Details in the Preservative Treatment of Wood, Kurt C. Barth. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 75-87, 5 figs. Details of (1) pressure and (2) nonpressure processes. Also specifications for refined coal-tar creosote oil treatment of U. S. Shipping Board Emergency Fleet Corporation.

MINING ENGINEERING

BASE MATERIALS

Gypsum. Important Developments of Gypsum. Cement, Mill & Quarry, vol. 15, no. 3, Aug. 5, 1919, pp. 36-42. Tentative specifications for crude gypsum and calcined gypsum and for gypsum plasters proposed by Am. Soc. for Testing Materials Committee.

Genesis of the Gypsum Industry. Curtis F. Columbia. Cement, Mill & Quarry, vol. 15, no. 4, Aug. 20, 1919, pp. 27-32, 5 figs. Brief review of the origin, mineralogical properties and geological distribution of gypsum.

Lime. Chicago Union Lime Works Pit Deepest in Country, William B. Eastwood. Cement, Mill & Quarry, vol. 15, no. 3, Aug. 5, 1919, pp. 11-15, 6 figs. Shaft now reaches 320 ft. into dolomite deposit more than 1300 ft. in depth near center of city. Method of qurrrying indicated.

Magnesite. Developments in Magnesite Industry, W. C. Phalen. Cement, Mill & Quarry, vol. 15, no. 3, Aug. 5, 1919, pp. 27-30. Outline of salient features of domestic industry, as noted by writer on recent trip to various plants in California and Washington.

Phosphate Rock. Practice in Preparation of Phosphate Rock, R. W. Stone. Rock Products, vol. 22, no. 16, Aug. 2, 1919, pp. 40-42, 6 figs. Washing, drying and grinding processes.

COAL AND COKE

Allegheny River Mine. A Large Coal Mine on tbe Allegheny River, Ralph W. Mayer. Coal Age, vol. 16, no. 8, Aug. 21, 1919, pp. 316-318, 3 figs. Describing mining operations and various notes of mine. Output is 500,000 tons per year.

Carbon Fuel Company. Nine Mines of tbe Carbon Fuel Company, Black Diamond, vol. 63, no. 6, Aug. 9, 1919, pp. 126-138, 34 figs. Metbods of mining preparing and shipping coal. 1918 production of district approacbed ten million tons.

Classification. Composition and Classification of Domestic Coals, A. C. Fieldner. Gas Age, vol. 44, no. 3, Aug. 1, 1919, pp. 104-106, 3 figs. Conclusions drawn from U. S. Bur. of Mines investigation.

Coal Formation. The Formation of Coal, J. D. Kendall. Can. Min. Inst. Bul., no. 88, Aug. 1919, pp. 877-882, 2 figs. Organic remains found in rocks.

Conditions of Formation of Coke (Sur les conditions de formation du coke), Georges Cbarpy and Gaston Decorps. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 26, June 30, 1919, pp. 1301-1305. Tabulation of experimental results in wbicb effects of preliminary compression and coking temperature were specially studied.

Coke Ovens. New Vertical Coke Ovens — Pintsh-Bolz type — at the Gas Works in Düsseldorf (Die neue Vertikalofenanlage "System Pintsch-Bolz" für 100,000 cbm. Tagesleistung mit zugebörigen Koks — und Kohlentransportanlagen auf dem Gaswerk zu Düsseldorf), W. Schweizer. Journal für Gasbeleucbtung u. Wasserversorgung, vol. 59, no. 16, Apr. 15, 1919, pp. 215-221, 11 figs. (To he concluded.)

Coking. The Coking of Illinois Coal in Koppers Type Oven, R. S. McBride and W. A. Selwig. Cbem. & Metallurgical Eng., vol. 21, no. 3, Aug. 1, 1919, pp. 122-128, 6 figs. Operating test at plant of Minnesota By-Product Coke Company conducted jointly hy Nat. Bur. of Standards and U. S. Bur. of Mines. Test is said to have clearly demonstrated that some of Illinois coals can he coked in "chamber-type" oven without radical cbange in operating metbods for production of coke whicb can be successfully used in hlast furnace. *See also Missouri Camel Coals and Orient Coke.*

Carhonizing Illinois Coal, R. S. McBride and W. A. Selvig. Gas Rec., vol. 16, no. 3, Aug. 13, 1919, pp. 11-17, 6 figs. Results of tests made at St. Paul coke oven plant by U. S. Bur. of Mines.

Drills, Electric. Electric Coal Drills, A. H. Telfer. Iron & Coal Trades Rev., vol. 99, no. 2681, July 18, 1919, p. 79, 1 fig. Suggestions in regard to working of tbin seams.

Electrical Machinery. Electricity Applied to tbe Mechanical Mining of Coal, CS. B. Reed. Assn. Iron & Steel Elec. Engrs., July 1919, pp. 1-13, and (discussion) pp. 13-24. Trend of practice in selecting machine types.

Electrical Operation. St. Vincent Mine of the Mount Pleasant By-product Coal Co., P. B. Rule. Coal Age, vol. 16, no. 7, Aug. 14, 1919, pp. 264-267, 7 figs. Electrically operated mining plant with ultimate capacity of 1,500 tons a day.

Europe. Alarming Sbortage of Coal in Europe, George S. Rice. Coal Industry, vol. 2, no. 8, Aug. 1919, pp. 311-314. Giving coal situation in allied and neutral countries, Germany and Eastern Europe. Writer helieves that countries formerly supplied by England must turn to America.

Extraction. A Problem in Coal Extraction, Coal Age, vol. 16, no. 6, Aug. 7, 1919, pp. 234-235, 1 fig. Account of mining conditions and present practice in coal field where present extraction varies from 40 to 50 per cent. Discussion is invited with view to development and adoption of metbods tbat will premit hetter recovery.

Mining Methods. A Model Illinois Coal Mine, S. Bowles King. Mine & Quarry, vol. 11, no. 3, July 1919, pp. 1172-1185, 24 figs. Mining methods.

A Modern Mine in a Progressive State, Andrews Allen. Coal Industry, vol. 2, no. 8, Aug. 1919, pp. 303-309, 11 figs. Notes on layout and operation of Kathleen mine of Union Colliery Co. located at Dowell, Ill. Holdings consist of approximately 3143 acres of coal. Seam is from 7 to 9 ft. thick at average depth of 200 ft.

Fuel Economy in Power Production, W. T. Lane. Iron & Coal Trades Rev., vol. 99, no. 2683, Aug. 1, 1919, pp. 135-137, 4 figs. How to reduce (1) losses incurred by baving to leave large pillars of coal for various purpose, (2) losses due to unsuitable methods in working seams, (3) losses due to non-working of thin seams of coal and (4) losses due to "gobbing" of small coal. Paper read hefore South Wales Inst. of Engrs.

Winning and Preparation of Coal, John H. Anderson. Trans. Inst. Marine Engrs., vol. 31, no. 243, June 1919, pp. 23-124, 77 figs., partly on 19 supp. sbeets. Account of methods followed at various English mines.. Incidentally writer suggests greater use of mechanical appliances to make it possible to work seams of coal that otberwise could not reacbed.

Missouri Cannel Coals. The Carhonization of Missouri Cannel Coals. Bul. School of Mines & Metallurgy, University of Missouri, Technical Series, vol. 5, no. 1, Aug. 1919, pp. 7-49, 11 figs. Tests in which five different cannel coals were subjected to destructive distillation in gas-fired-horizontal retort and compared with bituminous coal coked under similar conditions, are reported to have shown tbat decomposition temperature of cannel coals is much lower than tbat of bituminous coal.

Orient Coal. Experimental-Retort Tests of Orient Coal, R. S. McBride and I. V. Brumbaugh. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 171-174, 3 figs. Investigation on influence of coking temperature upon quantity and quality of coke produced. Comparison with results obtained when using other coals.

Roof Actions. Graphic Illustrations of Roof Actions, R. Z. Virgin. Coal Industry, vol. 2, no. 8, Aug. 1919, pp. 320-321, 4 figs. Method for using wire rope to strengthen timhers suggested.

Strippino. Coal Stripping in the United States — VI, Wilhur Greely Burrougbs, Coal Industry, vol. 2, no. 8, Aug. 1919, pp. 322-328, 4 figs. Approximate cost and efficiency of operations, care of stripping macbinery, and tables of what bas been accomplisbed.

Timbering. *See Roof Action.*

Washeries. Some Suggestions for the Standardizing of Guarantees for Coal Wasberies, Sherwood Hunter. Colliery Guardian, vol. 118, no. 3056, July 25, 1919, p. 229. How to interpret "free coal" and "free dirt" in terms of speeific gravity.

Washers. Further Improvements on tbe "Draper" Washer, J. M. Draper. Proc. of South Wales Inst. of Engrs., vol. 35, no. 1, July 18, 1919, pp. 21-32 and (discussion) pp. 32-39, 8 figs. It is claimed for this type of coal washer that it effects perfect separation witbout requiring skilled attention by direct upward flow of water at a rate sligbtly exceeding velocity fall of coal, witbout pulsators or mechanical motion.

Waste Utilization. Utilization of Coal Waste (L'utilisation des déchets de houille), H. Copaux. Cbemie & Industrie, vol. 2, no. 6, June 1919, pp. 656-660, Extraction of by-products. Report of special committee appointed by Société de Cbimie Industrielle.

COPPER

Horwood Process. The Horwood Process as Applied to tbe Copper-Zinc Ore of the Afterthought Mine, A. H. Heller. Min. & Sci. Press, vol. 119, no. 5, Aug. 2, 1919, pp. 151-158, 4 figs. Construction of 300-ton plant at California mine wbere tests witb Horwood process are said to bave given very promising results.

Huntingdon Mine. The Huntingdon Copper Mine, Quebec, Reginald E. Hore. Can. Min. Jl., vol. 40, no. 31, Aug. 6, 1919, pp. 582-584, 4 figs. Account of mining operations.

Slag. Metbod of Handling Granulated Slag in Anaconda, Oliver E. Jager. Min. & Sci. Press, vol. 119, no. 4, July 26, 1919, pp. 118-120, 6 figs. Comhination of granulation and haulage methods.

EXPLOSIVES

Detonators. Equipment for Detonation of Explosives by Electricity, Eng. & Contracting, vol. 52, no. 8, Aug. 20, 1919, pp. 220-221, 1 fig. Developed hy U. S. Army during the war.

Permissible Explosives. Permissible Explosives, John E. Miller, Coal Age, vol. 16, no. 6, Aug. 7, 1919, pp. 225-227, 18 figs. Safety rules and suggestions prepared by Bur. of Mines.

GEOLOGY AND MINES

Calcite Crystals. Some Notes on Japanese Minerals, Shimmatsu Ichikawa. Am. Jl. of Sci. (Fourth Series), vol. 48, no. 284, Aug. 1919, pp. 124-131, 3 figs. Concerning natural etchings of ealcite crystals.

Coral-Reef Zone. The Coral-Reef Zone During and After the Glacial Period, Reginald A. Daly. Am. Jl. of Sci. (Fourth Series), vol. 48, no. 284, Aug. 1919, pp. 136-159. Theory explaining tbeir origin hased on geological facts.

Crystallography of Carbonates. Refraction Indices of Rhombohedric Carhonates (Sur les indices de réfraction des carhonates rhomboédriques), Paul Gaubert. Bulletin de la Société Française de Minéralogie, vol. 42, no. 1-3, Jan.-Mar. 1919, pp. 88-120. Measurements on crystals belonging to isomorphous series.

Deep-Level Temperatures. The Maximum Temperature in Large Tunnels and Deep Wells Witb a Trial Empirical Formula, F. Butavand. Eng. & Contracting, vol. 52, no. 5, July 30, 1919, pp. 119-120. Temperatures obtained hy U. S. Geological Survey in wells located about five miles north of Clarksburg, W. Va., found to agree closely with those determined hy suggested metrical formula. Translated from Génie Civil.

Dissociation of Carbonate Rocks. An Apparatus for Studying the Dissociation of Carhonate Rocks, G. A. Bole, Jl. Am. Ceramic Soc., vol. 2, no. 5, May 1919, pp. 410-417, 2 figs. Victor Meyer vapor density apparatus, in wbich steam jacket has been raplaced by an electrical tuhe furnace.

Earthquakes. A Seasonal Variation in the Frequency of Earthquakes, Richard Dixon Oldham. Quarterly Jl. of Geological Soc., vol. 74, no. 294, July 9, 1919, pp. 99-104 and (discussion), pp. 104-105, 1 fig. on separate supp. plate. Records of observations of eartbquakes oceurring at time of great Indian eartbquake of 1917.

Fire Clays. Notes on Fire Clays of the Northern Appalachian Coal Basin, Ellis Lovejoy. Jl. Am. Ceramic Soc., vol. 2, no. 5, May 1919, pp. 374-385 and (discussion), pp. 385-390, 1 fig. Classification into four chief flint fireclays; occurrence and properties of each.

Japanese Minerals. *See Colcite Crystals.*

Mississippi. Mississippi — Its Geology, Geography, Soil and Mineral Resources, E. N. Lowe. Miss. State Geological Survey, Bul. no. 14, 1919, 346 pp., 20 figs. Popular presentations of previous published reports of State Geological Survey.

Pre-Cambrian. Relation of Regional Deformations to the Distribution of Ore in the Pre-Cambrian, Ellsworth Y. Dougherty. Min. & Sci. Press, vol. 119, no. 7, Aug. 16, 1919, pp. 227-230, 1 fig. Concerning hypothesis that ore deposits of hydrothermal and ingneous tynes can be referred to igneous activity of well-marked epochs.

Some Stratigraphic and Structural Features of the Pre-Cambrian of Northern Quebec — IV, H. C. Cooke. Jl. Geology, vol. 27, no. 5, July-Aug. 1919, pp. 367-382, 1 fig. Explorations of northern Quebec show existence of fairly sharp boundary line on one side of which limestone is member of Grenville while on the other it does not appear. From theoretical conditions writer concludes that this line represents an ancient topographic break, either a shore line or a boundary of a submerged plateau.

SEDIMENTATION. Inequalities of Sedimentation E. M. Kindle. Jl. Geology, vol. 27, no. 5, July-Aug. 1919, pp. 339-366. Points out various factors which make for periodic variability in rates of deposition and cites examples on existing lakes and seas to illustrate sharp contrasts in rate at which sediments accumulate at different points near the same coast line.

IRON

CANADA. The Production of Coal and Iron Ore in Canada Considered in Relation to the Iron and Steel Industries, F. W. Gray. Iron & Steel of Can., vol. 2, no. 8, Aug. 1919, pp. 177-179, 2 figs. Based on statistics complied by Dept. of Mines.

LEAD, ZINC, TIN

LEAD MINES, WANLOCKHEAD. The Wanlockhead Lead Mines, John Mitchell. Min. Mag., vol. 21, no. 1, July 1919, pp. 11-20, 3 figs. General description of South of Scotland mining district and account of records of working Leadhills and Wanlockedhead mines.

ZINC IN BELGIUM. Zinc Industry in Belgium, March F. Chase. Dept. of Interior, Bur. Mines, Minerals Investigations Series, no. 18, May 1919, 8 pp. Economical position of industry before the war and statistics of production from 1913 to 1918.

METERING. *See Gas, Natural.*

MISSISSIPPI. Oil and Gas Prospecting in Mississippi, E. N. Lowe. Miss. State Geological Survey, Bul. no. 15, 1919, 78 pp., 2 figs. Condensation of reports of actual investigations and of data presented in publications of various scientific organizations.

MINES AND MINING

AIR IN MINES. Notes on Defective Air in Disused Raises and Backstopes, C. J. Gray. Jl. of Chem., Metallurgical & Min. Soc. of South Africa, vol. 19, no. 11, May 1919, pp. 240-243 and (discussion), pp. 243-246. Result of analysis with Haldane's tube of air at various points in a disused raise in one of Witwatersrand mines.
See also Carbon Dioxide.

APEX LAW. An Unusual Apex Case, R. T. Walker. Min. & Sci. Press, vol. 119, no. 8, Aug. 23, 1919, pp. 262-264, 1 fig. How litigation between two companies led to disclosure of unusual type of vein structure.

CANADA, WESTERN. The Resources of Western Canada, R. C. Wallis, Jl. Eng. Inst. Can., vol. 2, no. 8, Aug. 1919, pp. 551-554. Geological and topographical notes, together with historical account of development of mining industry.

CARBON DIOXIDE. A "Safety First" Method for the Estimation of CO_2 in Mine Air, H. R. S. Wilkes. Jl. of Chem., Metallurgical & Min. Soc. of South Africa, vol. 19, no. 11, May 1919, pp. 246-249. Based on standard method except that quantities used are tenths and operation of titration with oxalic acid is eliminated.

CEMENT GUN. Results Obtained from the Use of the Cement Gun at the Cadogan Mine, Fred Norman. Coal Age, vol. 16, no. 7, Aug. 14, 1919, pp. 269-270, 4 figs. States difficulties in opertion due to bad, friable top rock, and notes how such difficulties were overcome by use of cement gun.

DREDGES. A Platinum Dredger. Engineer, vol. 128, no. 2217, July 25, 1919, pp. 90-91, 4 figs. Consists of large steel-framed and plated pontoon with unusual well for bucket ladder.

DRILLS. Pneumatic-Electric Rock Drill and Some of the Tools Used in Its Construction — II, Frank A. Stanley. Am. Mach., vol. 51, no. 6, Aug. 7, 1919, pp. 263-266, 7 figs. Jigs and fixtures provided for operations involved in finishing of parts.
Modern Rock Drill Practice, David Penman. Min. Mag., vol. 21, no. 1, July 1919, pp. 21-28, 13 figs. Particulars of Holman piston drill, Climax-Britannia hammer-drill and Ingersoll-Rrand jackhammer drill. (To be continued.)

GAS DETECTORS. Gas Detectors for Miners' Electric Lamps, T. J. Thomas. Colliery Guardian, vol. 118, no. 3058, Aug. 8, 1919, pp. 361-362. Possibilities of research. (Concluded.)
See also Carbon Dioxide.

LAWS, MINING. Common Violations of the Mining Laws, W. J. Heatherman. Coal Industry, vol. 2, no. 8, Aug. 1919, pp. 315-316. Failure to set proper timbers, shooting off solid, riding on trips, lack of adequate means of egress and ingress, recklessness and ignorance considered chief obstacles to mining safety. Paper presented before W. Va. Coal Min. Inst.
See also Apex Law.

MAPS, MINE. Conventional Symbols for Mine Maps, Lester C. Uren. Min. & Sci. Press, vol. 119, no. 7, Aug. 16, 1919, pp. 231-234, 4 figs. Used by engineering students in mine mapping at Univ. of Cal.

QUARRIES, IRONSTONE. Stripping and Working Ironstone Quarries, F. H. Match. Quarry, vol. 24, no. 270, Aug. 1919, pp. 211-216, 5 figs. Practice in English mines. Lecture delivered at Royal School of Mines.

ROASTING. Experiments in Magnetizing Roasting, George J. Young. Eng. & Min. Jl., vol. 108, no. 5, Aug. 2, 1919, pp. 176-177, 2 figs. Experimental results of tests made with pyritic concentrate.

SAFETY. Importance of Safety in Mining and Metallurgical Industries, W. R. Plank. Coal Age, vol. 16, no. 6, Aug. 7, 1919, pp. 228-231, 5 figs. Proposes establishment of safety departments,greater co-operation between employer and employee and continued training in first-aid and mine-rescue work,as means of curtailing accidents.

SIGNALINO SYSTEMS. Mine Electric Signaling Practice, Terrell Croft. Coal Age, vol. 16, no. 8, Aug. 21, 1919, pp. 308-312, 11 figs. Particulars of various signaling systems.

SKIP-CHANGE. Skip-Changing Device at the Steward Mine, Oliver E. Jager. Min. & Sci. Press, vol. 119, no. 6, Eug. 9, 1919, pp. 187-190, 5 figs. Device is of hinged guide and crawl type.

U. S. PRODUCTION, 1916. Mineral Production of the United States in 1916, H. D. McCaskey and Martha B. Clark. Dept. of Interior, U. S. Geological Survey, Series I:A, June 28, 1919, 70 pp., I fig. Statistics including comparison with earlier years.

MINOR INDUSTRIAL MATERIALS

TUNOSTEN. Tungsten and Its Importance in Industry (Wolframmetall und seine Bedeutung für die Industrie), Hugo Lohmann. Elektrotechnische Zeitschrift, vol. 25, no. 11/12, Feb.-Mar. 1919, pp. 141-143. As a substitute for diamonds in tool manufacture, for the chemical industry (crucibles, tubes), for the manufacture of electric bulbs, etc.
Tungsten and the Utilization of Slag in the Mining Industry. (Wolframgewinnung und Schlackenverwertung im Bergwerksbetriebe), Zeitschrift f. die gesamte Giessereipraxis, vol. 40, no. 6, Feb. 8, 1919, pp. 65-66. Tungstic acid recovered from some tin slag amounted to from 10 to 15 per cent.

OIL AND GAS

ENOLAND. Oil in England, J. Ford. Iron & Coal Trades Rev., vol. 99, no. 2682, July 25, 1919, pp. 110-111, 3 figs. Account of Derbyshire investigations which led to finding free oil.

GAS, NATURAL. Transportation and Distribution of Natural Gas, H. A. Quay, Gas Age, vol. 44, no. 3, Aug. 1, 1919, pp. 102-103. Improvements obtained by installation of meters.

PROSPECTINO. *See Mississippi.*

SEALING. Sealing Formations by Slime-Laden Fluid, Seth S. Langley. Eng. & Min. Jl., vol. 108, no. 7, Aug. 16, 1919, pp. 268-271, 4 figs. Methods for controlling gas pressure, preventing migration of oil, gas, and water, and preparing wells for abandonment.

SHALES. Oil Shales, Louis Simpson. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 176-187. Suggestions in regard to selecting method of retort.

WELL DRILLINO. The Rotary Method of Well Drilling, Albert G. Wolf. Eng. & Min. Jl., vol. 108, no. 5, Aug. 2, 1919, pp. 171-175, 5 figs. Process of sinking oil and gas wells in unconsolidated strata by means of bits used in alternating hard and soft formations.

PRECIOUS MINERALS

ASPEN. *See Silver Ore.*

ONTARIO. West Shining Tree Gold District, Ontario, L. H. Goodwin. Eng. & Min. Jl., vol. 108, no. 7, Aug. 16, 1919, pp. 261-264, 4 figs. Notable feature of prospects in area is said to be presence of spectacularly rich specimen ore carrying heavy gold.

SILVER ORE. Deep-Level Development in Aspen, Frederick W. Foote. Eng. & Min. Jl., vol. 108, no. 5, Aug. 2, 1919, pp. 178-180, 4 figs. Concentration by jigs and tables. Camp contains silver-ore deposits in sedimentary rocks.

METALLURGY

BLAST FURNACES

BRITISH BLAST-FURNACE PLANT. The Glengarnock Works of David Colville and Sons, Limited. Engineer, vol. 128, no. 3317, July 25, 1919, pp. 75-78, 19 figs. partly on four supp. plates. Arrangement and details of blast-furnace, bessemer, open-hearth, structural and by-product departments.

CHARGER, BLAST-FURNACE. A German Blast-Furnace Charger. Iron & Coal Trades Rev., vol. 99, no. 2680, July 11, 1919, pp. 40-41, 5 figs. Automatic skip for charging furnace in lieu of hand labor. Output capacity of new furnace is 400 tons in 24 hours, involving handling of about 1200 tons of ore and about 500 to 600 tons of coke. From Stahl und Eisen.

COPPER AND NICKEL

SPEISS SMELTING. Melting Copper Speiss in Electric Furnace (Fusion de speiss de cuivre au four électrique), P. Papencordt. Journal du Four Electrique, vol. 28, no. 14, July 15, 1919, pp. 98-100. Experiments to determine economy of recuperating metals contained in speiss.

FERROUS ALLOYS

ELECTRICAL PRODUCTION OF FERROALLOYS. Electrical Production of Ferroalloys (La production électrica de aleaciones férreas), José Maria Navarrete. Energia Eléctrica, vol. 21, no. 12, June 25, 1919, pp. 137-140. Concerning types and sizes of furnaces used in United States, france, England, and Switzerland.

NICKEL-CHROMIUM STEELS. Nickel-Chromium Steels, J. H. S. Dickenson. Jl. West of Scotland Iron & Steel Inst., vol. 26, no. 8, April 1919, pp. 110-123 and (discussion) pp. 123-125, 15 figs. on 8 supplement plates. Account of their commercial development and of results obtained in tests of various samples which were all oil hardened and tempered alike and afterward cooled off at different rates. Tensile and notched-bar test results are given in tabulated form.

FLOTATION

SPAIN. Status of Flotation in Spain. Eng. & Min. Jl., vol. 108, no. 8, Aug. 23, 1919, pp. 316-317. Possibility of utilizing process for recovering mineral content of dumps dating back to early Rome.

FURNACES

ELECTRIC FURNACES. Electric Furnaces for Melting Non-Ferrous Metals — The Baily Furnace. Metal Trades. vol. 10, no. 8, Aug. 1919, pp. 366-370, 6 figs. Of resistance type, its heating element consisting essentially of granular carbon placed in silicon-corbide trough.

ELECTRIC SMELTING. Electric Smelting with Special Reference to Canadian Conditions, Robert M. Keeney. Can. Min. Inst. Bul. no. 88, Aug. 1919, pp. 846-853. Also Colo. School of Mines Mag., vol. 9, no. 8, Aug. 1919, pp. 219-222. Electric furnace is seen not as competitor of combustion furnace, but as means of treating certain ores and of working out certain processes in a more advantageous manner than it is possible to do in a combustion furnace, or treat ores that exist in certain districts in Canada where, owing to local conditions of cheap power and expensive coal and coke, combustion furnaces anr not practicable.

SLAGS. Losses in Furnace Slags, Edward H. Robie. Eng. & Min. Jl., vol. 108, no. 7, Aug. 16, 1919, pp. 265-267, 2 figs. Results of tests at smeltery of International Nickel Co., Copper Cliff, Ont., to determine influence of slag and matte composition and temperature on copper content of slang.

IRON AND STEEL

COBALTCROM STEEL. Making Cobaltcrom Steel Tools. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1173-1174, 2 figs. Interesting feature of this steel is said to be that dies, milling cutters, etc., made from it can be cast to shape, teeth in cutters, for example, being cast directly in blank and requiring no other machining than grinding and boring or sometimes only reaming of hole.

FIBROUS STRUCTURE IN STEEL. Fibrous Structure in High Carbon Steel, A. W. Lorenz. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 203-204. Facts and data in connection with a certain ordnance contract.

FLAKES IN STEEL. Flakes in Alloy Steel, Ernest Edgar Thum. Chem. & Metallurgical Eng., vol. 21, no. 3, Aug. 1, 1919, pp. 145-146. Recapitulation and discussion of various articles on flakes in gun tubes and other large forgings of alloy steels.

FRANCE. Metallurgy of Iron (La métallurgie du fer), Métallurgie, vol. 30, 31 and 33, July 23, July 30 and Aug. 13, 1919, pp. 1935-1936, pp. 2010-2011 and pp. 2162-2164. From general report on conditions in French industry published by Ministry of Commerce.

MAGNET STEEL. Steel for Magnets— V. Mech. World, vol. 66, no. 1700, Aug. 1, 1919, pp. 57-58, 4 figs. Essential physical changes taking place during hardening process in case of magnet steels. (Continuation of serial.)

MALLEABLE IRON. The Manufacture of Malleable Iron, Henry A. Johnson. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1163-1164. With reference to physical and chemical phenomena that take place during process and mention of ordinary limits for chemical analysis for white-iron castings.

METALLURGICAL CALCULATIONS. Modern Steel Metallurgical Calculations, Charles H. F. Bagley. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 373-377. Synthetic method of calculating consumption of materials and technical results of manufacture of steel. Different kinds of pig iron and various standard processes are considered. Paper read before British Iron & Steel Ints.

OPEN-HEARTH PROCESSES. The Yields and Waste in Open Hearth Processes, J. E. Fletcher. Managing Engr., vol. 6, no. 3, July 1919, pp. 59-64, 5 figs. Photomicrographs illustrating progressive refining of white (eutectic) iron containing about 4 per cent carbon. Paper read before Stoke-on-Trent Engrs.' & Eng. Students' Assn. (To be continued.)

SOAKING PITS, ELECTRICALLY HEATED. Electrically Heated Soaking Pits, Re-Heating and Annealing Furnaces, and Automatic Furnaces, for Heat Treatment, as Applied to the Steel Industry, Thaddeus F. Baily. Iron & Steel of Can., vol. 2, no. 8, Aug. 1919, pp. 180-186, 5 figs. Paper read before Iron & steel Inst. of America.

TOOL STEEL. Modern High Speed Tool Steel, John A. Mathews. Ry. Mech. Engr., vol. 93, no. 8, Aug. 1919, pp. 489-492. Origin and development of modern high-speed steel; hardning and tempering qualities. Paper read before Am. Soc. for Testing Materials.

MICROPHOTOGRAPHY

ETCHING. *See Polishing and Etching.*

POLISHING AND ETCHING. Notes on Practical Metallographic Methods, Austin B. Wilson. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 380-386, 15 figs. Methods of polishing and etching for advanced research work.

RADIOMETALLOGRAPHY. Radiometallography Engineer, vol. 128, no. 3317, July 25, 1919, pp. 80-81, 8 figs. Arrangement of Coolidge tube for radiographic examination. Reproduction of various radiographs of castings.
The Examination of Materials by X-Rays. Engineering, vol. 108, no. 2794, July 18, 1919, p. 76, 4 figs. Radiographs of aluminum castings.

NON-FERROUS ALLOYS

ALUMINUM BRONZES. Relation of Microstructure to Phase Changes in Heat-Treated Aluminum Bronzes, L. R. Seidell and G. J. Horvitz. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 179-181, 13 figs. Tests of branze of composition 90 per cent copper and 10 per cent aluminum, and conclusions in regard to adaptability of this bronze for bearing and corrosion-resistant metal.

BRASS MELTING. Melting of Some Non-Ferrous Metals and Their Alloys in the Electric Furnace, E. F. Collins. Jl. Cleveland Eng. Soc., vol. 11, no. 5 & 6, Mar.-July 1919, pp. 293-314 and (discussion) pp. 314-320, 19 figs. Requirements for economical brass-melting furnaces, and comparison of electric melting with fuel-fired furnaces.

MONEL METAL. Monel Metal, Hugh R. Williams. Sci. Am. Supp., vol. 88, no. 2276, Aug. 16, 1919, pp. 98-99, 3 figs. Claimed points of superiority of this new natural alloy in all field for con-corroding steel.

OCCLUDED GASES

Preventing Occlusion of Gases, Robert Hadfield. Iron Trade Rev., vol. 65, no. 8, Aug. 21, 1919, pp. 504-505. Silicon found by Terre Noire Co., France, to assist materially in reduction of unsoundness and blowholes and to tend to rid steel of absorbed gases. From paper presented before Faraday Soc., Lond.

VARIA

SILICON-MANGANESE. Silicon-Manganese from Electric Furnaces, B. G. Klugh. Iron Age, vol. 104, no. 7, Aug. 14, 1919, pp. 438-440. Manufacturing data for various compositions. Manganiferous slags as raw material. Uses for the alloy. Paper read before Am. Electrochemical Soc.

CIVIL ENGINEERING

BRIDGES

ARCHES. Flat Arches on High Piers, South Side Bridge, Fairmont. Eng. News-Rec., vol. 83, no. 6, Aug. 7, 1919, pp. 270-272, 7 figs. Three equal 116-ft. flat-arch spans preferred to other designs because of symmetrical proportion and simplicity, which are said to have resulted in lower cost.

COFFERDAM. Cofferdam Experience at a Bridge in Chicago River, Hugh E. Young and William A. Mulcahy. Eng. News-Rec., vol. 83, no. 6, Aug. 7, 1919, pp. 268-269, 2 figs. Flooding due to inaccurate record of old tunnel. Movement of wall in deep water led to heavier construction.

CONDEMNED BRIDGE. Rondout Creek Bridge Design Condenmed for Excessive Load on Batter Piles. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 329-332, 3 figs. Outline of design condemned by N. Y. State Highway commissioner because of considered foundation dangers and belief that superstructure design was not adapted to site.

CONCRETING. Concreting the Winnipeg Aqueduct. Contracting, vol. 9, no. 3, Aug. 1, 1919, pp. 69-70, 9 figs. Structure consists of concrete conduit having horseshoe-shape cross-section varying from 5 ft. 5 in. high by 5 ft. 4 in. wide to 9 ft. high by 10 ft. 9 in. wide and containing 310,000 yd. of concrete.

ELECTRIC EQUIPMENT. Utilizing Electric Power at Movable Bridges, Mark H. Reasonu. Ry. Elec. Engr., vol. 10, no. 8, Aug. 1919, pp. 285-287, 4 figs. Methods used in group of five railway bridges built side by side over Calumet river at South Chicago, Ill.

PORTLAND. Cross-River Traffic Problems at Portland, W. A. Scott. Eng. World, vol. 15, no. 4, Aug. 15, 1919, pp. 38-40, 3 figs. Data relative to type and construction of several existing bridges.

REPAIRS. Extraordinary Repairs Made to a 1900-Ton Drawbridge, Thomas D. Fulton. Eng. News-Rec., vol. 83, no. 8, Aug. 21, 1919, pp. 366-369, 7 figs. Turntable, wheels and drum failing. Number of wheels was increased and new upper treads placed. Drum parts restored by heating and jacking.

TIMBER BRIDGES. Timber Bridge Problems on the Alaska Railway. Eng. News-Rec., vol. 83, no. 9, Aug. 28, 1919, pp. 420-422, 5 figs. Standard designs for 121-ft. spans on sheathed pile piers.

VIADUCTS. The Bloor Street Viaduct, Toronto, Ontario, Thomas Taylor. Jl. Eng. Inst. Can., vol. 2, no. 7, July 1919, pp. 485-498, 17 figs. Including practice in grading of sand and testing concrete and other miscellaneous materials.

BUILDING AND CONSTRUCTION

APPEARANCE. Aesthetic Treatment of Plant Structures. Iron Age, vol. 104, no. 7, Aug. 14, 1919, pp. 427-429, 6 figs. Details of buildings erected by Steel & Tube Co. of Am. at its Iroquois and Mark plants, which were designed with a view to meet needs of employees.

BEAMS. Reinforced-Concrete Structures (Construcciones de mamposteria armada), L. Ivanissevich. Ingenieria, vol. 23, no. 10, May 16, 1919, pp. 617-628, 9 figs. Formulæ for designing beams.

BLOCK YARD. Block Yard Cheaply Improvised from Old Equipment. Eng. News-Rec., vol. 83, no. 8, Aug. 21, 1919, pp. 356-357, 6 figs. How contractor is being able to produce output of 60 blocks per man per day.

BRIDGE CONSTRUCTION. Electricity Cuts Construction-Plant Power Costs. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 311-312, 3 figs. System for handling concrete in large arch-bridge construction.

CAISSONS. Telescopic Foundation Caissons Sunk in Bank Basement, Frank H. Eastman. Eng. News-Rec., vol. 83, no. 8, Aug. 21, 1919, pp. 369-370, 1 fig. Support 275-ton vault of Central Union Trust Co., New York City. Columns rest on brick piers supported on quicksand only one ft. below cellar floor.

CEMENT STUCCO. Practice for Portland Cement Stucco. Contract Rec., vol. 33, no. 31, July 30, 1919, pp. 741-743. Recommendations of Am. concrete Inst. Committee.
See also Finishing.

CHURCHES. Some Principles of Design and Construction in Church Building. Charles H. Moore. Architectural Record, vol. 46, no. 2, Aug. 1919, pp. 115-122. Simple design intended to suit needs of rural community; also considerations in regard to future developments of this branch of architecture in America.

Community Houses. The Community House as a War Memorial, Martha Candler. Am. Architect, vol. 116, no. 2277, Aug. 13, 1919, pp. 195-201 & 205-207, 10 figs. Plans and details of Read Memorial Community House at Purchase, N.Y.
New Principles Governing Planning of Civic Buildings, William Roger Greeley. Am. Architect, vol. 116, no. 2277, Aug. 13, 1919, pp. 208-211, 4 figs. Illustrating various plans for community buildings.

Concrete Foundations. Building Concrete Foundations, Ernest Irving Freese. Building Age, vol. 41, no. 8, Aug. 1919, pp. 250-251, 5 figs. How to proportion mix to make them waterproof.

Cottages. Erect 66 Sea Shore Cottages of Concrete, Concrete, vol. 15, no. 2, Aug. 1919, pp. 51-54, 17 figs. Features of design. Walls are of monolithic construction; cost was 22.4 cents per cu. ft.

Docks. The Building of the Municipal Docks at St. Louis, M. Serkes. Am. City, City Edition, vol. 21, no. 2, Aug. 1919, pp. 113-116, 2 figs. Built with co-operation of city and federal governments.

Factories. Modern Daylight Factories, Albert M. Wolf, Eng. World, vol. 15, no.3, Aug. 1, 1919, pp. 21-26, 8 figs. Economic value of installing modern improvements in factory buildings.

Finishing. Methods of Finishing Cement Stuccos. Contract Rec., vol. 33, no. 32, Aug. 6, 1919, pp. 753-754. Dash, sand-float, and exposed aggregate finishes. From committee report presented to Am. Concrete Inst.

Frame Houses. Bolts in Field Connections of Steel-Frame Buildings; a Study of Data and Experience, R. Fleming. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 316-321, 4 figs. Experimental investigation to determine whether substitution of bolting for riveting of steelwork can be satisfactorily effected in specifications for steel-frame buildings.

Gardens. Ottawa Housing Commission Has Prepared Ideal Garden Development Plan. Contract Rec., vol. 33, no. 33, Aug. 13, 1919, pp. 775-778, 1 fig. One-eighth of area set aside for open spaces.

Gypsum Construction. Gypsum Construction for Railway Terminals, Curtis F. Columbia. Eng. World, vol. 15, no. 4, Aug. 15, 1919, pp. 33-37, 5 figs. Claimed advantages based on laboratory experiments.

Housing. Keeping the Costs of Building the Government Houses, John C. Prior and Herbert P. Green. Eng. News-Rec., vol. 83, no. 6, Aug. 7, 1919, pp. 252-261, 7 figs. System reporting progress and cost used by U. S. Housing Corporation.
Modern Housing Standards at Dawson, New Mexico, Charles F. Willis. Coal Age, vol. 16, no. 6, Aug. 7, 1919, pp. 220-224, 20 figs. Types of houses erected by Phelps-Dodge Corpn. for use of mine workers.
Workingmen's Houses in Italy-I, Alfredo Melani. Architectural Record, vol. 46, no. 2, Aug. 1919, pp. 176-185, 7 figs. Legislation enacted relative to construction of such dwellings by State.
Solving the Problem of the Low Cost House. Am. Architect, vol. 116, no. 2278, Aug. 20, 1919, pp. 229-234, 14 figs. Typical designs erected by various shipbuilding plants by U. S. Shiping Board Emergency Fleet Corporation.
The Engineering Aspect of the Housing Problem. Eng. Rev., vol. 33, no. 1, July 15, 1919, pp. 9-10. Points out manner of effecting economy in connection with internal woodwork.
The New London Housing Project, Louis L. Tribus. Man. Jl. & Public Works, vol. 47, no. 7, Aug. 16, 1919, pp. 102-104, 4 figs. General plan of procedure in carrying out project involving a million and a quarter dollars.

Japanese Design. The Principles of Japanese Design, Francis Taylor Piggott. J. Roy, Soc. of Arts, vol. 67, no. 3478, July 18, 1919, pp. 555-563 and (discussion) pp. 563-566, 13 figs. Architectural characteristics in their relation to artictic beauty.

Moving Houses. Moving Reinforced Concrete Building to a New Site, Jack L. Schnitz. Concrete, vol. 15, no. 2, Aug. 1919, pp. 60-62, 4 figs. Three-story, 3000-ton structure 60 ft. x 95 ft. moved one city block at Detroit.

Quillet System of Construction. Quillet System of Construction (Système de construction Quillet). Bulletin Technique de la Suisse Romande, vol. 45, no. 16, Aug. 9, 1919, pp. 157-160, 8 figs. Cement bricks are provided with gudgeons which permit them to hold rigidly together, thus making construction quasi-monolithic.

Reservoir. St. Paul Covered Reservoir. Cement & Eng. News, vol. 31, no. 8, Aug. 1919, pp. 24-26, 2 figs. Reinforced-concrete 30,000,000-gal. reservoir built with movable concrete-mixing and spouting plant.

Roofing. Roofing Ordinance Proposed for Indianapolis, Construction, vol. 8, no. 6, June 1919, pp. 273-274. For the purpose of insuring safety against fire in construction.
German Regulations for Reinforced-Concrete Roofs (Der neue Ministerialerlass über ebene Steindecken vom 23 November 1918). Beton u. Eisen, vol. 18, no. 4/5, Mar. 5, 1919, pp. 51-52. Stipulate composition of concrete and strength and bending moment of slabs for flat roofs.
Barn Roof Design, J. L. Strahan. Trans. Am. Soc. Agricultural Engrs., vol. 12, Dec. 1918, pp. 57-75, 6 figs. Observes that Shawver truss is not a true truss in the sense that it is truly rigid. Writer recommends modificatio n to make it so.

Stirrups in Concrete Beams. Diagram for Locating Stirrups in Concrete Beams, M. J. Lorente. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 310-311, 2 figs. Graphs for spacing vertical stirrups in uniformly loaded beam for two methods of stress distribution.

Tanks. Concrete Fuel-Oil Tank Design and Construction. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 322-323. Precautions to be observed in building small oil-storage reservoirs for use in industrial plants.
Reinforced Concrete Tanks, F. W. Frerichs. Popular Engr., vol. 12, no. 2, Aug. 1919, pp. 10-12, 3 figs. Details of large storage tanks for ammonica liquors. Paper read before Am. Inst. Chem. Engrs.
Tank Construction — XXX, Ernest G. Beck. Mech. World, vol. 66, no. 1699, July 25, 1919, pp. 42-43, 6 figs. Methods of supporting wall sheeting in tanks of large depth. (Continuation of serial.)

Tile Houses. Damp-proofing Hollow Tile Houses, Perry R. MacNeille. Construction, vol. 8, no. 6, June 1919, pp. 279-284, 3 figs. Account of various practices.

CEMENT AND CONCRETE

Boiler House. Concrete Used in Boiler-House Structure and Fittings, George S. Nobles. Eng. News-Rec., vol. 83, no. 6, Aug. 7, 1919, pp. 262-263, 4 figs. Coal hoppers, forced-draft air ducts, and boiler breeching made of reinforced concrete at Brooklyn Navy Supply Base heating plant.

Concrete-Block Casting. Efficient Plant for Casting Concrete Blocks for Miami River Revetment. Eng. & Contracting, vol. 52, no. 8, Aug. 20, 1919, pp. 214-215, 4 figs. Blocks are molded in small flat cars, 16 blocks per car, remaining on cars from time they are cast till they are unloaded in storage yards.

Gravel. Missouri Sand and Gravel-I. Cement Mill & Quarry, vol. 15, no. 4, Aug. 20, 1919, pp. 11-17, 21 figs. Method of production. From report of Missouri Bur. of Geology and Mines.

Rodding. Effect of Rodding Concrete, F. E. Giesecke. Can. Engr., vol. 37, no. 7, Aug. 14, 1919, pp. 217-218, 2 figs. Tests made at University of Texas to determine physical properties as determined by relative quantity of cement. From University Bul. no. 1815.
Cause of Adherence of Concrete to Steel in Reinforced-Concrete Structures (Sur la cause de l'adhérence du béton au fer dans les constructions en béton armé), Vasilesco Karpen. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 1, July 7, 1919, pp. 21-23. Arguments offered in proof that cohesion is due to friction.

Texas, Concrete Aggregate. Texts of Concrete Aggregates Used in Texas, J. P. Nash, Univ. of Texas Bulletin, no. 1771, Dec. 20, 1917, 80 pp., 8 figs. Aggregates were tested by incorporating them in concrete and determining various properties of resultant concrete. Data are given regarding water used, age, crushing strength, number of specimens tested, weight of concrete and amount of cement per cu. yd. of laid concrete.

Waste-Heat Utilization. The Manufacture of Cement at Bellevue, Mich., C. M. Wright. Cement & Eng. News, vol. 31, no. 8, Aug. 1919, pp. 37-39, 1 fig. Practice in shutting down kiln and method of utilizing waste heat.

Wood for Reinforcing Concrete. Wood as Reinforcement for Concrete (Holz und Schilf als Ersatz des Eisens in der Zugbewehrung) v. Emperger. Beton u. Eisen, vol. 18, no. 4/5, Mar. 5, 1919, pp. 46-48, 7 figs. Well-seasoned impregnated wood, completely covered with concrete, said to have given satisfactory results at Vienna.

EARTHWORK, ROCK EXCAVATION, ETC.

Conduits Under Dams. Miami District Completes Conduits Under Dams. Eng. World, vol. 15, no. 4, Aug. 15, 1919, pp. 13-16, 4 figs. Purpose of conduits is to convey normal discharge of respective streams under dams without holding back water of streams, except during flood stages. Conduits were built in sections with both horizontal and vertical joints.

Dams. Protective and Restoration Work at Chaudpatha Dam, Sipri, S. K. Gurtu, Indian Eng., vol. 65, no. 18, May 3, 1919, p. 205, 5 figs. on supp. plate. Examining entire foundation and restoring portion carried away by uplift.
See also Conduits under Dams.

Big Eddy Dam on Spanish River. Contract Rec., vol. 33, no. 34, Aug. 2, 1919, pp. 787-790, 4 figs. Dam is of gravity type, containing approximately 80,000 cu. yd. of slag concrete, 1:3:6 mix. Methods of foundation work with caissons described.
The Construction of the Grand River Roller Crest Dam, O. T. Reedy. Reclamation Rec., vol. 10, no. 8, Aug. 1919, pp. 374-378, 8 figs. Dam consists of six bays, each 70 feet wide.

Foundations in Quicksand. Foundations in Quicksand and Watery Gravel, Eng. News-Rec., vol. 83, no. 9, Aug. 28, 1919, pp. 414-415, 2 figs. Sinking wells for concrete cylinder piers for building foundations for Canal St. viaduct in Chicago.

Hudson River Tunnel. Hudson River Tunnel Problems, Walter C. Parmley. Eng. World, vol. 15, no. 3, Aug. 1, 1919, pp. 31-34, 2 figs. Structural and construction problems of proposed tunnel.

Hydraulicking. Hydraulicking Dam Embankment on Miami Flood-Control Project. Eng. News Rec., vol. 83, no. 8, Aug. 21, 1919, pp. 371-373, 3 figs. Glacial drift excavated by draglines, hauled by train to hog boxes, mixed with water and then pumped to dam.

Piercing. Piercing the Mountain Barrier between France and Spain, F. Honore. Sci. Am., vol. 121, no. 8, Aug. 23, 1919, pp. 186-187, 9 figs. Outline of projects for piercing.

Subways. New Construction Methods in Subway Work Under Philadelphia City Hall. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 300-309, 15 figs. Subway built from roof downward by continuous underpinning; method determined by poor character of foundation of building.

Tunnels. Chicago's Tunnels for Electric Light and Power Cables, G. B. Springer. Eng. World, vol. 15, no. 3, Aug. 1, 1919, pp. 53-58, 10 figs. Construction methods employed. Relative advantages of tunnels and conduits.
See also Piercing.

Design and Construction of the Telephone and Telegraph Tunnel Under the Chicago River at Harrison Street, William Artingstall. Mun. & County Eng., vol. 57, no. 2, Aug. 1919, pp. 58-59. Tunnel is approximately 500 ft. long and 90 ft. below street surface. Reference is made specially to shaft sinking.

The Austrian Alphine Tunnels. Ry. Engr., vol. 40, no. 475, Aug. 1919, pp. 168-171, 6 figs. Tauern, Karawanken and Wochein. Methods of construction. (Continuation of serial.)

HARBORS

CURTIS BAY PIER, B. & O. R.R. The Curtis Bay Pier of the B. & O. R.R. I, M. A. Long. Coal Trade Jl., vol. 50, no. 32, Aug. 6, 1919, pp. 953-955, 3 figs. General features of pier said to be capable of handling 12 million tons per annum.

DOCK-STONE SHIPPING. Stone-Shipping Dock is patterned after Ore-Bin Type. Cement & Eng. News, vol. 31, no. 8, Aug. 1919, pp. 34-35, 1 fig. Cylindrical steel bins, loaded from cars above, discharge by gravity to steamers. Capacity 7880 tons.

DULUTH ORE DOCK. Duluth Ore Dock is the Largest in the World, W. H. Hoyt. Ry. Age, 67, no. 8, Aug. 22, 1919, pp. 345-348, 9 figs. Dock has length of 2438 ft. and is 84 ft. above water. It has electric-light masts reaching to 120 ft. above water. Reinforced-concrete slab used for foundation.

PEARL HARBOR DRY DOCK. Completion of the Pearl Harbor Dry Dock, A. Russell Bond. Sci. Am., vol. 121, no. 9, Aug. 30, 1919, pp. 202-203, 11 figs. Method of construction necessitated by reason of peculiar geological conditions.
Unique Construction of Pearl Harbor Graving Dock. Contracting, vol. 9, no 3, Aug. 1, 1919, pp. 77-79, 9 figs. Transverse floor sections built and floated to site in dry dock.

PORTSMOUTH NAVY YARD DOCK. World's Largest Dry Dock Completed at Portsmouth Navy Yard at Cost of $4,000,000. Cement & Eng. News, vol. 31, no. 8, Aug. 1919, pp. 42-43, 1 fig. Basin is 1022 ft. in length; width of coping lines is 144 ft. and width of floor bottom 112 ft.

PURFLEET JETTY AND VIADUCT. Purfleet Jetty and Viaduct. Ferro-Concrete, vol. 10, no. 12, June 1919, pp. 355-364, 11 figs. Structure equipped with cranes for discharging collier steamships. Total river frontage is 586 ft. in length.

HYDRAULIC ENGINEERING

FLOOD WATER. Concrete Channel for Stream Over Fractured Mine Outcrop, Harley A. Coy. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 327-328, 3 figs. Flood water which formerly backed up creek and seeped through into mine below is now carried past broken ground.
See also Storm Water.

RIVER BANKS EROSION. The Causes of Erosion of River Banks, Col. Hoc. Eng. & Contracting, vol. 52, no. 5, July 30, 1919, pp. 123-125, 9 figs. Tendency of river to assume sinuous course explained by analysis that curve of current of liquid is like bending of loaded flexible column. Translated from Génie Civil.

RIVER BANKS PROTECTION. Protecting the Banks of Savannah River Through Augusta, E. C. Garvin. Eng. News-Rec., vol. 83, no. 9, Aug. 28, 1919, pp. 410-412, 1 fig. Development of methods used and data on cost of rock face revetment placed in prewar and war years.

SAND IN SUSPENSION. The Determination of the Amount of Sand in Suspension in Water, G. J. Gibbs. Central (Jl. of Old Students of City and Guilds Eng. Col., Lond.), vol. 16, no. 45, June 1919, pp. 13-20, 2 figs. Method for ascertaining amount of sand carried in suspension by running water, developed as part of problem of dealing with growth and disappearance of sand banks in estuary of river.

STORM WATER. Graphical Method for Estimating Storm-Water Run-Off, Ralph W. Horner. Eng. News-Rec., vol. 83, no. 6, Aug. 7, 1919, p. 282, 1 fig. Graph constructed from formula $Q=ciA$ where Q is total run-off, c run-off coefficient of area, i intensity of rainfall, and A drainage area.

WATER STORAGE. The General Principles of the Development and storage of Water for Electrical Purposes, J. W. Meares. Jl. Instn. Elec. Engrs., vol. 57, no. 283, June 1919, pp. 426-439. 8 figs. Also Engineering, vol. 108, no. 2798, Aug. 15, 1919, pp. 222-224, 5 figs. Examines subject from view point of delivering and continuing to deliver, water to prime mover. Collection, storage and delivery of water on high, medium and low falls are discussed.

MATERIALS OF CONSTRUCTION

GRAVEL. *See Sand and Gravel.*

ROAD MAKING MATERILAS, SAMPLING. Instructions Governing the Sampling and Inspection of Road Making Materials in New Jersey, William G. Thompson. Mun. & County Eng., vol. 57, no. 2, Aug. 1919, pp. 66-69. Prepared by State Highway Engineers.

SAND AND GRAVEL. Properties of Sand and Gravel, A. Ledoux. Cement, Mill & Quarry, vol. 15, no. 3, Aug. 5, 1919, pp. 21-26, 4 figs. Morphological and physical: also tabulated results of granular metric analysis showing difference in percentage of fineness between several grades of sand and gravel.

MUNICIPAL ENGINEERING

BOSTON. Replanning Boston's Most Congested District, Elisabeth M. Herlihy. Am. City, City Edition, vol. 21, no. 2, Aug. 1919, pp. 107-112, 5 figs. Recommendations of Boston City Planning Board for providing right living conditions in " North End."

CITY PLANNING. *See also Portland.*

NIAGARA DISTRICT. Regional Planning of the Niagara District, Thomas Adams' Can. Engr., vol. 37, no. 5, July 31, 1919, pp. 187-189. Future purposes of industrial development, sub-division of land, housing, transportation, sources and distribution of power, water supplied and sewerage, and general amenities. Address at Nat. City Planning Conference.

PORTLAND. City Planning for Portland. Mun. Jl. & Public Works, vol. 47, no. 8, Aug. 23, 1919, pp. 116-118, 5 figs. Zone plans for several districts prepared by City Commission. (To be continued.)

WATER RATES. Water Rates and Fire Protection Charges. Mun. Jl. & Public Works, vol. 47, nos. 5-6, Aug. 2 & 9, 1919, pp. 70-72 & 88-90. Data from several hundred cities of United States; maximum and minimum rates; changes since before the war; receipts for public hydrants and private protection. (To be continued.)

RECLAMATION AND IRRIGATION

DRAINAGE PLANT, CODIGORO. The New Drainage Plant at Codigoro (Die neue Entwåsserungs-Anlage in Codigoro), G. Müller. Schweizerische Bauzeitung, vol. 74, no. 2, July 12, 1919, pp. 14-16, 7 figs. Reinforcing the substructure for the new boiler and machine house; new pumping station. (To be continued.)

LINDSAY-STRATHMORE IRRIGATION DISTRICT. Construction Details of the Lindsay-Strathmore Irrigation District, California, E. Court Eaton. Eng. News-Rec., vol. 83, no. 8, Aug. 21, 1919, pp 348-351, 6 figs. Cement-lined canals and wood and asphaltum-impregnated felt-covered steel pipe lines used.

MIAMI FLOOD WORKS. Miami Flood Works Involve Radical Railway Changes. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 313-315, 4 figs. Railways crossing flood-retarding basins shifted to high ground. Levees guard stretches crossing lowlying areas.

NACHES-SELAH IRRIGATION CANAL. Reconstruction of the Naches-Selah Irrigation Canal, Elbert M. Chandler. Eng. News-Rec., vol. 83, no. 6, Aug. 7, 1919, pp. 276-279, 4 figs. Parts of old sidehill canal in disrepair replaced, under war conditions, by concrete-lined tunnels, reinforced-concrete flumes, and canal with wire-reinforced concrete.

ROADS AND PAVEMENTS

ASPHALTIC PAVEMENTS. Asphaltic Pavements at Ashokan, R. R. Barrett. Good Roads, vol. 18, no. 8, Aug. 20, 1919, pp. 95-96, 3 figs. Method employed in applying asphalt cement for the seal coat of bituminous-concrete roads.

CANADA. Progressive Method of Road Improvement, Gabriel Henry. Can. Engr., vol. 37, no. 6, Aug. 7, 1919, pp. 203-206. Points out advantages of adopting this method in Province of Quebec. Paper read before Can. Good Roads Assn.

CONCRETE ROADS. Stresses in Concrete Road Slabs from Wheels of Heavy Trucks, A. T. Goldbeck. Eng. & Contracting, vol. 52, no. 6, Aug. 6, 1919, pp. 165-166. Conclusions from tests conducted by U. S. Bur. of Public Roads.
See also Standard Details.
A Study of Aggregates in Concrete Paving, R. W. Scherer. Cement & Eng. News, vol. 31, no. 8, Aug. 1919, pp. 32-33, 3 figs. Opinions expressed by various investigators and engineers having had experience in road building.

CONVICTS. Convicts on Road Work. Mun. Jl. & Public Works, vol. 47, no. 5, Aug. 2, 1919, pp. 64-67, 4 figs. Experience with use of convicts in States of Arizona, Florida, Idaho, Illinois, Louisiana, Maryland, Nebraska, New Jersey, Oklahoma, Rhode Island, Utah, West Virginia and Wyoming.

FRANCE. Some Lessons from French Roads, E. A. Kingsley. Mun. Jl. & Public Works, vol. 47, no. 6, Aug. 9, 1919, pp. 82-85. Bituminous treatment claimed to have proven beneficial.

GRADE CROSSING ELIMINATION. Civic and Engineering Features of Grade Crossing Elimination, Allen L. Golinkin. Mun. & County Eng., vol. 57, no. 2, Aug. 1919, pp. 61-63, 1 fig. Suggested sections for railway track-depression sceneme permits passengers an unobstructed view to original ground level.

GRANITE. Paving of Streets and Aisles, Brooklyn Army Supply Base. Eng. News-Rec., vol. 83, Aug. 28, 1919, pp .400-402. Granite used for heavy traffic, asphalt blocks for medium and special construction, and bitulithic for light traffic.

GUARDS. Steel Paving Guards, Chas. F. Puff, Jr. Am. City, Town & Country Ed., vol. 21, no. 2, Aug. 1919, pp. 141-142; also Am. City, City Ed., vol. 21, no. 2, Aug. 1919, pp. 141-142, 1 fig. Results of two years' experience in Philadelphia mentioned as evidence that guard used as edge protection is direct success.

HIGHWAYS TRANSPORT COMMITTEE. Highways Transport Committee for New York. Good Roads, vol. 18, no. 6, Aug. 6, 1918, pp. 77-78. Text of Reconstruction Commission's report recommending establishment of a State Highways Transport Committee to promote marketing of farm produce by rural motor express.

MACADAM ROADS. Construction of Water-Bound Macadam Roads, A. Paradis. Can. Engr., vol. 37, no. 5, July 31, 1919, pp. 175-178 and 193. Experience of Quebec Province Highway officials, particularly in regard to maintaining roads subject to heavy automobile traffic. Translation of paper read in French before Can. Good Roads Assn.
Recommended Method of Resurfacing an Old Macadam Road that is Filled with Ruts and Holes, William N. Bosler. Mun. & County Eng., vol. 57, no. 2, Aug. 1919, pp. 69-70. Practice in Central Kentucky.
Water-Bound Macadam in Multnomah County, Ore, H. B. Chapman. Am. City, Town & County Ed., vol. 21, no. 2, Aug. 1919, pp. 111-114, 3 figs. Advocates construction of water-bound macadam where travel is not too great.

MAINTENANCE. Maintenance Costs of Primary Highways in Washington for Two-Year Period, George F. Cotterill. Mun. & County Eng., vol. 57, no. 2, Aug. 1919, pp. 51-56. State funds from motor-license revenue apportioned to counties for purposes of maintenance and repairing highways. Rules, regulations and requirements are prescribed by State Highway Board.
See also Patrol System.

High Cost of Maintenance of Light Macadam Highways, Frederick Stuart Greene. Eng. News-Rec., vol. 83, no. 8, Aug. 21, 1919, pp. 353-355. Commissioner's answer to inquiry resulting from published statement that only concrete pavement would be built hereafter in New York State.

Highway Maintenance in Wisconsin — I, II, III, J. T. Donaghey. Good Roads, vol. 18, nos. 7, 8 and 9, Aug. 13, 20 and 27, 1919, pp. 87-89, 97-98 and 105-106 and p. 108, 2 figs. Aug. 13: Plan adopted by Wisconsin Highway Commission for taking care of highways by patrol system. Duties of patrolmen. Aug. 20: Specifications approved by Highway Commission. Concerning use of graders, drags and dragging. Aug. 27: Use of road planers and graders. Methods for sandy and clayey roads.

Methods of Maintaining Highways Systems Prior to Construction by the State or County. Frederic E. Everett. Am. City, Town & County Ed., vol. 21, no. 2, Aug. 1919, pp. 107-110. Particularly experience of New Hampshire.

Material-Handling Plant. Labor Saving Material Handling Plant for Concrete Road Construction, A. R. Losh. Eng. & Contracting, vol. 52, no. 6, Aug. 1919, pp. 172-173, 2 figs. Materials are received at central storage and loading plant and are sent direct to mixer in batch units by means of industrial railway equipment. From Public Roads.

Patrol System. Lessons from 191 Experiences of Patrol System of Road Maintenance in Wisconsin. Eng. & Contracting, vol. 52, no. 6. Aug. 6, 1919, pp. 158-159, 1 fig. Data compiled by State Highway Commission. Maintenance in Wisconsin was carried out under a patrol system, supplemented in practically all counties by small gangs for reconstruction and heavy repair work.

Road Machinery. The Selection and Use of County Road Machinery, J. R. Johnson. Mun. & County Eng., vol. 57, no. 2, Aug. 1919, pp. 64-66. Concerning factors influencing selections and precautions to take for maintaining equipment in good conditions.

Economic Utilization of Labor Saving Road Machinery, Chas. M. Upham. Good Roads, vol. 18, no. 6, Aug. 6, 1919, pp. 75-76, 2 figs. Advantages of central loading method of handling material in construction of cement-concrete pavements in Delaware. Paper presented before Am. Road Builders' Assn.

Rural Roads. Proportion and Reasonable Economy in Rural Road Design, W. G. Hargar. Eng. News-Rec., vol. 83, no. 7, Aug. 14, 1919, pp. 324-327, 1 fig. Discussion of correct alignment grades, surfacing and foundations. Comparison of recent practice with that of 10 years ago.

Recommended Practice of Mississippi Valley State Highway Departments for Concrete Road Construction. Eng. & Contracting, vol. 52, no. 6, Aug. 6, 1919, pp. 166-167. From report of conference of Mississippi Valley Assn. of State Highway Dept., held at Chicago to consider questions relating to rural concrete-road construction.

Standard Details. Standard Details of New Jersey State Highway Departments Minor Features of State Roads. Eng. & Contracting, vol. 52, no. 6, Aug. 6, 1919, p. 163, 6 figs. Standard concrete gutter, standard method of banking on curves, standard method guard rail and standard details for catch basins and culvert pipes.

Monolithic Brick Road. New Mechnical Methods Employed with Marked Success in Building Monolithic Brick Road from Ashtabula to Conneaut, Ohio, F. A. Churchll. Mun. & County Eng., vol. 57, no. 2, August 1919, pp. 57-58, 1 fig. By means of two automatic templets which were used for fashioning concrete foundation of monolithic brick road, constructor is said to have been able to built from 1000 ft. to 1100 ft. of monolithic 16 ft. pavement in a day, including foundation and final grouting.

Standard Sections. Standard Sections of State Highway Department of Pennsylvania for Road Pavements. Eng. & Contracting, vol. 52, no. 6, Aug. 6, 1919, p. 156, 11 figs. For bituminous, concrete telford, macadam, wood-block and stone-block roads; also showing construction of car tracks.

SANITARY ENGINEERING

Cleaning. The Cleaning of Receiving Basins and Grit Chambers by Hydraulic Methods, Charles E. Gregory. Am. City, Town and County Ed., vol. 21, no. 2, Aug. 1919, pp. 151-153. Practice in Borough of Manhattan, N. Y. City.

Grease Interception from Sewage. Grease Interception from House Sewage, H. J. Belmont. Domestic Eng., vol. 88, no. 6, Aug. 9, 1919, pp. 249-251 and 285, 5 figs. Grease traps of various kands.

Grit Chambers. *See also Cleaning.*

Incinerators. Incinerators Used at Cantonments. Mun. Jl. & Public Works, vol. 47, no. 8, Aug. 23, 1919, pp. 120-122, 6 figs. Details of design prepared by Construction Division of army for camp of twenty thousand men.

Receiving Tanks. *See also Cleaning.*

Refuse. Collection and Disposal of Refuse in the Future, F. W. Brookman. Can. Engr., vol. 37, no. 6, Aug. 7, 1919, pp. 207-208. Suggestions in regard to choice of wagons, in view of facilities available in consequence of war. Paper read before Inst. of Cleansing Superintendents, England.

Sewage Tanks. The Cantonment Sewage Tanks. Mun. Jl. & Public Works, vol. 47, no. 4, July 26, 1919, pp. 46-50, 3 figs. Difficulties experienced in operating, reasons therefor in opinion of several experts and means devised for their elimination; sewage of unusual concentration and high grease content.

Sewage Treatment. Electrical Treatment of Sewage: The Landreth Direct Oxidation Process, Henry Germain, Maude Creighton and Benjamin Franklin. Jl. Franklin Inst., vol. 188, no. 2, Aug. 1919, pp. 157-187, 9 figs. Description of million gallon plant erected at Easton, Pann., for demonstration purposes. Account of experimental results.

Results of the Test Run of the Direct Oxidation Experimental Sewage Treatment Plant at Easton, Pa., C. A. Emerson Jl. Mun. & County Eng., vol. 57, no. 2, Aug. 1919, pp. 70-75, 1 fig. Consideration of performance led to conclusion that combined action upon sewage of fine screen, line treatment and electrolytic cell render sewage in such a condition that after sedimentation in properly designed tanks effluent can be discharged into a stream, affording a reasonable dilution of relatively clean water, without danger of creating nuisance.

Sewage-Treatment Works at Langley Field, Virginia, Thorndike Saville and Carl L. Weil. Eng. News-Rec., vol. 83, no. 8, Aug. 21, 1919, pp. 374-377, 6 figs. Imhoff tank with receiving bowls, inlet channels, bar screen, distributing channel with downtakes. Dosing chamber, ventilated springling filters, and final settling tanks to be added.

Town Sewerage. Town Sewerage, Edward B. Savage. Surveyor, vol. 56, no. 1435, July 18, 1919, pp. 40-43 and (discussion) pp. 43-44. Concerning provision of manholes and of ventilation and freezing of sewers.

SURVEYING

Twist in Conformed Mapping. On the Twist in Conformed Mapping, T. H. Gornwall. Proc. Nat. Acad. Sciences, vol. 5, no. 7, July 1919, pp. 248-250. Importance of twist in comparison of maps of different regions.

WATER SUPPLY

Chlorination. *See also Water Treatment.*

Gallery Water-Collecting System. Special Features of the Gallery Water Collecting System of the Des Moines Water Co., Des Moines, Ia., A. F. Luce. Mun. & County Eng., vol. 57, no. 2, Aug. 1919, pp. 75-77, 4 figs. Constructional features of each one of the infiltration galleries, with notes on geology of region.

Metering. Metering and Water Consumption, H. P. T. Matte. Can. Engr., vol. 37, no. 5, July 31, 1919, pp. 181-184. Effective installing of water meters upon onsumption of water. Comparison of usage in various cities. Paper read before Western Soc. of Engrs.

Water-Purification Units, Portable. Motor Truck Mounted Water Purification Units, William J. Orchard. Eng. World, vol. 15, no. 3, Aug. 1, 1919, pp. 35-38, 7 figs. Description and operation of unit developed for A. E. F.

Water Treatment. Water Facilities for Southern at Monroe. Ry. Maintenance Engr., vol. 15, no. 8, Aug. 1919, pp. 270-272, 4 figs. Treatment given to turbid and muddy water in sedimentation basin and coagulating system.

Feed Water Treating and Purifying Plant, S. H. McKee. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 401-405, 4 figs. Treating capacity is 300,000 gal. per hr. It is noted that plant was laid out so that a 25 per cent extension can be made to give ultimate treating capacity of 375.000 gal. per hr.

Chlorination Treatment of London Water Supply Proves Pronounced Success. Contract Rec., vol. 33, no. 33, Aug. 13, 1919, pp. 779-781. Comments on speed and cost.

Action of Sodium Hyposulphite on Hypochlorites (Action de l'hyposulfite de solium sur les hypochlorites), F. Dienert and F. Wandenbulcke. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 1, July 7, 1919, pp. 29-30. Experiments to determine quantity of sodium hyposulphite necessary to combine with free chlorine in treatment of water.

INDUSTRIAL TECHNOLOGY

Acetylene. Acetylene, R. A. Witherspoon. Can. Chem. Jl., vol. 3, no. 8, Aug. 1919, pp. 250-253. General properties and its application in industry. *See also Cardide.*

Alcohol. Notes on the Production of Synthetic Alcohol, E. K. Rideal. Chem. Age, vol. 1, no. 1, June 21, 1919, pp. 9-11, 1 fig. Potentialities of wood cellulose as raw material.

Asphalt. The Municipal Asphalt Plant of the District of Columbia, G. B. Hunt. Am. City, City Edition, vol. 21, no. 2, Aug. 1919, pp. 119-120, 2 figs. Record of operation for 1918, with cost data.

Bleaching. *See Cotton Bleaching.*

Calcination. *See Gypsum.*

Carbide. The Canada Carbide Company, Limited, J. C. King. Can. Chem. Jl., vol. 3, no. 8, Aug. 1919, pp. 262-264, 2 figs. Brief history of carbide industry and description of its growth and development at Shawinigan Falls.

Cellulose. Reactions of Cellulose, Florence B. Seibert and Jessie E. Minor. Paper, vol. 24, no. 23, Aug. 13, 1919, pp. 15-20. 4 figs. Study of development of oxycellulose in papermaking.

Chemical Industry, American. The Economic Status of American Chemical Industry, Frederick E. Breithut. Chem. & Metallurgical Eng., vol. 21, no. 3, Aug. 1, 1919, pp. 129-131, 10 figs. Charts based on specifications given in Census of Manufacturers for 1914.

Chemicals, Prices. Prices of Chemicals During the War Frederick E. Breithut. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 174-176, 2 figs. Charts showing movement away from pre-war level.

Chlorine. The Nelson Electrolytic Chlorine Cell, C. F. Carrier, Jr. Chem. & Metallurgical Eng., vol. 21, no. 3, Aug. 1, 1919, pp. 133-136, 4 figs. History, description and record of commercial application. From paper read before American Electrochemical Soc.

Electric Installations of Works Manufacturing Chlorine (Les installations électriques de l'usine "Le Chlore Liquide"), Jacques de Soucy. Chimie & Industrie, vol. 2, no. 6, June 1919, pp. 627-640, 13 figs. Current supplied at 26,000 volts is stepped down to 3200 volts and partly to 1850 volts.

Coal Tar. Continuous Process for Distilling Coal Tar. Gas Age, vol. 44, no. 4, Aug. 15, 1919, pp. 149-152, 11 figs. Description of plant erected at Gas Works of Geneva, Switzerland. From Journal des Usines & Gaz.

Column Apparatus. Column Apparatus in Chemical Industry, Sydney J. Tungay. Chem. Age, vol. 1, no. 1, June 21, 1919, pp. 11-14, 6 figs. Discussion of principles regarding use, of towers, columns and filling materials manufactured from acid-resisting iron. Special reference is made to type to distallation and washing column patented by Kubierschky.

COTTON BLEACHING. Bleaching of Cotton (Blanchiment du Coton), Robert Weiss. Bulletin de la Société Industrielle de Mulhouse, vol. 84, no. 6, Oct.-Nov.-Dec' 1914, pp. 499-506. Experiments with strontium as substitute for lime.

CRUCIBLES. *See Graphite.*

CYANIDES. The Recovery of Cyanides from coal. Chem. Age, vol. 1, no. 4, July 12, 1919, pp. 90-92, 1 fig. Extraction process of hydrocyanic acid resulting from distillation of coal.

GLASS. The Cooling of Optical Glass Melts, Howard S. Roberts. Jl. Am. Ceramic Soc., vol. 2, no. 7, July 1919, pp. 543-563, 7 figs. Conditions to be attained when melt of optical glass is cooled in the pot.

The Volatilization of Iron from Optical Glass Pots by Chlorine at high Temperatures, J. C. Hostetter, H. S. Roberts and J. B. Ferguson. Jl. Am. Ceramic Soc., vol. 2, no. 5, May 1919, pp. 356-372, 5 figs. Experiments said to have indicated beyond doubt that iron can be readily removed from pots by this method.

GLUES. Water-Resistant Glues, F. L. Browne. Crem. & Metallurgical Eng., vol. 21, no. 3, Aug. 1, 1919, pp. 136-138, 3 figs. Including bibliography on casein and casein glues.

GRAPHITE. Structure of Graphite in Relationship to Crucible Making, Reinhardt Thiessen. Jl. Am. Ceramic Soc., vol. 2, no. 7, July 1919, pp. 508-542, 29 figs. Crucibles containing Ceylon graphite were examined; also English crucible containing Madagascar graphite,several American crucibles containing American graphite and one Japanese crucible of unknown graphite origin. They all showed flake formation excepting Ceylon graphite, which evidenced granulars form.

Effect of Variable Pressure and Tar Content on the Briquetting of Alabama Graphite, R. T. Stull and H. G. Schurecht. Jl. Am. Ceramic Soc., vol. 2, no. 5, May 1919, pp. 391-399, 8 figs. Results of experiments.

GYPSUM. Gypsum Wall Plaster of France, C. F. Columbia. Cement, Mill & Quarry, vol. 15, no. 3, Aug. 5, 1919, pp. 17-19. Methods of extraction and account of French process of calcination.

HYDROCYANIC ACID. *See Cyanides.*

JAPANS. Water Japan, Wheeler P. Davey. Gen. Elec. Rev., vol. 22, no. 8, Aug. 1919, pp. 634-635. Characteristics of emulsion. Electric-dip and hot-dip methods for applying it.

LEATHER. Leather from the Sea, Robert G. Skerrett. Sci. Am., vol. 121, no. 8, Aug. 23, 1919, pp. 182-183, 2 figs. Work done in adaptation of skins of sharks, rays, dogfish, backfish, etc., to general purposes of leather worker.

OILS. Suggestions Regarding the Selection of Drying Oils, Henry A. Gardner. Educational Bur., Scientific Section, Paint Manufacturers' Assn. of U. S., no. 66, Aug. 1919, 3 pp. Including contents of specifications for raw, boiled, and refined linseed oils, as recommended by the U. S. Interdepartmental Committee on Standardization of Paint Specifications.

Soya Oil, Henry A. Gardner. Educational Bur., Scientific Section, Paint Manufacturers' Assn. of U. S., no. 67, Aug. 1919, 16 pp. Summary of data regarding composition, physical properties and industrial uses.

Marine Animal Oils in Paints and Varnishes, Henry A. Gardner. Educational Bur., Scientific Section, Paint Manufacturers' Assn. of U. S., no. 68, Aug. 1919, 7 pp. Survey of results obtained and practices developed by various investigators.

Driers for Soya Oil, Henry A. Gardner. Educational Bur., Scientific Section, Paint Manufacturers' Assn. of U. S., no. 69, Aug. 1919, 12 pp. It is concluded as result of experiments that raw soya oil may be dried almost as rapidly as boiled linseed oil. Drier combinations that produce best results are given.

PAPER. Paper Pulp Manufacture in Australia, Gerald Lightfoot. Paper, vol. 24, nos. 23 and 24, Aug. 13 and 20, 1910, pp. 22-23 and 27-30, Aug. 13: Investagation of possibilities of production prompted by shortage of raw materials, Aug. 20: Investigations on pulping qualities of Young Kutri timber.

Paper Mill Bark As Tanning Material, Vance P. Edwardes. Paper, vol. 24, no. 24, Aug. 20, 1919, pp. 18-21, 1 fig. The utilization of waste hemlock bark from pulp mills for tanning purposes. Experiments at Forest Products Laboratory.

EAT-FUEL PROCESS. Willmarth Peat Fuel Process, C. A. Willmarth. Jl. Am. Peat Soc., vol. 12, no. 3, July 1919, pp. 113-122, 5 figs. For making peat coke and extracting by-products.

PHOTOGRAPHY. The Crystallography and Optical Properties of the Photographic Sensitizing Dye, Pinaverdol, Edgar T. Wherry and Elliot Q. Adams. Jl. Wash.Acad. Sci.,vol. 9, no. 14, Aug. 19, 1919, pp. 396-405, 4 figs. This dyestuff, formerly made only in Germany is now being produced in England and the U. S.

POTASH. American Potash, Herbert H. Roe. Min. & Sci. Press, vol. 119, no. 6, Aug. 9, 1919, pp. 195-202, 11 figs. Review of recent achievements.

Potash Recovery at Cement Plants, Alfred W. G. Wilson. Canada Dept. Mines, bul. no. 29, May 6, 1919, 34 pp., 10 figs., partly on supp. plates. Based upon investigations undertaken under instructions from chairman of Committee of Reconstruction and Development of the War Trade Board.

The Alsatian Potash Industry, Frank K. Cameron. Am. Fertilizer, vol. 51, no.14, Aug. 16, 1919, pp. 49-54. Cubic contents of potash estimated as 275,000,000 tons.

The International Potash Situation. Chem. Age, vol. 1, no. 5, July 19, 1919, pp. 131-133, Statistics and war time experience. Pre-war and future cost of production; natural deposits outside Germany; potash from felspars, leucites, etc.

RUBBER. Chemistry of Rubber, S. C. Bradford, Sci. Am. Supp., vol. 88, no. 2275, Aug. 9, 1919, pp. 82-83. Historical account of researches and constitution and inventions relating to process of vulcanization.

Crude Rubber to the Front. Raw Material, vol. 1, no. 5, July 1919, pp. 246-251. Variaties of crude rubber, their trade names,qualities and market forms.

The Nature of Vulcanization, H. P. Stevens. Jl. Soc. Chem. Indus. vol. 38, no. 13, July 15, 1919, pp. 192T-196T. Two theories noted: (1) vulcanization is primarily an absorption process, or (2) a chemical combination, of sulphur with rubber hydrocarbon. Writer quoted experiments undertaken to determine whether or not technical effect of vulcanization can be produced without chemical combination between sulphur and hydrocarbon taking place.

SULPHATE OF AMMONIA. Report of Alkali Works Inspector. Iron & Coal Trades Rev., vol. 99, no. 2683, Aug. 1, 1919, pp. 146-147. Concerning production for 1918 of sulphate of ammonia in bulk as by-product.

TANNIN. Hemlock Bark as a Source of Tannin, Vance P. Edwardes. Chem. Engr., vol. 27, no. 8, Aug. 1919, pp. 178-182, 1 fig. Results of investigations conducted by Forest Products Laboratory.

See also Paper.

TETRACHLORETHYLENE. Preparation of Tetrachlorethylene, H. B. Weiser and G. E. Wightman. Jl. Phys. Chemistry, vol. 23, no. 6, June 1919, pp. 415-439. Survey of results obtained by various investigators and account of experiments undertaken by writers.

WOOD DISTILLATION. A New Method of Distilling Both Green and Seasoned Hardwoods. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 193-194. Chief point of advantage claimed for process used by Kingsport Wood Reduction Company is method of briqueting sawdust or finely divided woodwaste and of distilling wood briquets under controlled conditions of temperature and pressure in multitubular retorts.

MUNITIONS AND MILITARY ENGINEERING

BALLISTICS. Equations of Differential Variations in Exterior Ballistics, W. E. Milne. Jl. U. S. Artillery, vol. 51, no. 2, Aug. 1919, pp. 154-159, 1 fig. Suggested modifications in method of derivation devised by F. R. Moulton.

Trajectories and Their Corrections, A. G. Kirk. U. S. Naval Inst. Proc., vol. 45, no. 198, Aug. 1919, pp. 1375-1395, 7 figs. Method of computation by mechanical integration.

CAMOUFLAGE. The Dazzle Paintings of Ships, Norman Wilkinson. Engineering, vol. 108, no. 2797, Aug. 8, 1919, pp. 192-195, 5 figs. Origin and development, and reasons for its adoption as opposed to painting a ship with a view to acheving invisibility.

CHEMICAL WARFARE. Innovations of the Recent War, William L. Sibert. Jl. Cleveland Eng. Soc., vol. 11, nos. 5 & 6, Mar.-May 1919, pp. 272-281. Chemical work involved, particularly in connection with gas warfare, with notes on policy followed by Chemical Warfare Service.

CHRONOGRAPH. The Aberdeen Chronograph. Sci. Am., vol. 121, no. 6, Aug. 9, 1919, pp. 131 and 145, 5 figs. Device for timing fight of projectile developed by Army Ordnance Dept.

COAST DEFENSE. Coast Defenses Constructed by the Germans on the Belgian Coast, Augustus Norton and Donald Armstrong. Jl. U. S. Artillery, vol. 51, no. 2, Aug. 1919, pp. 160-181, 55 figs. Battery on Belgian coast consisted of four 28-cm. guns.

Discussion of Method of Indirect Firing for Coast Defense (De toepassing Van de methode der indirecte righting bij Kustgeschut), H. D. S. Hasselman and P. Post Ulterweer. Arthleristisch Tijaschrift, no. 8, Aug. 1919, pp. 474-489, 1 fig.

EXPLOSION OF CHARGES AT SEA. Science and Its Application to Marine Problems, J. C. McLennan. Engineer, vol. 128, no. 3317, July 25, 1919, p. 92. Investigations of characteristics of pressure waves generated by explosion of charges in sea. (Concluded). Paper read before North-East Coast Instn. of Engrs. and Shipbuilders.

GUN MOUNTS. Building 5-inch Gun Mounts at Brantford, J. H. Moore. Can. Machy., vol. 22, no. 6, Aug. 7, 1919, pp. 143-145, 7 figs. Mining operations and inspection. Second installmen.t

See also Naval Guns.

GUN OPERATION. Operations on the British 9.2-in. Gun — I, II, III, William Chubb. Am. Mach., vol. 51, nos. 6, 8 and 9, Aug. 7, 21 and 28, 1919, pp. 275-280, 373-377 and 423-427, 26 figs. Aug. 7: Noting particularly difference in production operations from practice on ordnance in United States, British 9.2. army gun is very similar in design and construction to guns of British navy, Aug. 21: Manufacture of various sizes of rings from one forging by combined processes of trepanning, turning and boring. Aug. 28: Mining, bulding and inspection.

ILLUMINATING DEVICES. Illuminating Devices in the Great War — I, II, M. Brayton. Sci. Am. Supp., vol. 88, no. 2277, Aug. 23, 1919, pp. 114-115 and p. 127, 1 fig. Account of areial fighting devices and their development from 1914 to the armistice.

MOTOR TRANSPORT CORPS. The Automotive Industry and the Motor Transport Corps, B. F. Miller. Jl. Soc. Automotive Engrs., vol. 5, no. 2, Aug. 1919, pp. 148-154. Concerning maintenance engineering features of Motor Transport Corps.

NAVAL GUNS. Transportation and Mounting of Naval Guns at the Front (Transporto e montamento del Cannoni navili alla fronte), Guiseppe Floravanzo. Rivista Marittima, vol. 52, no. 6, June 30, 1919, pp. 293-305, 13 figs. Types of both mobile and fixed mountings developed by Italian army.

NAVY, BRITISH. The New Navy — VII. Mar. Engr. & Naval Architect, vol. 42, no. 503, Aug. 1919, pp. 7-11, 4 figs. Details of "Courageous" and "Glorious." These ships are in large light-cruiser category and form unique class.

POWER GASES. On the Possible Form of the Equation of State of Powder Gases, A. G. Webster. Proc. Nat. Acad. Sciences, vol. 5, no. 7, July 1919, pp. 286-288. Examination of most general form possible for equation of state that will permit of variability of specific heats, but maintain constancy of their difference.

PRESSURE MEASUREMENT IN GUNS. A new Instrument for Measuring Pressure in a Gun, A. G. Webster and L. T. E. Thompson. Proc. nat. Acad. Sciences, vol. 5, no. 7, July 1919, pp. 259-263, 4 figs. Apparatus which is said to register pressure at any time while projectile is in barrel.

REPAIR SHOPS. Portable Repair Shops for the Army, Harold S. Lord. Am. Mach., vol. 51, no. 7, Aug. 14, 1919, pp. 317-322, 6 figs. Including lists of tools and accessories carried by (1) machine shop, (2) blacksmith shop and (3) carpenter shop, and also list of regular equipment for material truck.

SALVAGING SUBMARINES. A Salvaging Submarine, Hawthorne Daniel. Sci. Am., vol. 121, no. 7, Aug. 16, 1919, pp. 154-155 & 166-168, 7 figs. Combination of surface vessel and diving bell, so arranged that whether diving bell is submerged or not, surface workmen can readily pass from surface vessel to bell and vice versa.

SHELL MANUFACTURE. Researches in regard to Various Points in the Manufacture of Shells (Recherches sur différents points de la fabrication des obus), Léon Guillet. Revue de la Métallurgie, May 1917, 36 pp., 125 figs., partly on 34 supp. plates. Micrographic examinations and chemical analysis to determine influence of form of punch, rapidity of its wear, process of piercing, temperature of metal and of punch.

SUBMARINE DEFENSE. Science and Its Application to Marine Problems, J. C. McLennan. Shipbuilding & Shipping Rec., vol. 14, no. 5, July 31, 1919, pp. 123-124. Also Engineering, vol. 108, no. 2795, July 25, 1919, pp. 128-130. Development of anti-submarine measures and devices. Paper read before Northeast Coast Instn. Engrs. and Shipbuilders.

TORPEDO-BOAT DESTROYERS. Torpedo-Boat Destroyers in the Making, James Reed. Mech. Eng., vol. 41, no. 9, Sept. 1919, pp. 739-743 and p. 781. Historical review of modern American torpedo craft. Non-technical description of the "Ward," which was launched 64 per cent complete and only 17½ days after laying of keel.

GENERAL SCIENCE

CHEMISTRY

ACETYLENE ANALYSIS. A Modified Method for the Analysis of Mixtures of Ethylene and Acetylene, William H. Ross and Harlan L. Trumbull. Jl. Am. Chem. Soc., vol. 41, no. 8, Aug. 1919, pp. 1180-1183, 3 figs. Gas holder used by writers applying method outlined by Chavastelon (see Compt. rend., 125, 245, 1897), for determination of acetylene in gaseous mixture.

ANALYSIS. A New Method of Chemical Analysis, A. W. Hull. Jl. Am. Chem. Soc., vol. 41, no. 8, Aug. 1919, pp. 1168-1175, 9 figs. Method consists in reducing to power form substance to be examined, placing it in small glass tube, sending beam of monochromatic X-rays through it, and photographing the diffraction pattern produced.

See also Glass, Carbon Bisulphite, Matte and Slag. Rubber, Flue Gas, Gas, Acetylene and Ethylene.

CARBON BISULPHIDE. Estimation of Carbon Bisulphide: A. Critical Examination of the Various Methods Usually Employed, Percy E. Spielmann and F. Butler Jones. Jl. Soc. Chem. Indus., vol. 38, no. 13, July 15, 1919, pp. 185T-188T. With regard to their relative value, conditions of best results, and limits of accuracy of each.

COLLOIDS. *See Soaps.*

ELECTRICAL CONDUCTIVITY OF ELEMENTS. Is the Electrical Conductivity of the Elements Conditioned by the Presence of Isotopes? F. H. Loring. Chem. News, vol. 119, no. 3091. July 11, 1919, pp. 14-16. Table showing proportionate number of isotopes and percentages of higher values in various metals discloses that electrical conductivity is conditioned by proportion of isotopes present.

ETHYLENE ANALYSIS. *See Acetylene Analysis.*

FUEL-GAS ANALYSIS. Combustion Control in Mill Boiler Plant — III, Robert June. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 398-400, 4 figs. Flue-gas analysis.

GAS ANALYSIS. Industrial Analysis of gaseous Mixtures by refractometric Method (Analyse industrielle des mélanges gazeux par la méthode réfractométrique), Marcel Ponchon. Chimie & Industrie, vol. 2, no. 6, June 1919, pp. 647-655, 6 figs. How to use Lord Rayleigh's interferential refractometer.

GAS MEASUREMENT. Apparatus for Measuring Volume of Gas Liberated in a Chemical Reaction (Appareil pour mesurer le volume gazeux dégagé dans une réaction chimique), P. Nicolardot and M. H. Robert. Chimie & Industrie, vol. 2, no. 6, June 1919, pp. 641-646, 1 fig. Modification of apparatus described in Bul. Soc. Chim. de France, vol. II, p. 406, 1912. Change consists in using water instead of mercury.

GLASS ANALYSIS. The Rapid Electrometric Determination of Iron in Some Optical Glasses, J. B. Feugnson and J. C. Hostetter. Jl. Am. Ceramic Soc., vol. 2, no. 8, Aug. 1919, pp. 608-621, 3 fig. Discusses results of application of electrometric determination of iron with stannous chloride and potassium dichromate.

HELIUM. *See Structure of Matter..*

MAGNETITE. Determination of Magnetite in Matte and Slag, F. G. Hawley. Eng. & Min. Jl., vol. 108, no. 8, Aug. 23, 1919, pp. 308-310. Writer holds that qualitative tests are of little significance, and claims that quantitative method has been proved to be sufficiently accurate and is also rapid.

RUBBER. The Use of Hydrometers to Determine the Rubber Content of Latex, O. de Vries. India-Rubber Jl., vol. 58, no. 2, July 12, 1919, pp. 17-18. 1 fig. Explanation for anomalous results obtained with experiments such as metrolac of R. G. A. or Griffin's latexometer. From Archief voor de Rubber-cultur.

SOAPS. Colloid-Chemical Studies on Soaps, Martin H. Fischer. Chem. Engr., vol. 27, no. 8, Aug. 1919, pp. 184-193, 12 figs. Non-aqueous liophilic soap colloids.

STRUCTURE OF MATTER. The Structure of Atoms and the Octet Theory of Valence, Irving Langmuir. Proc. Nat. Acad. Sciences, vol. 5, no. 7, July 1919, pp. 252-259. Concerning extension of Lewis theory of cubinal atom.

The Arrangement of Electrons in Atoms and Molecules — II, Irving Langmuir. Gen. Elec. Rev., vol. 22, no. 8, Aug. 1919, pp. 587-600, 12 figs. Writer points out what he terms uncertainties attached to textbook conceptions of valency, and suggests much more general theory of valence which he subsequently applies in elucidating structure of a number of organic and inorganic compounds. (To be continued.)

Helium Atom According to Bohr's Theory (Sur l'atome d'Helium selon la théorie de Bohr), Franz Tank. Archives des Sciences physiques et naturelles, vol. 1, May-June 1919, pp. 240-241. Table giving $\triangle n$ for neutral heilum.

Ritz's Formula and Theory of Quanta (La formule de Ritz et la théorie des quanta), L. Bloch. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 25, June 23, 1919, pp. 1271-1273. As to whether by slightly complicating structure of atom it is possible by calculations similar to Bohr's to arrive at Ritz's formula.

SULPHIONS. "Sulphions" formed by Sodium, Rubidium and Cassium Iodides (Sur les sulfones formées par les iodures de sodium, de rubidium et de caesium), R. de Forchand and F. Taboury. Competes rendus des séances de l'Académie des Sciences, vol. 168, no. 25, June 23, 1919, pp. 1253-1257. Experiments to confirm accounts reported by various writers relative to transformations of certain salts in presence of sulphurous anhydrites.

TERNARY SYSTEM. The Ternary System, J. B. Ferguson and H. E. Merwin. Am. Jl. of Sci. (Fourth Series), vol. 48, no. 284, Aug. 1919, pp. 81-123, 17 figs. Experimental research of solidus-liquidus relations.

WEIGHING. The Single Deflection Method of Weighing, Paul H. M.-P. Brinton. Jl. Am. Chem. Soc., vol. 41, no. 8, Aug. 1919, pp. 1151-1155. Writer claims to have found method practicable and reliable after critical investigation.

MATHEMATICS

ABELIAN VARIETIES. Real Hypersurfaces Contained in Abelian Varieties, S. Lefschetz. Proc. Nat. Acad. Sciences, vol. 5, no. 7, July 1919, pp. 296-298. Number of algebraically distinct real hypersurfaces which abelian variety of genus p and rank one, if real, may have.

CUBICAL PARABOLAE. *See Parabolic Scales.*

CURVE GENERATION. On a Certain Generation of Rational Circular and Isotropic Curves, Arnold Emch. Bul. Am. Math. Soc., vol. 25, no. 9, June 1919, pp. 397-404. Establishes necessary and sufficient conditions for form of parametric representation of rational circular, in particular of rational isotropic curve, and their generation by rational transformation in a complex plane.

DERIVATIVE OF A FUNCTIONAL. The Derivative of a Functional, P. J. Daniell. Bul. Am. Math. Soc., vol. 25, no. 9, June 1919, pp. 414-416. Concerning definition given by Volterra in Equations Intégrales, p. 12 et seq. Writer establishes that under more general conditions, variation is linear functional in sense of Riesz and, therefore, a Stieltjes integral.

EQUATIONS. The Singularities of Differential Equations and the Summative Series (Les singularités des équations différentielles et les séries sommables), Georges Remoundos. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 25, June 25, 1919, pp. 1265-1268. Theorem establishing case in which analytical function defined by series is integral of differential equation verified by series.

HERMITE'S QUADRATIC FORMS. Hermite's Positive Quadratic Forms (Sur les formes quadratiques positives d'Hermite), G. Humbert. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 25, June 23, 1919, pp. 1240-1246. Cases when $P = 1$ or 2 in formula of measure for given discriminant.

INVARIANTS. Modular Invariants of a Quadratic Form for a Prime Power Modulus, J. E. McAtee. Am. Jl. Math., vol. 41, no. 3, July 1919, pp. 225-242. Invariants of n-ary quadratic form modulo P and polynomial modular invariants of a binary quadratic form.

Invariants of Differential Geometry by the Use of Vector Forms, C. I Rice. Am. Jl. Math., vol. 41, no. 3, July 1919, pp. 165-182. Example illustrating procedure.

OPERATOR GROUPS. Groups Containing a Relatively Large Number of Operator of Order Two, G. A. Miller. Bul. Am. Math. Soc., vol. 25, no. 9, June 1919 pp. 408-413. Generalization of following form: Whenever more than hal of operators of a group are of order 2 this excess is an odd number.

PARABOLIC SCALES. New Construction of Cubical Parabolas (Nouvelle constructio des paraboles cubiques), P. Sonier. Génie Civil, vol. 75, no. 4, July 2 1919, pp. 78-79, 2 figs. With reference to method of drawing by paraboli scales, writer points out theorem which permits determining point of parabol situated on given vertical line.

QUARTICS. Investigations on the Plane Quartic, Teresa Cohen. Am. Jl. Math vol. 41, no. 3, July 1919, pp. 191-211. On undulation of quartic and discr minants of Hessian and other conics.

QUINTICS. The Self-Dual Plane Rational Quintic, L. E. Wear. Bul. Am. Mat Soc., vol. 25, no. 9, June 1919, pp. 405-408. In quintic $2d+3c=15$, whe $d=c=3$.

SALTUS EQUATIONS. On Certain Saltus Equations, Henry Blumberg. Am. Math., vol. 41, no. 3, July 1919, pp. 183-190. Gives solutions in vario cases.

TRIVARIANT SYSTEMS. Theorem on Trivariant Systems (Theorème sur les systèmes trivariants), Félix Michaud. Annales de Physique, vol. 12, May-June 1919, pp. 291-295. Relative to varying volumes jof two phases without changing concentrations.

VECTORIAL SPACES. Vectorial Spaces with Undetermined Asymptotic Directions (Champs vectoriels à directions asymptotiques indéterminées), Axel Egnell. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 25, June 23, 1919, pp. 1263-1265. Case of indetermination of asymptotic directions when tangents of orthogonal trajectors form part of lineal complex.

PHYSICS

ACOUSTICS. Acoustical Impedance, and the Theory of Horns and of the Phonograph, Arthur Gordon Webster. Proc. Nat. Acad. Sciences, vol. 5, no. 7, July 1919, pp. 275-282, 5 figs. Introducing complex ratio defining impedance in study of oscillating system into which a volume of air periodically enters under a given excess pressure.

BENZINE. *See Vapor Pressures.*

CYCLOHEXANE. *See Vapor Pressures.*

GAS LAW ALIGNMENT CHART. Alignment Chart for the Gas Laws, Alan G. Wikoff. Chem. & Metalllurgical Eng., vol. 21, no. 4, Aug. 15, 1919, p. 195, 1 fig. Temperature scales so graduated that scale reading in deg. cent. corresponds to logarithm of absolute temperature.

HEAT TRANSFORMATION INTO ELECTRICAL ENERGY. Direct Transformation of Heat Into Electrical Energy Otherwise Than by Means of Electrothermic Couples (Sur la transformation directe de la chaleur en energie électrique par d'autres voies que les couples thermoélectriques), Albert Perrier. Archives des Sciences physiques et natruelles, vol. 1, May-June 1919, pp. 243-246. Consequences derived from magnetic and electric asymmetries of matter.

MAGNETIC ISOTHERMALS. Ferromagnetism and Characteristic Equation of Fluids (Ferromagnétisme et équation caractéristique des fluides), Pierre Weiss. Archives des Sciences physiques et naturelles, vol. 1, May-June 1919, pp. 169-185, 8 figs. Interpretation of magnetic isothermals of nickel in vicinity of Curie's point.

PHONOGRAPH. *See Acoustics.*

RELATIVITY. On the Theory of Relativity (Sur la théorie de la rélativité), Edouard Guillaume. Archives des Sciences physiques et naturelles, vol. 1, May-June 1919, pp. 246-250. Concerning introduction of single pyrometer to represent time.

SPECTRUM. New Lines in Iron Spectrum (Une nouvelle répartition de raies dans le spectre du fer), Aug. Hagenbach. Archives des Sciences physiques et naturelles, vol. I, May-June 1919, pp. 231-235, 1 fig. Observed by writer in vicinity of 500 *uu.*

VAPOR PRESSURES. Maxima Pressures of Benzine and Cyclohexane Vapors at Mean Temperatures and Calculation of Their Principal Specific Hearts (Pressions maxima des vapeurs du benzène et du cyclohexane aux températures moyennes et calcul de leurs chaleurs spécifiques principales), G. Dejardin Annales de Physique, vol. 12, May-June 1919, pp. 253-291, 7 figs. Values computed from formulæ compared with results of experimental observations.

AERONAUTICS

AIRCRAFT

B-CLASS AIRSHIPS. *See United States.*

BRITISH AIRSHIPS. The British Navy Airship S. R. I, Italian "M" Type. Flight, vol. 11, no. 30, July 24, 1919, pp. 979-981, 10 figs. Semi-rigid type. Dimensions are: Length, 290 ft.; diameter, 58 ft.; overall height, 72 ft.; disposable lift, 7700 lb.
See also R-34.
Lighter-Than-Air Craft, T. R. Cave-Browne-Cave. Jl. Soc. Automotive Engrs., vol. 5, no. 2, Aug. 1919, pp. 167-175, 3 figs. Structural characteristics of British naval types. Paper read before Roy. Aeronautical Soc. of Gt. Britain.

C-CLASS DIRIGIBLE. *See United States.*

R-34. H. M. Dirigible R-34, A. E. Bishop. Rudder, vol. 35, no. 8, Aug. 1919, pp. 353-357, 5 figs. With notes on development of airships.

RIGID AIRSHIPS. General Foundamentals of Rigid Airship Design, R. H. Upson. Jl. Soc. Automotive Engrs., vol. 5, no. 2, Aug. 1919, pp. 117-119, 1 figs. From study of British and German types.
Stresses in a Rigid Airship Due to Bending, E. H. Lewitt. Aeronautics, vol. 17, no. 299, July 10, 1919, pp. 48-50, 5 figs. Technical study leads to assertion that ordinary bending formula $M/I=f/y$ may be applied to rigid airship with diagonal bracing of wire, providing that section of ship can be inscribed in circle and that transverse girders are of equal length, the longitudinals being assumed to take all the bending.
Rigid Airships (Les dirigeables rigides), E. Gouault. Génie Civil, vol. 75, no. 4, July 25, 1919, pp. 69-87, 18 figs. Constructional details of R-34 and other dirigibles.

UNITED STATES. Airship Engineering Progress in the United States, J. C. Hunsaker. Aviation, vol. 7, no. 2, Aug. 15, 1919, pp. 72-76, 7 figs. Development of B class. (To be concluded.)
U. S. Navy Class "C" Dirigible. Aerial Age, vol. 9, no. 24, Aug. 25, 1919, pp. 1095-1098, 6 figs. General specifications. "C" type is 192 ft. long, 43 ft. wide, and 46 ft. high; it has capacity of 180,000 cu. ft.

APPLICATIONS

INDIA. Aviation as Affecting India, Lord Montagu of Beaulieu. Jl. Roy. Soc. Arts, vol. 67, no. 3477, July 11, 1919, pp. 543-551 and (discussion) pp. 551-554, 2 figs. Suggested routes from England to India.

WAR PERIOD. Progress of Aviation in the War Period, Leonard Bairstow. Engineer, vol. 128, nos. 3317 and 3318, July 25 and Aug. 1, 1919, pp. 93-94 and 115-117, 8 figs. July 25: Reference is made to B. E. 2C. In discussing developments during war, writer considers unfortunate that growth has not been accompanied with usual concurrent growth of civil demand. Graph is given illustrating aerodynamic disadvantages of high speed. Aug. 1: Accelerometer records of loads and records of pitching oscillations. Paper read before Roy. Aeronautical Soc., Great Britain.

AUXILIARY SERVICE

HANGARS. Reinforced-Concrete Hangars for the Naval Aviation Center of Algiers, E. Carret. Eng. & Contracting, vol. 52, no. 5, July 30, 1919, pp. 132-133, 2 figs. Translated from Génie Civil.

PARACHUTES. The Smith Parachute. Aerial Age, vol. 9, no. 21, Aug. 4, 1919, p. 974, 4 figs. Of flat type 28 ft. in diameter, with 42-in. patent shock-absorbing vent supported by 40 silk shroud lines of 250 lb. breaking strength.

PHOTOGRAPHY. Photographic Industry and National Defense (L'industrie photographique française et la défense nationale), L. P. Clerc. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 3, May-June 1919, pp. 614-627, 9 figs. Military and civil uses of aerial photography in France.

RESPIRATORY APPARATUS. Automatic Respiratory Apparatus for High-Altitude Flights (L'Appareil respiratoire automatique pour vols à haute altitude), M. Garsaux. Aérophile, vol. 27, nos. 11-12, June 1-15, 1919, pp. 176-179, 6 figs. Showing scheme of installation and manner in which it operates.

TANKS, GASOLINE. The Imber Self-Sealing Gasoline Tank, George F. McLaughlin. Aerial Age, vol. 9, no. 22, Aug. 11, 1919, pp. 1009-1011, 7 figs. Resilient outer covering protects tank so that when inside pressure exceeds a certain point, tank yields and rubber stretches out from side under pressure. This covering also permits self-sealing of tank when struck by bullet.

DESIGN

HORSEPOWER OF RESISTANCE. The Horsepower of Resistance in Aeroplane Design, N. I. Lieberman. Mech. Eng., vol. 41, no. 9, Sept. 1919, pp. 721-727 and p. 792, 11 figs. Summary of experimental results obtained by Langley, Lanchester, Foppl, Prandtl, Reynolds and Zahm in regard to resistance coefficients for various types of fuselages, total panel area required and distribution of horsepower consumption. Article concludes with a theoretical study on the probable size of craft, fuel load and power equipment necessary to accomplish a transatlantic flight.

CEILINGS. Approximate Ceilings of Aeroplanes. Automobile Engr., vol. 9, no. 129, Aug. 1919, p. 259, 2 figs. Charts given as fairly representative of what may be expected from aeroplanes as at present constructed.

LOADS AND STRESSES. The Loads and Stresses on Aeroplanes, John Case. Aeronautics, vol. 17, no. 300, July 17, 1919, pp. 72-74, 4 figs. Lateral distribution of pressure. Distribution of load between front and rear trusses. (Continuation of serial.)

METAL CONSTRUCTION. Metal Construction of Aircraft, A. P. Thurston. Engineering, vol. 108, nos. 2796 and 2797, Aug. 1 and 8, 1919, pp. 142-144 and 176-180. 34 figs. Aug. 1: Notes on comparative advantages of wood and metal. Aug. 8: Details of metal parts.

PERFORMANCE. Analysis of Aeroplane Performance in Relation to Height, S. C. S. Part. Aeronautics, vol. 17, no. 300, July 17, 1919, pp. 75-77, 3 figs. How various alterations may be compared when fullest particulars required for Sorean type of curve are not available.

RADIATORS, NOSE RESISTANCE. Resistance Due to Nose Radiator. Aerial Age, vol. 9, no. 21, Aug. 4, 1919, pp. 972-973, 6 figs. Results of wind tunnel experiments. It is concluded that resistance of fuselage with streamline nose is increased more by removing streamline nose and substituting a radiator than it is by adding equivalent free-air radiator and retaining streamline nose.
Resistance of Nose Radiators. Aviation, vol. 7, no. 1, Aug. 1, 1919, pp. 28-29, 6 figs. Report of Nat. Advisory Committee for Aeronautics.

STRUTS. The Design of Hollow Interplane Struts Armin Elmendorf. Aviation, vol. 7, no. 2, Aug. 15, 1919, pp. 85-86, 2 figs. Effect of modulus of elasticity on strength, position of material to obtain maximum strength, shear stresses and buckling of hollowed struts considered.

TAIL SKIDS. Theory of Sprung Tail Skids on Aeroplanes, Aerial Age, vol. 9, no. 24, Aug. 25, 1919, pp. 1098. Expression for reaction between skid and ground deduced from equation of motion about axle. From Oesterreichische Flug-Zeitschrift, Dec. 1918.

WAR DEVELOPMENTS. Some Developments in Aircraft Design and Application During the War, Lord Weir. Engineering, vol. 108, no. 2794, July 18, 1919, pp. 93-99, 31 figs. Also Flight, vol. 11, no. 30, July 24, 1919, pp. 987-991, 16 figs. General development in wing construction; progress of design and construction of propellers.

WING DESIGN. Elements of a General Theory of Airplane-Wing Design, Walter C. Durfee. Mech. Eng., vol. 41, no. 9, Sept. 1919, pp. 728-729, and (discussion) pp. 729-730 and p. 787, 3 figs. Following subjects considered: Vortex theory of lift; theory of initial motion around wings; vortex theory of shape; hydrodynamic-electromagnetic analogy; action of vortices with reference to each other; action on vortices with reference to their images; influence of local wind; laws of energy content in trailing vortex; friction and head resistance; and explosion of eddies.

ENGINES

B.H.P. The "B.H.P." Aeroplane Engine. Engineering, vol. 108, no. 2796, Aug. 1, 1919, pp. 135-137, 5 figs. Six-cylinder, double-ignition water-cooled type. Output at normal speed of 1400 r. p. m., 240 b.hp.

Carburation, High Altitude. Carburation at High Altitudes (La Carburation aux hautes altitudes), Aérophile, vol. 27, nos. 11-12, June 1-15, 1919, pp. 185-186, 3 figs. Keeping mixture constant by means of turbo-compressors. Scheme of operation.

Maintaining Constant Pressure Before the Carburettors of Aero Engines Regardless of the Altitude, Leslie V. Spencer. Flight, vol. 11, no. 33, Aug. 14, 1919, pp. 1086-1090, 5 figs. Survey of experimental research with notes on supercharger developed by E. H. Sherbonoy for Aircraft Production Bureau. (To be concluded.)

Fuels. An Investigation of Airplane Fuels, E. W. Dean and Clarence Netzen. Jl. Soc. Automotive Engrs., vol. 5, no. 2,.Aug. 1919, pp. 126-130. Conducted by Bur. of Mines to ascertain whether or not selection of proper grade of fuel would materially help training fields in getting maximum service from a limitednumber of planes.

Hispano-Suiza. The Hispano-Suiza Airplane Engine—III, IV, H. O. C. Isenberg. Am. Mach., vol. 51, nos. 6 and 8, Aug. 7 and 21, 1919, pp. 259-261 and 365-368, 23 figs. Aug. 7: System of mounting cylinder blocks. Aug. 21: Preparation and making of complete molds.

Liners, Steel. Aircraft Engine with Steel Liners in Aluminum Cylinder Blocks. Automotive Industries, vol. 41, no. 8, Aug. 21, 1919, pp. 367-369, 8 figs., partly on supp. plate. Puma six-cylinder vertical type witb output of 260 hp. at 1500 r.p.m.

Napier Lion Engine. The Napier Lion Aircraft Engine. Automobile Engr., vol. 9, no. 129, Aug. 1919, pp. 250-258, 29 figs. Said to be lighter per horsepower than any other water-cooled aero-engine yet produced. (Weight per b.hp., less fuel and oil, 2.51 lb.) Engine holds altitude record of 30,500 ft.

Rotary Engines. *See Zeitlin Aero Engine.*

Shock Recorders. Development of an Airplane Shock Recorder, A. F. Zabm. Jl. Franklin Inst., vol. 188, no. 2, Aug. 1919, pp. 237-244. 4 figs. Apparatus consists of many vertical styluses supported individually by springs and recording on a single chronograph drum.

War Developments. Some Developments in Aircraft Design during the War, Lord Weir. Automobile Engr., vol. 9, no. 129, Aug. 1919, pp. 263-266, 10 figs. Also Engineering, vol. 108,no. 2795, July 25, 1919, pp. 108-111, 19 figs. Emphasizes particularly the fact that experience and research work had culminated in production at time of the armistice of various types of machines which represented distinct advance on anything previously used. From paper presented before Northeast Coast Instn. of Engrs. and Shipbuilders.

Zeitlin Aero Engine. The Zeitlin Aero Engine. Aerial Age, vol. 9, no. 22, Aug. 1. 1919, pp. 1012-1014 and 1027, 10 figs. Four-stroke cycle, 9-cyl. rotary type. Fundamental difference with other similar engines is said to be that piston stroke is not of uniform length in each of four movements constituting complete cycle.

MATERIALS OF CONSTRUCTION

Duralumin. *See Steel and Duralumin.*

Pitch Pockets. Pitch Pockets and Their Relation to the Inspection of Airplane Parts, J. R. Watkins. Jl. Franklin Inst., vol. 188, no. 2, Aug. 1919, pp. 245-253, 3 figs. Résumé of theories advanced to account for presence of pitch pockets and results of tests made at Forest Products Laboratory.

Sheets, Metal, Thin. Metal Construction of Aircraft, A.P.Thurston. Engineering, vol. 108, no. 2798, Aug. 15, 1919, pp. 224-226, 5 figs. Influence of cold work on physical properties of thin sheets. (Concluded.) Paper read before Royal Aeronautical Soc.

Steel and Duralumin, Comparison of. Metal Construction of Aircraft, A. P. Thurston. Aviation, vol. 7, no. 1, Aug. 1919, pp. 18-21, 2 figs. Comparative values of steel and duralumin. From paper read before Roy. Aeronautical Soc.

METEOROLOGY

Algue Barocylonometer. *See Barocyclonometer.*

Aneroids. Aneroids (Ueber Aneroide), E. Warburg and W. Heuse. Zeitschrift f. Instrumentenkunde, vol. 39, no. 2, Feb. 1919, pp. 41-55, 2 figs. Experimental work for reducing influence on the instrument of temperature and of after-effects of former pressures which are more pronounced the greater the difference between the previous pressures and those to be measured is.

Atmospheric Pressure Waves. On the Explosion at Okhta, B. Galitzin. Proc. Roy Soc., vol. 95, no. A-673, July 15, 1919, pp. 508-515, 3 figs. Records of atmospheric-pressure wave obtained at various observatories in neighborhood used to compute characteristics of motion of wave.

Barocyclonometer. The Algué Barocyclonometer, Robert G. Skerrett. Rudder, vol. 35, no. 8, Aug. 1919, pp. 368-370, 7 figs. Combination of aneroid barometer and device called cyclonometer or wind disk. Used for foretelling coming of hurricane.

Stratosphere. *See Wind Velosity.*

Wind Velocity. Wind Velocity in the Stratosphere (Sur la vitesse du vent dans la stratosphère), J. Rouch. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 25, June 23, 1919, pp. 1281-1283. Data obtained by aerologic soundings.

MILITARY AIRCRAFT

Bomb Droppino. The Science of Bomb Dropping from Airplanes, A. Wilmer Duff. Jl. Worcester Polytechnic Inst., vol. 22, no. 4, July 1919, pp. 322-338, 2 figs. Technical discussion of principles involved.

Naval Aircraft. Progress in Naval Aircraft—I. J. C. Hunsaker. Am. Mach., vol. 51, no. 7, Aug. 14, 1919, pp. 305-311, 4 figs. Also U. S. Naval Inst. Proc., vol. 45, no. 198, Aug. 1919, pp. 1347-1368, 8 figs. Tells of causes leading up to building of N C boats and gives some details of their design, construction and performance. Paper presented before Soc. of Automotive Engrs.

Torpedoplane. The Torpedoplane—The New Weapon which Promises to Revolutionize Naval Tactics, Henry Woodhouse. Flying, vol. 8, no. 7, Aug. 1919, pp. 597-602, 9 figs. Account of mystery airplanes of British Navy as given by various periodical and in various reports of the Admiralty.

PLANES

Austin "Whippet." The Austin "Whippet." Flight, vol. 11, no. 33, Aug. 14, 1919, pp. 1076-1078, 7 figs. Single-seater tractor biplane with all-steel fuselage, folding wings, and no bracing wires.

B.A.T. The B. A. T. Type F. K. 26 Transport Airplane. Aviation, vol. 7, no. 1, Aug. 1, 1919, pp. 22-23, 2 figs. Machine is tractor biplane fitted with cabin which affords accommodation for either four passengers or their equivalent weight in goods or mails.

Bristol. The Bristol Aeroplanes. Aerial Age, vol. 9, no. 23, Aug. 18, 1919, pp. 1049-1052,8 figs. General features ofdesign and records of performance.

Caproni. *See Liberty Caproni.*

De Havilland. The De Havilland Aeroplanes. Aerial Age; vol. 9, no. 21, Aug. 4, 1919, pp. 969-971 and 982, 3 figs. Comparison of various "Airco" types.

German Machines. The Large Land Airplane in German Practice, ErikHildersheim. Aviation, vol. 7, no. 1, Aug. 1, 1919, pp. 23-25, 5 figs. Notes on development of giant airplane and outline of principal features of Linke-Hoffman machine.

Gosport Flying-Boats. The Gosport Flying-Boats. Flight, vol. 11, no. 31, July 31, 1919, pp. 1006-1009, 12 figs. Drawings and specifications of six commercial types which range from large ten-seater of over 100-ft. span to small single-seater of only 23-ft. span.

Liberty Caproni. The Liberty Caproni Biplane. Aerial Age, vol. 9, no. 24, Aug. 25. 1919, pp. 1089-1091 and 1108, 6 figs. General specifications and performances.

Linke-Hoffman. *See German Machines.*

Nieuport "Night Hawk." The Nieuport "Night Hawk" Single-seater Scout—I. Engineer, vol. 128, no. 3319, Aug. 8, 1919, pp. 132-134, 8 figs. Fitted with 320-hp., nine-cylinder, fixed-radial, air-cooled A. B. C. "Dragon-Fly" engine. Designed to travel at 135 m.p.h. at altitude of 15,000 ft.

Tunnel, Aerodynamic. The Aerodynamic Experimental Tunnel, W. Knight. Aviation, vol. 7, no. 2, Aug. 15, 1919, pp. 77-80, 18 figs. Principles to be followed in designing, with notes of features adopted in tunnel built for Instituto Centrale Aeronautico in Rome.

Vickers Vimy. The Vickers "Vimy-Commercial" Biplane. Flight, vol. 11, no. 29, July 17, 1919, pp. 936-941, 15 figs. Except for fuselage, machine is identical to "Vimy" bomber. Description is confined to fuselage.

War Developments. Some Developments in Aircraft Design and Application During the War, Lord Weir. Flight, vol. 11, nos. 29, 31 and 32, July 17, 31 and Aug. 7, 1919, pp. 955-959, 1013-1016 and 1048-1053, 42 figs. July 17: Aerodynamic features of progress and design. July 31: One-seater and two-seater fighters; progress in engine design. Aug. 7: Navigation and meteorology.

PROPELLERS

Aerodynamic Calculations. Aerodynamical Considerations in the Design of a Propeller, H. Levy. Automotive Industries, vol. 41, no. 7, Aug. 14, 1919, pp. 316-320, 10 figs. Method of calculating required dimensions and probable performance of propeller on basis of airfoil theory.

Wood Propellers. Some Problems in the Design of Wood Propellers, Leslie V. Spencer. Aerial Age, vol. 9, no. 23, Aug. 18, 1919, pp. 1053-1054 and 1059, 5 figs. Relative value of different woods. Advantages and disadvantages of different methods of blade tipping.

VARIA

Government Organization of Industry. Single Government Department for All Aeronautics Urged by Mission, Allen Sinsheimer. Automotive Industries, vol. 41, no. 7, Aug. 14, 1919, pp. 297-303, and pp. 323-327. Industry created by war fast disappearing, declares report of American Aviation Mission which has been studying European aeronautics. They urge establishment of agency equal to war department.

International Air Navigation Convention. International Air Navigation Convention. Flight, vol. 11, no. 31, July 31, 1919, pp. 1029-1032, 2 figs. Annexes dealing with marking of aircraft, rules as to lights and signals, international aeronautical maps and ground markings, collection and dissemination of meteorological information and customs. Additional to account given in issue of May 8.

Time Determination. An Easy Method of Getting the Greenwich Mean Time, Franklin Van Valdenburgh. U. S. Naval Inst. Proc., vol. 45, no. 198, Aug. 1919, pp. 1343-1345, 1 fig. Chart constructed by drawing lines representing loci of all places having same GMT at same time.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

COPPER SULPHATE SOLUTIONS. Electrical Conductivity and Other Properties of Saturated Solutions of Copper Sulphate in the Presence of Sulphuric Acid, H. M. Goodwin and W. G. Horsch. Chem. & Metallurgical Eng., vol. 21, no. 4, Aug. 15, 1919, pp. 181-182, 3 figs. Gives specific electrical conductance at 25 deg. cent. of solutions saturated with copper sulphate and containing sulphuric acid ranging in concentration from 0.15 equivalent to 3.6 equivalents per liter.

ELECTRODEPOSITION

COPPER DEPOSITION. Electrolytic Deposition of Copper in the Leaching of Roasted Ore and Concentrate, Percy R. Middleton. Min. & Sci. Press, vol. 119, no. 5, Aug. 2, 1919, pp. 149-150, 3 figs. Results of experimental work.

DEPOSITION OF METAL, TIME ELEMENT. A Compilation of Tables Showing the Time Required to Deposit a Given Thickness of Metal, W. G. Knox. Metal Industry, vol. 15. no. 3, July 18, 1919, pp. 46-48. Table showing time required for thickness of deposit in inches of nickel-cobalt. Calculated on basis of 100 per cent cathode efficiency.

GALVANIZING PLANT. Planning and Operating a Galvanizing Plant, E. P. Later. Metal Industry, vol. 15, no. 2, July 11, 1919, pp. 30-32. Concerning advisability of isolating plant from rest of factory, material to use for kettles, coating tanks used for cold acid solutions, etc.

NICKEL PLATING. The Re-Nickeling of Surgical Instruments, Joseph Haas, Jr. Metal Indus., vol. 17, no. 8, Aug. 1919, pp. 364-365. Results of investigations carried on in Medical Repair Dept. Laboratory established by A. E. F. in France during war.

ELECTROPHYSICS

COILS, ELECTROMAGNETIC. Calculation of electromagnetic Coils (Sur le calcul des bobines des électro-aimants—, Ad. Curchod Revue Générale de l'Electricité, vol. 6. no. 3, July 19, 1919, pp. 74-77. Formulæ for determining dimensions for a required field.

See also Solenoids.

CONDUCTION IN LIQUID DIELECTRICS. Conduction in Liquid Dielectrics, J. E. Shrader. Elec. Jl., vol. 16, no. 8, Aug. 1919, pp. 334-338, 10 figs. Test cup developed at Westinghouse Research Laboratory.

D. C. ARMATURE IN A. C. FIELD. Direct-Current Armature in an Alternating Field (Der Gleichstromanker in wechselfeld), Robert Moser. Elektrotechnik u. Maschinenbau, vol. 37, no. 3, Jan. 19. 1919, pp. 25-28, 2 figs. Deduces general formulæ for any desired position of brushes, any form of field, and any period.

EDDY CURRENTS. Problems of Eddy Currents (Wirbelstrom-probleme), Milan Virmar. Elektrotechnik u. Maschinenbau, vol. 57, no. 8, Feb. 23, 1919, pp. 69-77, 5 figs. Tests made by writer to investigate problems of heat losses in eddy currents, with special reference to turbo-generators and large transformers. Discusses also use of aluminum in construction of electric machinery.

ELECTROMAGNETISM. General Laws of Electromagnetism and Induction in Circuits Having no Resistance (Lois générales de l'électromagnetisme et de l'induction dans les circuits sans résistance), G. Lippmann. Annales de Physique, vol. 12, May-June 1919, pp. 245-253. Theory developed after making $r = 0$ in expression of coefficient of self-induction in terms of resistance, intensity and electromotive force. Since phenomena of electromagnetism and induction are independent of nature of conductor, while resistance depends on this nature, writer considers as more logical to investigate laws of electromagnetism and induction by disregarding resistance.

ELONGATION AND MAGNETIZATION. The Elongation Due to Magnetization, C. Barus. Proc. Nat. Acad. Sciences, vol. 5, no. 7, July, 1919, pp. 267-272, 3 figs. Experiments with contact lever. Interest is chiefly concentrated in continued increase of contractions, due to magnetization obtained in strong fields after magnetization has reached a maximum.

GALVANOMETRY. Contribution to Galvanometry (Contribution à la galvanométrie), D. Germani. Revue générale de l'Electricité, vol. 6, no. 4, July 26, 1919, pp. 99-101, 2 figs. Graph showing "ballistic constant" in times of resistance of galvanometric circuit.

HARMONICS IN ALTERNATING-CURRENT WAVES. Order and Amplitude of Harmonics in Voltage Wave Forms With Indicating Instruments, Leslie F. Curtis. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 8, Aug. 1919, pp. 947-958, 13 figs. Method for determining order and percentage of various components of alternating wave of e.m.f., using indicating meters and other similar apparatus. Oscillograms are included to show various phenomena and to check results of calculations. Value of so-called standards for indication of wave form is questioned.

HIGH-FREQUENCY ELECTRIC WAVES. Production and utilization of Electrical Waves Maintained at High Frequencies (Production et emploi des ondes électriques entretenues à haute fréquence), M. Boutaric. Industrie Electrique, vol. 28, no. 649, July 10, 1919, pp. 250-255, 4 figs. Alexanderson alternator with which it is said to be possible to obtain a frequency of 100,000 periods per second. (Concluded.)

LOADING COILS, INDUCTANCE. Elementary Considerations of the Inductance of Loading Coils and Their Insertion in Cables, E. S. Ritter and A. Morris. Post Office Elec. Engrs. Jl., vol. 12, no. 2, July 1919, pp. 76-87, 9 figs. General requirements of loading coil design.

SOLENOID MAGNETIC FIELD. Magnetic Field of a Solenoid (Champ magnétique d'un solénoïde), O. Billieux. Revue Générale de l'Electricité, vol. 6, no. 3, July 19, 1919, pp. 67-70, 1 fig. Formulæ for determining self-induction, mutual induction, etc.

TRANSMISSION CIRCUITS. Electrical Characteristics of Transmission Circuits—II, Wm. Nesbitt. Elec. Jl., vol. 16. no. 8, Aug. 1919, pp. 314-326, 12 figs. Details for determining reactance of conductor directly from its resistance.

WAVES. *See Harmonics and High Frequency Waves.*

FURNACES

Electric Furnaces (Consideraciones generales sobre hornos electricos), José M. Navarrete. Energia Eléctrica, vol. 21, no. 11, June 10, 1919, pp. 125-130. Comparative study of arc, resistance and induction types.

AJAX-WYATT. Ajax-Wyatt Electric Furnace, C. H. Clamer. Metal Indus., vol. 17, no. 8, Aug. 1919, pp. 362-363, 2 figs. Diagrammatic sketch. Furnace is of induction type. Paper read before Am. Chem. Soc.

CARBONS. Electric Furnace Carbons, Thomas Robson Hay. Raw Material, vol. 1, no. 5. July 1919, pp. 262-264, 4 figs. It is held that while both graphitic and amorphous carbons have their advantages, latter is considered as having superior strength and lasting qualities.

Manufacture and Application of Carbon Electrodes for Electric Furnaces, Thomas Robson Hay. Elec. Rec., vol. 26, no. 2, Aug. 1919, pp. 72-74, 7 figs. Noting particularly improvements in design and practice evolved during war.

EXPERIMENTAL FURNACE. Electric Furnace for Experimental Work, H. A. J. Fitzgerald and Grant C. Moyer. Thirty-sixth General Meeting of Am. Electrochem. Soc., Sept. 23, 1919, advance copy, no. 4, pp. 27-31. Type which has been found convenient and satisfactory for small-scale experiments at Fitzgerald Laboratories of Niagara Falls, N.Y.

HEAT-TREATING FURNACE. Vertical-Cylindrical Electric Furnaces for Heat-Treating and Shrinking. A. M. Clark, Chem. & Metallurgical Eng., vol. 21, paper no. 4, Aug. 15. 1919, pp. 205-207, 5 figs. Types developed by General Elec. Co., notably low-temperature furnaces (up to 950 deg. fahr.) which have been used primarily for shrinking jackets over gun barrels.

OPERATION. Effect of Actions Inside Furnaces on Performance, W. K. Booth. Elec. World, vol. 74, no. 5, Aug. 2, 1919, pp. 236-237, 2 figs. Causes of fluctuation in load, limitations to short-circuit current, stabilization of arc and high-power-factor furnaces from service viewpoint.

RADIANT RESISTOR FURNACE. Radiant Resistor Furnace, H. A. J. Fitzgerald. Thirty-sixth General Meeting of Am. Electrochem. Soc., Sept. 23, 1919, advance copy, paper no. 1, pp. 1-7, 4 figs. Unit built and operated at Fitzgerald laboratories for distillation of low-grade or scrap zinc. It is said that with current of approximately 845 amp. at 65 volts output was about 50 kg. of refined zinc per hour.

TRANSFORMERS. *See Transformers, Converters, etc.*

GENERATING STATIONS

GROUND IN DISTURBANCES. *See Overloading.*

OPERATION IN PARALLEL. Some Problems in the Operation of Power Plants in Parallel, E. C. Stone. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 8, Aug. 1919, pp. 973-996, 6 figs. It is observed that in order to operate two power plants satisfactorily in parallel, the transmission line which ties them together must have sufficient carrying capacity. Factors determining synchronizing power are mentioned and limiting values for synchronizing power of lines under various operating conditions are given.

Paralleling Alternators, J. F. Ashton. Mech. World, vol. 66, no. 1701, Aug. 8, 1919, pp. 61-65, 3 figs. Precautions to take.

OVERLOADING. Recent Progress Made in Preventing Overloading of Electric Installations (Die jüngsten Fortschritte in der Beurteilung und Bekämpfung von Ueberspannungen in elektrischen Anlagen), W. Kummer. Schweizerische Bauzeitung, vol. 74, no. 4, July 26, 1919, pp. 39-41, 4 figs. Grounding disturbances and how to remedy them. (To be concluded.)

PARALLELING. *See Operation in Parallel.*

RATES. Central-Station Rates in Theory and Practice, H. E. Eisenmenger. Elec. Rev., vol. 75, no. 7, Aug. 16, 1919, pp. 266-269. How diversity of demand affects demand cost. Sixth article.

Central-Station Rates in Theory and Practice, H. E. Eisenmenger. Elec. Rev., vol. 75, no. 8, Aug. 23, 1919, pp. 304-307. Consumer cost, what it includes and how it varies. Seventh article.

RICE RIPS STATION. Construction Costs of Rice Rips Station, J. A. Leonard. Elec. World, vol. 74, no. 5. Aug. 2, 1919, pp. 228-230, 3 figs. Hydroelectric power plant of 2000-kva. capacity designed to carry peak loads rather than base loads.

SWISS CENTRAL STATION. Central Station at Massaboden near Brig of the Swiss State Railroads (Das Elektrizitätswerk Massaboden bei Brig der Schweiz. Bundesbahnen), H. Eggenberger and A. Danzeg. Schweizerische Bauzeitung, vol. 73, no. 25, June 21, 1919, pp. 287-291, 10 figs. Pressure pipes during construction; description of water chamber; plan and cross-sections of pressure pipes and reservoir.

SWITCH AIR BREAK. A 5000-Kva., 100,000-Volt New-Type Air-Break Switch, George T. Couthgard, Elec. World. vol. 74, no. 8, Aug. 23, 1919, pp. 407-409, 7 figs. Designed to interrupt charging current drawn by 125 miles of 100,000-volt line, it is said to have broken current of 100-mile line.

SWITCH HOUSE. Layout of Modern Switch House, C. A. Conney. Elec. World, vol. 74, no. 6, Aug. 9, 1919, pp. 286-290, 6 figs. Special consideration given to future requirements, safety of operators, continuity of service, economy of materials and relation to rest of generating station.

TATA POWER PLANT. The Tata Hydro-Electro Power-Plant, Bombay—II. Indian & Eastern Engr., vol. 44, no. 6, June 1919, pp. 187-190, 6 figs. Details of pipe line. Power house is designed for generating total of 108,000 hp.

Vienna Municipal Central Station. Municipal Central Station in Vienna (Die städtischen Elektrizitätswerke in Wien). Elektrotechnik u. Maschinenbau, vol. 37, no. 4, Jan. 26, 1919, pp. 35-40. Has seven substations with 18 steam turbines and 6 water turbines of a total horsepower of 155,095 and 21 reciprocating steam engines of 41,000 hp.

GENERATORS AND MOTORS

Bipolar Diagram. On Some Properties of the Bipolar Diagram of Synchronous Alternators in a Constant-Potential Network (Quelques propriétés du diagramme bipolaire des alternateurs synchrones (moteurs ou récepteurs) sur un réseau à potentiel constant), André Blondel. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 1. July 7, 1919, pp. 12-16. Derivation of equation of polar curve of internal power of alternator.

Breakdowns. Some Causes of Breakdown to Electrical Machinery, W. C. Worral. Elec. Rev., vol. 75, no. 8, Aug. 23, 1919, pp. 308-312. Examination of typical examples of breakdowns met in industrial plants.

Generator Plants, French. Uses of Generator Groups During the War (Emploi des groupes électrogènes à la guerre), A. Soulier. Revue générale de l'Electricité, vol. 6, no. 4, July 26, 1919, pp. 111-118, 10 figs. Illustrating general arrangement of Ballot, Aster, and Delieuvin gas engine and dynamo units.

Grounded Neutral. Grounded Neutral on Alternating-Current Generators, S. L. Henderson. Elec. Jl., vol. 16, no. 8, Aug. 1919, pp. 340-343, 10 figs. Method of grounding neutral.

Induction Generator Plants, Automatic. Automatic Induction Generator Plants, E. A. Quinn. Power Plant Eng., vol. 23, no. 16, Aug. 15, 1919, pp. 730-732, 4 figs. Abstract of Eng. Committee report of Pacific Coast Section, Nat. Elec. Light Assn.

Induction Motors. Induction Motors Driving Centrifugal Pumps, Fraser Jeffrey. Power, vol. 50, no. 9, Aug. 26, 1919, pp. 324-327, 11 figs. Adaptability of various types of motors to different kinds of pumping work, with reference to several existing installations.

Rolling-Mill Motors. Regulation Without Loss of Three-Phase Rolling-Mill Motors (über den derzeitigen Stand der Frage der verlustlosen Regelung von Drehstrom-walzenzugmotoren), H. Hermanns. Elektrotechnische Rundschau, vol. 36, nos. 5-6, 7-8 and 9-10. Feb. 5. Feb. 19 and Mar. 5. 1919, pp. 17-18, 25-26, and 33-34, 13 figs. Commutator-motor regulation by brush adjustment, various connection schemes. (Concluded.)

Siemens Machinery. Siemens Electrical Equipment (Equipement électrique Siemens). Génie Civil, vol. 75, no. 6, Aug. 9, 1919, pp. 117-120, 6 figs. At steel works of Skinningrove Iron Co. of Yorkshire. Rolls require 19,000 hp. to operate.

Transient Phenomena. Transient Phenomena of a Polyphase Motor at Starting and Those of a Direct-Current Motor (In Japanese), J. Takeuchi. Denki Gakkwai Zasshi, no. 372, July 10, 1919.

IGNITION APPARATUS

Condensers. Function of the Condenser in High-Tension Magnetos, Harry F. Geist. Automotive Industries, vol. 41, no. 6, Aug. 7 1919, pp. 267-272, 6 figs. Diagram showing difference between induced voltages that occur both with and without condenser.

Magnetos. Aircraft Magneto Adapted to Four Cylinder Car. Automotive Industries, vol. 41, no. 8, Aug. 21, 1919, pp. 364-366, 9 figs. British war product in which aluminum enters very largely into construction. Special feature, makers claim, is use of laminated poleshoes.

LIGHTING AND LAMP MANUFACTURE

Delco. Lighting Plant Capacity Increased to 3 Kw., P. M. Heldt. Automotive Industries, vol. 41, no. 8, Aug. 31, 1919, pp. 370-374, 7 figs. Unit designed for Delco line for use on large estates, hotels and similar plants, has single-cylinder air-cooled engine with anti-friction crankshaft bearings, direct-connected to six-pole generator.

Gas-Filled Lamps. The Gas-Filled Lamp and Its Effect on Illuminating Engineering, Francis W. Wilcox. Illuminating Engr., vol. 12, no. 6, June 1919, pp. 142-161 and (discussion), 161-171, 43 figs. Features of gas-filled lamps that have modified lighting practice and effects of this type of lamp in various fields of lighting, with notes on lighting codes adopted in various parts of U. S.

Incandescent Burners, Inverted. The Regenerative Effect as Influencing the Lighting Efficiency of the Inverted Incandescent Burner, J. S. G. Thomas. Gas Jl., vol. 147, no. 2930, July 8, 1919, pp. 77-78, 2 figs. Experiments interpreted as indicating that increased lighting efficiency is obtained when gaseous mixture of coal gas and primary air is preheated.

Industrial Lighting Systems. Design of Industrial Lighting Systems—II, Ward Harrison and H. H. Magdsick. Elec. World, vol. 74, no. 5, Aug. 2, 1919, pp. 232-234, 5 figs. Concerning selection of correct size and type and location of lighting unit.

Photometers. Extending the Use of the Relative-Photometer (Erweiterte Anwendung das Relativphotometers), L. Weber. Zeitschrift für Beleuchiungswesen, Heizungs- u. Lüftungstechnik, vol. 25, no. 1/2, Jan. 1919, pp. 8-9, 3 figs. For determining intensity of illumination in proportion to the sky, for comparing two illuminating intensities and for comparing two intrinsic brilliances.

Safety Orders, Lighting. General Lighting Safety Orders. Jl. Electricity, vol. 43, no. 4, Aug. 15, 1919, pp. 173-174. Issued by Industrial Accident Commission under Workmen's Compensation Insurance and Safety Act.

Stage Lighting. The Art of Stage Lighting, J. B. Fagan. Illum. Engr., vol. 12, no. 5, May 1919, pp. 118-124 and (discussion) pp. 124-133. Historical account of development of art and notes on practices followed in various countries.

Workshops. Auxiliary Lighting Apparatus for Use in Engineering Workshops, J. Beaumont Harrison. Electrical Review, vol. 85, no. 2175, Aug. 1, 1919, pp. 131-132, 2 figs. Hand lamp-test set. Arrangement consists of bank of connecting sockets, indicator lamps, contactor switch, main fuse and main switch.

MEASUREMENTS AND TESTS

Amplifiers. Use of Amplifiers for Measuring Small Differences of Potential (Emploi des amplificateurs pour la mesure des différences de potentiel faibles), A. Blondel, Revue Générale de l'Électricité, vol. 6, no. 6, Aug. 9, 1919, pp. 163-178, 18 figs. Laboratory methods in which audions may be introduced—thermo-ionic ballance static or deviation bridges, potenionmeter methods and oscillations. (To be continued.)

Condenser, High Voltage. Half-Million-Volt Condenser for Testing. Elec. World, vol. 74, no. 8, Aug. 23, 1919, pp. 404-405, 4 figs. Built for frequencies up to 60,000 cycles and combined with Poulsen arc converter and inductance for the purpose of testing high-voltage insulators.

Frequency Determination. A New Method for the Absolute Determination of Frequency, Ashutosh Dey. Proc. Roy. Soc.. vol. 95, no. A-673, July 15, 1919, pp. 533-545, 1 fig. Principle of method is maintenance of oscillations of sub-synchronous frequency by a periodic field of force.

Hysteresis Curve. The Determination of the Hysteresis Curve, M. Schleicher. Elecn., vol. 83, no. 2148, July 18, 1919, pp. 67, 2 figs. By ring method similar to that used for determining commutating curves. From Elektrotechnische Zeitschrift.

Insulator Tester. The Keokuk Insulator Tester, R B. Howland. Stone & Webster Jl., vol. 110-113, Aug. 1919, 7 figs. on five supp. plates. Said to be specially suited for locating suspension-type insulator units which have become defective, and which can be used to advantage during night hours.

Motors, Railway. Manufacturers' Tests of Materials for Railway Motors, J. S. Dean. Elec. Ry. Jl., vol. 54, no. 7, Aug. 16, 1919, pp. 320-325, 20 figs. Tests, apparatus used and results obtained for determining physical and electrical properties of material entering into construction of railway motors.

Motor Selection. Motor Testing in Industrial Plants, Philip Chapin Jones. Elec. World, vol. 74, no. 6, Aug. 9, 1919, pp. 295-296, 6 figs. Question of selecting motors of correct size to offset their increased cost.

Power Factor Measurement. Measuring Power Factor with Unbalanced Load, Williard S. Wilder. Elec.World, vol. 74, no. 5, Aug. 2, 1919, pp. 239-240, 2 figs. Method of securing permanent record of maximum value and time of occurrence.

Short-Circuit Current Calculation. Calculating Short-Circuit Currents in Networks, W. R. Woodward. Elec. Jl., vol. 16, no. 8, Aug. 1919, pp. 344-345, 4 figs. Testing with miniature networks.

MATERIALS OF CONSTRUCTION

Aluminum Conductors. Aluminum Electrical Conductors (Les conducteurs d'Électricité en aluminium), E. Dusaugey. Supplement to Revue Générale de l'Electricité, vol. 6, no. 4, July 26, 1919, 20 pp. Recent developments in electrical uses of aluminum and mechanical and physical properties of aluminum presented to show that employment of aluminum as substitute for copper is both feasible and economical. Report of Committee of l'Union des Syndicats de l'Electricité.

Cadmium. Cadmium, C. E. Siebenthal. Brass World, vol. 15, no. 8, Aug. 1919, pp. 246-249. Its use as a substitute for tin and in bronze telegraph and telephone wires.

Insulating Materials. Electrical Insulating Materials, R. P. Jackson. Elec. Jl., vol. 16, no. 8, Aug. 1919, pp. 326-333. Classification under two general divisions—organic and inorganic. Characteristic properties of each and of various combinations of several of them.

Industrial Insulators (Etude des diélectriques industriels), Raymond Bouzon. Revue Générale de l'Electricité, vol. 6, nos. 5 and 6, Aug. 2 and 9, 1919, pp. 137-148 and 181-187, 20 figs. Aug. 2: Definition of specific qualities of insulators, description of apparatus used for measuring them, their standardization and application. Aug. 9: Manner of measuring losses in insulators due to alternating currents; results of experiments.

POWER APPLICATION

Construction Work. Largest Use of Electric Power on Construction Work. Eng. News-Rec., vol. 83, no. 9, Aug. 28, 1919, pp. 417-420, 5 figs. How and why Dayton flood protection works use 8000 hp. from central plant, in motors of 5 to 500 hp., for pumps, excavators, concrete mixers and other equipment scattered over 1000 square miles.

Dredges, Hydraulic. Features of Electrically Operated Hydraulic Dredge, Charles W. Geiger. Elec. Rev., vol. 75, no. 7, Aug. 16, 1919, pp. 263-265, 5 figs. Advantages of electric drive and savings effected by its operation by City of Oakland, Cal.

Gold Mining. Notes on the Electrical Equipment at the Circular Shaft, New Modderfontein Gold Mining Company, Ltd., R. H. Copeland. Trans. of South African Inst. Elec. Engrs., vol. 10, no. 5, May 1919, pp. 62-69 and (discussion), pp. 69-72, 6 figs., partly on supp. plate. Energy brought to transformer house at 20,000 volts and there stepped down to 21000 volts and 525 volts for direct motor use; mine transformers get it down again to 200 volts between phases and 115 volts between phases and earthed neutral or to 57½ volts for lighting.

Rice Industry. Electricity Makes Rice Industry Possible, W. E. Camp. Jl. Electricity, vol. 43, no. 3, Aug. 1, 1919, pp. 102-104. 9 figs. Electrical pumps used in irrigation works.

Tube Mills. An Electrically Driven Tube Mill. Iron & Coal Trades Rev., vol. 99, no. 2683, Aug. 1, 1919, p. 139, 3 figs. Principal feature noted is direct driving of two Pilger mills by motor running at speed of mill and driving without fly wheel.

Typewriter Industry. Electric Heat in the Typewriter Industry, A. M. Clark. Thirty-sixth General Meeting of Am. Electrochem. Soc., Sept. 23, 1919, advance copy, paper no. 3, pp. 23-26, 2 figs. Electrically heated oven for baking japan on various parts of typewriters. Comparative tables show better economy and larger capacity of electrically heated oven compared with gas- or oil-heated oven.

TELEGRAPHY AND TELEPHONY

Antenna. Calculation of Antenna Capacity, L. W. Austin. Jl. Wash. Acad. Sci., vol. 9, no. 14, Aug. 19, 1919, pp. 393-396. Table giving observed values of capacity of elongated parallel wire antenna, and comparison of capacities calculated according to Bur. Stand. formula.

Cables, Telephone. Investigation and Examination of Telephone Cables. Telephone Engr., vol. 22, no. 2, Aug. 1919, pp. 70-73, 3 figs. Francke machine for determining damping effect of homogeneous or composite lines; also account of tests performed with it. From Elektrotechnik u. Maschinenbau.

Direction Finders. The Marconi Direction Finder. Elecn., vol. 83, no. 2151, Aug. 8. 1919, pp. 142-143, 4 figs. Installation having components arranged as separate unit.

Duplex Apparatus. Universal Duplex Apparatus—In Use by the Western Union Telegrapb Company. Telegraph & Telephone Age, vol. 15, no. 869, Aug. 1, 1919, pp. 374-377, 2 figs. Circuits of repeater when working differentially on botb west and east sides. (Continuation of serial.)

Electrostatically Coupled Circuits. A Study of Electrostatically Coupled Circuits, W. Orland Lytle. Proc. Inst. Rzdio Engrs., vol. 7, no. 4, Aug. 1919, pp. 427-444, 60 figs. Claims to have found by theory and also by experiment that by one method of tuning, as circuits are coupled closer, one wave length remains constant while other approaches infinity, thereby concentrating and increasing proportion of energy in one wave. It is shown by curves and by Braun tube figures that when ratio of the two wave lengths is a wbole number, the root-mean-square value of the current is a maximum.

French Telegraph Construction. Notes on French Telegrapb Construction, Capt. P. Dunsbeath. Post Office Elec. Engrs. Jl., vol. 12, no. 2, July 1919, pp. 87-91, 7 figs. Comparing French with British methods.

Overland Work. Radio Telegraphy in Competition with Wire Telegraphy in Overland Work, Robert Boyd Black. Proc. Inst. Radio Engrs., vol. 7, no. 4, Aug. 1919, pp. 391-407, 1 fig. Recommends radio duplex circuits; reception with loud-speaking receivers and amplifiers, trunk and way circuits from large radio centers of traffic and relaying stations as means to overcome obstacles in way of successful competition of overland radio service versus wire service. Organization and operation of Pacific coast chain of duplex radio stations of Federal Telegrapb Company are described.

Quenched Gap. On the Multi-Section Quenched Gap, M. Shuleikin and I. Freiman. Proc. Inst. Radio Engrs.. vol. 7, no. 4, Aug. 1919, pp. 417-425, 5 figs. Writers consider relation between breakdown voltage of series of quenched gap sections and that of a single section. Relation of direct proportionality is found not to hold because of electric flux leakage from each plate to nearby plates and neighboring conductors. Limiting value of breakdown voltage of a number of gaps of given length is shown graphically for various values of flux leakage and breakdown voltage of gaps.

A Special Type of Quenched Spark Radio Transmitter, D. Galen McCaa. Proc. Inst. Radio Engrs., vol. 7, no. 4, Aug. 1919, pp. 409-415, 4 figs. Apparatus is so arranged that capacity in highly damped primary circuit is that between a special extra antenna and ground, and primary and secondary circuits are partly capacitively coupled by capacity between special antenna and usual secondary antenna, and partly inductively coupled through common inductance in ground lead.

Radio-Telephones. Radio-Telephone Development in Army, Nugent H. Slaughter, Francis Gray and John W. Stokes. Elec. World, vol. 74, no.. 7, Aug. 16, 1919, pp. 340-343, 7 figs. Historical and technical summary.

Sending and Receiving. Simultaneous Sending and Receiving, Ernst F. W. Alexanderson. Proc. Inst. Radio Engrs., vol. 7, no. 4, Aug. 1919, pp. 363-378, and (discussion), pp. 379-390, 19 figs. System described involves transferring received speech from separate receiving antenna at some distance from receiving antenna to subscriber's line, and transferring speech originating at subscriber's station to radiophone transmitter. A directional combination of aperiodic antenna, with unilateral directional characteristic "barrage receiver" is also described.

Telephone Cable Tunnels. Conduit Construction in Telephone Cable Tunnels. Elec. Rev., vol. 75, no. 8, Aug. 23, 1919, pp. 301-303, 6 figs. Average length is about 700 ft. and depth beneath level of sidewalk varies from 80 ft. to 90 ft. Tunnels are built entirely of concrete.

Telephone Control System. West Ham's Telepbone Control System. Electric Ry. Jl., vol. 54, no. 8, Aug. 23, 1919, pp. 397-398, 4 figs. Introduction of system for control of traffic conditions in London suburb said to have reduced accident costs.

Telephone Exchanges. Comments on Automatic-Manual Consolidation, H. E. Brockwell, Telephone Engr., vol. 22, no. 2, 1919, pp. 55-58. Converting present central manual equipment in Winnipeg exchanges to automatic mechanical operation.

Telephone Line, Current Propagation. Propagation of a Current in a Homogenous Telephonic Line (Propagation du courant sur une ligne téléphonique homogène), J. B. Pomey. Revue Générale de l'Electricité, vol. 6, no. 5, Aug. 2. 1919, pp. 131-134. Formulæ applicable to artificial line formed of identical sections.

Telephone Repeater. The Telephone Repeater. Post Office Elec. Engrs. Jl., vol. 12, no. 2, July 1919, pp. 70-75, 6 figs. Diagram of equal potential system which is used in some cases where Edison difference in circuit has been found unstable. (Continuation of serial.)

Telephone Signalling System. A Modified Common Battery Signalling Telephone System, H. W. White. Post Office Elec. Engrs. Jl., vol. 12, no. 2, July 1919, pp. 115-118, 7 figs. Suggested for use in centers where suitable power supply for charging secondary cells does not exist.

Telephone Systems. Unification of the Manual and Automatic Telephone Systems, D. E. Wiseman. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 8, Aug. 1919, pp. 1011-1026. 10 figs. Operating and construction methods contained in plans for physical union of Bell manual and Automatic Electric telephone systems of Los Angeles, Cal.

Waves, Electric. The Scientific Problems of Electric Wave Telegraphy, J. A. Fleming. Jl. Roy. Soc. Arts, vol. 67, no. 3481, Aug. 8, 1919, pp. 597-605. Theory of generation and radiation of electric waves.

Wireless Telephone Transmitter. Wireless Telephone Transmitter for Seaplanes. Elec. Rev., vol. 75, no. 6, Aug. 9, 1919, pp. 237-241, 5 figs. Light-weight but powerful set developed for use by Navy's flying boats during war.

TRANSFORMERS. CONVERTERS, FREQUENCY CHANGERS

Amplifiers. Amplifiers for Direct Currents and for Currents of Very Low Frequency (Amplificateurs pour courants continus et pour courants de très basse fréquence), Henri Abraham and Eugène Bloch. Comptes rendus des séances de l'Académie des Sciences, vol. 168, no. 26, June 30, 1919, pp. 1321-1323. Interconnections by means of auxiliary batteries.

Cores and Coils. Cores and Coils for Transformers—I, Arthur Palme. Power vol. 50, no. 6. Aug. 5, 1919, pp. 212-215, 16 figs. Structural details.

Electric-Furnace Transformers. Static Transformers for Use witb Electric Furnaces. Elecn., vol. 83, nos. 2148 and 2149, July 18 and 25, 1919, pp. 69-70 and 89-90, 6 figs. July 18: Characteristics of British Westinghouse types. July 25: Layout of furnace plant. Also in Iron & Coal Trades Rev., vol. 99, no. 2681, July 18, 1919, pp. 71-72, 5 figs. and Electrical Rev., vol. 85, no. 2174, July 25, 1919, pp. 124-126, 7 figs.

Loading. Loading a Bank of Dissimilar Transformers, H. B. Dwight. Elec. World, vol. 74, no. 5, Aug. 2, 1919, pp. 230-231, 1 fig. Calculations proposed for determination of current in each transformer for balanced load.

Phase Changers. Predetermination of Synchronous Phase-Modifier Performance, mance, Hubert V. Carpenter. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 8, Aug. 1919, pp. 997-1003, 4 figs. Reviews method for showing behavior of transmission lines as developed by Perrine and Baum and then shows how it can be used in determining effect of use of synchronous motor operating without load for improving power factor. Effect of losses in motor shown both on line alone and on line with step-up and step-down transformers.

Rotary Converters. Pulsation of tbe D. C. Terminal Voltage in Rotary Converters, J.K.Kostko. Elecn., vol. 83,nos.2148 and 2149,July 18 and 25,1919,pp.61-63 and 86-88, 3 figs. Pulsations due to tbe reverse M.M.F. of armature in single-phase converters. Self-induction coefficient of a distributed winding. (Concluded.)

Secondary Connections. Secondary Connections for Constant-Current Transformers, L. Arnold. Gen. Elec. Rev., vol. 22, no. 8, Aug. 1919, pp. 632-633, 4 figs. Single circuit vs. multi-circuit.

Windings. Cores and Coils for Transformers—II, Arthur Palme. Power, vol. 50 no. 7. Aug. 12, 1919, pp. 254-256, 8 figs. Types of windings in modern transformer practice.

See also Cores and Coils.

TRANSMISSION, DISTRIBUTION, CONTROL

Feeders, Voltage Regulation. Selecting Voltage Regulators for Feeders, Frank Hersey. Elec. World, vol. 74, no. 7, Aug. 16, 1919, pp. 344-346, 2 figs. Recommendations regarding application of single and polyphase regulators for lighting and power loads.

Grounded Neutral Transmission Line. Grounded Neutral Transmission Line, W. E. Richards. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 8, Aug. 1919, pp. 1005-1010, 3 figs. Conditions on system which was originally delta-connected. In order to overcome trouble experienced whenever short-circuit occurred specially with synchronous apparatus connected to line, transmission was changed to Y-system with neutral grounded. Effect of short-circuit witb new connection is alleged to have been decidedly minimized.

Load-Dispatching. Reinforcing System Operator's Memory, Frank Gillooly. Elec. World, vol. 74, no. 7, Aug. 16, 1919, pp. 347-350, 5 figs. Electric chart used in load-dispatching system at Philadelphia Electric Company's plant.

Long-Distance Transmission. Transmission of Electrical Energy at Long Distances (Sur les longues lignes de transmission d'énergie électrique). P. Bunet. Revue Générale de l'Electricité, vol. 6, no. 5, Aug. 2. 1919, pp. 148-158. Comparison of direct-current with alternating-current systems.

Merz-Price System of Cable Protection. The Merz-Price System of Cable Protection. C. W. Marshall. Electrical Review, vol. 85, no. 2176, Aug. 8, 1919, pp. 165-166, 5 figs. Action depends on principle that when feeder is sound the current is the same at both ends; whereas when it is faulty, there is a difference either in magnitude or in phase between currents at two ends.

Network Calculations. Development of Analytical Solutions, Charles Fortescue. Elec. Jl., vol. 16, no. 8. Aug. 1919, pp. 350-352. Suggests separation of network into invariable and variable portions, the latter constituting supply and load circuits.

Analytical Solutions, Robert D. Evans. Elec. Jl., vol. 16, no. 8, Aug. 1919. pp. 345-349, 21 figs. Concerning methods of solving network of power circuits.

Overhead Conductors. Overbead Conductors (Canalisations Aériennes), Ch. Vallet. Industrie Electrique, vol. 28, no. 649, July 10, 1919, pp. 246-247. Formula for computing maximum length of suspended portion of cable. (Continuation of serial.)

Overhead Mains: Some Reflections, S. G. Leech. Electrical Rev., vol.85 ; no. 2174, July 25, 1919, pp. 99-101, 6 figs. Instances of overhead installations presented as proof that such installations can be erected without visual offence.

POLES. Impregnating Poles for Aerial Lines (über gesetzmassige Aufnahmen von Imprägniermit- Elektrotschnik u Maschinenbau, vol. 37, no. 11, Mar. 16, 1919, pp. 105-108, 3 figs.It has been found that wood of the same kind, impregnated by the same process, under the same conditions, shows various degrees of saturation and therefore, of resistance to rotting. Curves given show saturation points of pine poles in tests made by writer.
The Selection of Proper Wooden Poles for Aerial Cables (Uber die wahl geeigneter Holzmaste fur elektrische Freileitungen), Willy Kinberg. Elektrotechnik u. Maschinenbau, vol. 37, no. 2, Jan. 12, 1919, pp. 13-17, 3 figs. Tables showing strength ratio, load ratio, breaking stress ratio, etc., of E and D poles.

POWER-FACTOR CORRECTION. Power Factor Correction, J. Humphrey. Colliery Guardian, vol. 118, no. 3056, July 25, 1919, pp. 228-229, 4 figs. Methods used and advantages claimed for each.

THREE-WIRE SYSTEMS. Three-Wire Systems, Burton McCollum and E. R. Shepard. Elec. Traction, vol. 15, no. 8. Aug. 1919, pp. 504-506, 2 figs. Diagrammatic representation of sectionalized three-wire system.

TRANSIENT PHENOMENA. Problems in High Tension Power Transmission, W. P. Dobson. Sibley Jl., vol. 33, no. 6, July-Aug. 1919, pp. 74-78, 6 figs. With special reference to line transients.

TRANSMISSION-LINE CONSTRUCTION. Analysis of Transmission-Line Construction, D. D. Ewing. Elec. World, vol. 74, no. 8, Aug. 23, 1919, pp. 406-407, 4 figs. Empirical equation and graphs establishing relations between line voltage and line length, service capacity, spacing of conductors and tower height.

WIRING

WIRE CAPACITY. Selecting Conduit Size for Power-Plant Wiring, A. R. Zahorsky. Elec. World, vol. 74, no. 8, Aug. 23, 1919, pp. 399-400, 2 figs. Curves for determining wire capacity of wrought iron in conduit.

WIRE JOINTS AND CONNECTIONS. Various Types of Wire Joints and Connections. Ry. Elec. Engr., vol. 10, no. 8, Aug. 1919, pp. 281-284, 22 figs. With notes on selection of splices according to size of conductors and kind of service required.

VARIA

APPRAISALS. Practice in making Electric Utility Appraisals, Charles W. McKay. Elec. Rev., vol. 75, no. 6, Aug. 9, 1919, pp. 226-230, 4 figs. Methods used in inventory of land, buildings and outside plant.

SWITCHBOARD. A Lighting and Experimental Switchboard, R. Drilhon. Model. Engr. & Elecn., vol. 41, no. 951, July 17, 1919, pp. 49-51, 6 figs. Features of board made for controlling light in a photographic dark room and for providing necessary current for electrical experiments.

THEORY OF PROBABILITIES. Theory of Probabilities Applied to Failures of Suspension Insulators, L. M. Klauber. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 8, Aug. 1919, pp. 959-972, 3 figs. After finding minimum number of insulators pers tring. required for any given operating conditions, writer points out method of determining amount of extra insulation desirable from an insurance standpoint according to law of probabilities. Equations are developed from which probability of failure for any given case or ration between probabilities for any pair of cases may be determined directly.

ORGANIZATION AND MANAGEMENT

ACCOUNTING

COST FACTORS. Arranging Industrial Cost Factors, M. H. Potter. Iron Trade Rev., vol. 65, no. 8, Aug. 21, 1919, pp. 508-510, 6 figs. Charts illustrating relation of machine rates toproduction factors; also forms for tabulating various elements.

COST SYSTEMS. Manufacturing Cost Systems, M. H. Potter. Metal Indus., vol. 17, no. 8, Aug. 1919, pp. 366-368, 4 figs. Author deals with economic production and consequent efficiency in operation of metal shop.

GERMAN COSTING SYSTEMS. Costing Systems in Sulphuric Acid Works, H. J. Bush. Chem. Age, vol. 1, no. 3, July 5, 1919, pp. 58-59. Method pursued at one of large chemical works in South Germany.

OVERHEAD. Overhead and General Costs in Manufacturing, Thomas R. Deacon. Jl. Eng. Inst. Can., vol. 2, no. 7, July 1919, pp. 505-506, 1 fig. Shows importance of overhead expense, and how failure of legitimate business "can be traced to inadequate provision for indirect or overhead expense."

STANDARDIZED ACCOUNTINO SYSTEMS. Standardized Accounting System. Jl. Electricity, vol. 43, no. 4, Aug. 15, 1919, pp. 168-170, 1 fig. Outlined in committee report of Nat. Elec. Contractors and Dealers' Assn.

EDUCATION

APPRENTICES. Recording the Progress of Apprentices. Machy. (N.Y.). vol. 25, no. 12, Aug. 1919, pp. 1155-1156, 3 figs. Plan followed by Westinghouse Elec. & Mfg. Co.
The Training of Engineering Pupils and Apprentices, George Knox. Proc. South Wales Inst. of Engrs., vol. 35, no. 1, July 18, 1919, pp. 59-80 and (discussion) pp. 81-115. Urges establishing junior technical schools for preparatory training of apprentices; also additon of scientific departments in secondary schools for preparatory training of pupils. Scheme for apprentice and tute lage courses is outlined.

ARCHITECTURAL INSTRUCTION. The Need of Architectural Instruction in American Colleges, George C. Nimmons. Am. Architect, vol. 116, no. 2276, Aug. 6, 1919, pp. 169-172 and 175-176. Argument is based on assistance which understanding of arts, particularly architecture, is claimed would be in acquiring of good taste and refinement, and appreciation of and preference for finer and better things of life.

FACTORY TRAININO. An Efficient Training Department in a Large Plant. Am. Mach., vol. 51, no. 9, Aug. 28, 1919, pp. 420-421. Bulletin issued by U. S. Training Service, Washington, D. C.

MACHINE TOOL BUILDERS. Training for the Building of Machine Tools, Edward A. Kraus. Am. Mach., vol. 51, no. 8, Aug. 21, 1919, pp. 353-356. Details of elimination of those undesirable or not suited to fit into production organization; training green workers for simple operations; studying personnel of factory with view to possibility of upgrading and studying to straighten out problem of misplaced help.

VOCATIONAL TRAININO. Vocational Training, A. P. Fletcher. Jl. Cleveland Eng. Soc., vol. 11, nos. 5 and 6, Mar.-May, 1919, pp. 283-289 and (discussion) pp. 289-291. Suggests getting for boys in schools half-time jobs with employers that will pay their way through school the other half of times. Instances of thus placing boys reported.

EXPORT

BRITISH MACHINE TOOL TRADE. British Machine Tool and Metal Industries, Alexander Luchars. Iron Age, vol. 104, no. 9, Aug. 28, 1919, pp. 573-577. Report issued by Am. Trade Commissioner sent abroad by Dept. of Commerce.
The Machine Industry in England and France. A. C. Cook. Am. Mach., vol. 51. no. 7, Aug. 14, 1919, pp. 331-335. Present economical aspect and plans being aid for future development.

CHINA. China's Industrial and Commercial Outlook, Julean Arnold. Jl. Electricity, vol. 43, no. 4, Aug. 15, 1919, pp. 157-158, 1 fig. Writer sees great possibilities in electrical development and railroad building.

CEMENT. International Trade in Cement. Cement. Mill & Quarry, vol. 15, no. 4, Aug. 20. 1919, pp. 19-25. Export opportunities for American producers.

FRANCE. *See British Machine Tool Trade.*

GREECE. Engineering Opportunities in Greece. Engineer, vol. 128, no. 3315, July 11, 1919, pp. 30-31. Calls attention to various engineering projects being contemplated.

LATIN-AMERICAN MARKETS. Entering the Latin American Markets, Percy F. Martin. Eng. & Indus. Management, vol. 2, no. 5, July 31, 1919, pp. 142-143, 1 fig. Opening for farming machinery pointed out.

SIBERIA. Resuming Trade with Siberia. Jl. Electricity, vol. 43, no. 4, Aug. 15, 1919, pp. 153-154, 1 fig. Conditions and possibilities of stable trading. Report of U. S. Bureau of Commerce based on recent investigation undertaken by Sub-Committee on Markets and Supplies of Canadian Economic Commission in Siberia.

SOUTH AMERICA. West Coast Electrical Trade with South America. Jl. Electricity, vol.43, no. 4, Aug. 15, 1919, pp. 150-152, 4 figs. Conditions of market indicating disadvantages and opportunities for business as reported by trade commissioner sent by Bureau of Foreign and Domestic Commerce to investigate field.

SPAIN. American Progress in Spanish Industry. Iron Age, vol. 104, no. 8, Aug. 21, 1919, p. 513. From document prepared by British Department of Overseas Trade concerning conditions and prospects of iron and steel industries and engineering projects in Spain.

FACTORY MANAGEMENT

BONUS SYSTEM. Management of the Power Plant, Robert June. Textile World Jl., vol. 56. no. 5, Aug. 2, 1919, pp. 93-95, 3 figs. Principles and administration of bonus systems in boiler rooms. Fourteenth article.
Bonus System for Boiler Room Employees, Robert June. Refrig. World. vol. 54, no. 8. Aug. 1919, pp. 25-26, 2 figs. Experience of various plants after applying system and suggestions in regard to principles on which to base system.

BUSINESS ORGANIZATION. Visualizing the Management's Part in Business for Employees, Henry Tipper. Automotive Industries, vol. 41, no. 8, Aug. 21, 1919, pp. 378-381, 10 figs. Concerning talks on business organization given by president of American Multigraph Co. to all employees.
Administration of Industrial Enterprises (Pratique de la réorganisation administrative des entreprises industrielles), Paul Legler. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 3, May-June 1919, pp. 540-571, 14 figs. Illustrates with various examples necessity for administrative technique.based on H. Fayol's book, entitled "Administration industrielle et générale."

CONTROL OF MATERIALS. Using Punched Cards for Controlling Materials, A.E. Van Bibber. Am. Mach.. vol. 51, no. 7, 1919, pp. 295-300, 10 figs. Description of system used at Hog Island Shipyard, with reproduction of forms used, matter tabulated and examples of use of system.

EMPLOYMENT MANAGEMENT. Employment Management—IV, V, VI, A. Rowland-Entwistle. Eng. & Indus. Management, vol, 2, nos. 4, 5 and 7, July 24, 31 and Aug. 14, 1919, pp. 102-106. 146-149 and 203-206. 7 figs. July 24: Suggests forms for labor requisition, interview forms, and forms for keeping employment record. July 31: Applications of psychology and the reading of character. Aug. 14: Comparison of labor turnover in America and in England.
Applying Army Methods of Selecting Men for Industry, P. N. Golden. Am. Mach., vol. 51, no. 9. Aug. 28, 1919, pp. 409-411. 7 figs. Experience of army described as having resulted in prevention of much lost motion and expense by sorting out applicants for employment before they get into shop.

Heat-Treating Plant. Methodic Organization of Metallurgical Plant (Essais d'organisation méthodique dans une usine métallurgique). G. Charpy. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 3, May-June 1919, pp. 572-606. 35 figs. How Taylor system was introduced at heat-treating plant of Saint-Jacques of Montluçon.

Industrial Relations. The Works and Products of Messrs. Barr and Stroud, Limited. Engineering, vol. 108, no. 2796, Aug. 1, 1919, pp. 133-134. Administrative methods and industrial relations of works manufacturing range-finders. (To be continued.)

Job Planning. Planning a New Job, Otto Knaak. Am. Mach., vol. 51, no. 7, Aug. 14, 1919, pp. 313-316. 2 figs. Procedure of H. H. Franklin Manufacturing Co., Syracuse, N.Y., noting forms which permit co-operation between designers and shopmen in planning out sequence of operations.

Machinery Handling. Relation of Large Machine Units to Production, Arnold P. Yerkes. Trans. Am. Soc. Agricultural Engrs.. vol. 12, Dec. 1918, pp. 136-150, 1 fig. Urges extending use of efficient machines and methods on farms.

Plant Layout. The Works and Products of Messrs. Barr and Stroud, Limited. Engineering, vol. 108, no. 2798, Aug. 15, 1919, pp. 198-200, 10 figs. Arrangement of buildings. (Continuation of serial.)

Progress Department. Planning a Progress Department—IV, V, W. J. Hiscox. Eng. & Indus. Management, vol. 2, nos. 3 and 6, July 17 and Aug. 7, 1919, pp. 79-80 and 163-166. 7 figs. July 17: For motor car factory. Aug. 7: On plant manufacturing a.c. and d.c. electric motors.

Rate Setting. Time Study and Rate Setting in a Machine Tool Plant. Machy. (Lond.). vol. 14, no. 356. July 24, 1919, pp. 493-497, 8 figs. Review of methods used by R. K. Le Blond Machine Tool Co. in making time studies and setting bonus rates.

Restaurants. Plant Restaurant Managed by Employees. Iron Age, vol. 104, no. 8, Aug. 21. 1919, pp. 489-492, 6 figs. Experiment at Wisconsin Steel Works. To convince men that restaurant was operated solely for service and with no idea of profit. company turned over management of institution to employees. Plan said to have proven great success.

Scientific Management. Scientific Management—I, II, II, Henry Atkinson. Eng. & Indus. Management, vol. 2, nos. 3, 5 and 7, July 17, 31 and Aug. 14, 1919, pp. 71-73, 137-140 and 197-199, 1 fig. July 17. Its meaning and object. July 31: Its rapid rise since Taylor expounded his system before Am. Soc. M. E. an indication of its more recent tendencies. Aug. 15: On Taylor's fundamental principles of management.

Works Management. Eng. & Indus. Management, vol. 2, no. 6, Aug. 7, 1919, pp. 168-169, 2 figs. Suggestions in regard to promoting efficient organization in factory.

Application of Taylor System in large Government Powder Works (Essai d'application du système Taylor dans un grand établissement d'Etat), E. Nusbaumer. Bulletin de la Société d'Encouragement pour l'Industrie Nationale. vol. 131, no. 3, May-June 1919, pp. 495-539, 17 figs. With tables giving detailed statements of manufacturing costs.

Ship Yards. Results of Applying Working Methods in Ship Yard Employing 3,000 Workers (Resultats obtenus par l'application des nouvelles méthodes de travail dans un chantier de 3,000 ouvriers), L. Lavallée. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 3, May-June 1919, pp. 441-494, 24 figs. Noting especially forms used in keeping records of work and workmen and Indicating arrangements by which time was saved in various operations.

Sites. Some factory Sites Not Cheap, Even as a Gift. Can. Machy., vol. 22, no. 6, Aug. 7, 1919, pp. 146-148. Discussion of geographic position in relation to supply of raw material and market for finished product, transportation facilities, labor, supply, health statistics, educational facilities, and cost of land and taxation assessments, as factors for selecting location of factory.

Storeroom. Definitions for Storeroom Material, H. B. Twyford. Iron Age, vol. 104. no. 6, Aug. 7, 1919, pp. 357-359, 2 figs. Method adopted by manufacturing establishment for standardizing material and small articles.

See also Tool Stores.

Stock Parts and Their Routing, Luther D. Burlingame. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1109-1114, 12 figs. Method said to have proven successful in actual practice.

Keeping Record of Iron in Storage, D. C. Kickler. Foundry, vol. 47, no. 329, Aug. 15, 1919, pp. 538-539, 2 figs. Recommendations in regard to taking drillings.

Sugar-Mill Equipment. Better Results by Better Management, L.W.Alwyn-Schmidt. Sugar, vol. 21, no. 8, Aug. 1919, pp. 402-405, 2 figs. Suggestion in regard to selecting equipment in sugar mill. (Continuation of serial.)

Tool Stores. The Modern Tool Stores-IV, Herbert C. Armitage. Eng. & Indus. Management, vol. 2, no. 4, July 24, 1919, pp. 99-101, 4 figs. Arrangement, organization, construction and equipment. (Concluding article).

Track Layout. Ideal Track Layout for Gravel Plant. Rock Products, vol. 22, no. 16, Aug. 2, 1919, pp. 32-33, 2 figs. Yard layout of Western Indiana Sand and Gravel Co. cited as effective design which permits handling large number of cars with minimum switching.

Working Staff, Handling. Maintenance of Works Departments, Ry. Gaz., vol. 31, no. 3, July 18, 1919, pp. 89-91. Suggests how to make more effective use of and obtain better results from working staff.

LABOR

Business Information for Employees. How to Make Your Business a Human Story for Employees, Harry Tipper. Automotive Industries, vol. 41, no. 7, Aug. 14, 1919, pp. 330-332. Tells how one company put all transactions before employees so that all could see, step by step, why a big business machine was needed.

Clubs. Making the Factory a Place of Both Work and Play. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1130-1131, 5 figs. Employees club built by Globe Machine & Stamping Co., Cleveland.

Farms for Employees. "Opportunity": The Anaconda Company's Farm for Employees, Oliver E. Jager. Min. & Sci. Press, vol. 119, no. 5, Aug. 2, 1919, pp. 159-162, 4 figs. How good will was created inconsequence of establishment.

Fatigue. Fatigue induced by Labor, A. F. Stanley Kent. Eng. & Indus. Management, vol. 2, no. 3, July 17, 1919, pp. 82-85. Experiments and researches undertaken by various investigators are quoted and their conclusions summarized and applied to study effects of cumulative fatigue and similar phenomena. Paper read before Bistol Medico-Chirurgical Soc.

Hawaiian Islands. Some of the Factors in the Industrial Development of the Hawaiian Islands, J. N. S. Williams. Jl. Roy. Soc. Arts, vol. 67, no. 3479, July 25, 1919, pp. 571-579, 1 fig. Including features of plan of co-operation entered into by planters in 1882 in order to remedy labor shortage which became acute during that year.

Health. The Care of the Human Machine, Thomas Darlington. Eng. & Min. Jl., vol. 108, no. 8, Aug. 23, 1919, pp. 311-313, 1 fig. Wholesome food and proper care of body as aids in conservation of health and to promote efficiency. Address delivered before Min. & Metallurgical Soc. of Am.

Hours of Work. Hours of Work as Related to Output and Health of Workers. Nat. Indus. Conference Board, Research Report no. 18, July 1919, 62 pp. Including data collected in metal trades proper, foundries, automobile plants, hardware, electrical equipment and various miscellaneous establishments.

Industrial Relations. Solving the Labor Problem, K. H. Condit. Am. Mach., vol. 51, no. 7, Aug. 14, 1919, pp. 301-304. Account of H. F. G. Porter's early attempts to introduce democratic principles in industrial relations at plants of Nernst Lamp Co. and Nelson Valve Co., and later at those of Hercules Powder Co., and results of experiment. Also exposition of Int. Harvester Co. scheme.

Golden Rule Best Labor Plan, W. A. Grieves. Iron Trade Rev., vol. 65, no. 9, Aug. 28, 1919, pp. 565-566. Points out that too much democracy is as bad as too little and that loyalty is result of honest purpose and common-sense action.

Securing the Co-operation of your Employes, William A. Rockenfield, Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1128-1129. How man at head of concern determines conditions throughout plant, "not only because the men holding minor executive positions under him will reflect his ideas, but also because he will, in the first place, select the type of men for these positions who are capable of dealing with labor in the same way as he would."

Relations Between Employer and Employee, William M. Leiserson. Blast Furnace & Steel Plant, vol. 7, no. 8, Aug. 1919, pp. 394-396 and 410. Suggestions in regard to operating labor administration machinery.

Labor Problems. A Constructive Labor Program, T. N. Carver. Jl. Soc. Automotive Engrs., vol. 5, no. 2, Aug. 1919, pp. 155-158. Economical aspect of labor problem.

Rating Employees. Rating Each Workman According to Merit, W. D. Stearns. Factory, vol. 23, no. 2, Aug. 1919, pp. 297-299. Proposes dealing with employee as individual but without anything that savors of paternalism, and suggests plan.

Road Labor. The Organization of Efficient Concrete Road Gangs, Halbert P. Gillette. Concrete Age, vol. 30, no. 4, July 1919, pp. 9-11. Suggestions to college engineers.

Wage Adjustments. Salary and Wage Adjustment, Mett McKune, Metal Indus., vol. 17, no. 8, Aug. 1919, pp. 375-376. Plan provides for classification of all help, adoption of minimum rate to be paid at beginning of service, for periodic increase, minimum to be attained at end of period when it is assumed employee has attained highest degree of efficiency.

Wage-Payment Systems. Wage Payment Systems in Machine Shops, W. D. Stearns. Machy, (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1115-1117. Method evolved by Westinghouse Elec. & Mfg. Co. after reviewing present practices.

Welfare Work. Maintaining the Efficiency of the Working Force, Erik Oberg. Machy. (N. Y.), vol. 25, no. 12, Aug. 1919, pp. 1149-1152, 5 figs. Methods employed in welfare work, health supervision and medical care by R. K. Le-Blond Machine Tool Co. of Cincinnati.

Women. Efficiency of Both Sexes in the Machine Industry, L. W. Alwyn-Schmidt. Am. Mach., vol. 51, no. 6, Aug. 7, 1919, pp. 281-282. Based on report of Labor and statistics compiled by Nat. Industrial Conference Board.

SAFETY ENGINEERING

Accident Prevention. The Work of Accident Prevention, William Conibear. Eng. & Min. Jl., vol. 108, no. 6, Aug. 9, 1919, pp. 226-227. Low accident rates said to be dependent in large measure on over-coming of carelessness when miners work at high speed.

Electrical Inspection. The Demands of Electrical Inspection E. F. Hensler. Jl. Electricity, vol. 43, no. 3, Aug. 1, 1919, pp. 118-119. Value of regular inspection of electrical installations and appliances in their relation to safety standards.

Explosion of Chemicals. The Explosion of Chemicals — II, Workmen's Compensation Acts, Chesla C. Sherlock. Chem. & Metallurgical Eng., vol. 21, no. 3, Aug. 1, 1919, pp. 131-132. Notes that theory of compensation acts is not based upon fault at all, but upon idea that all injuries suffered by accident in course of employment should be compensated.

Fire Protection. Fire Protection for Schooles, H. W. Forster. Nat. Fire Protection Assn., vol. 13, no. 1, July 1919, pp. 20-60, 28 figs. Detailed analysis of conditions and statistics of fire accidents lead writer to conclusion that what country needs is national team work in fighting fire waste. Schools, he says, have a double responsibility and opportunity in the premises first, to put their own houses in order and second, to wield a powerful educational influence.

See also Sprinklers.

Fire Hazards of Cotton Seed Oil Mills, T. C. Taliaferro. Nat. Fire Protection Assn., vol. 13, no. 1, July 1919, pp. 75-81. Scheme of sub-dividing oil mills into six fire divisions.

Fire Hazards Met in Storage of Fuel Oil, J. W. Lord. Eng. News-Rec., vol. 83, no. 9. Aug. 28, 1919, pp. 415-416. Precautions necessary in the installation of fuel-oil tanks in industrial plants, observed by insurance companies. Paper read before Am. Concrete Inst.

Fire Protection in Factories, Charles E. Rigby. Eng. & Indus. Management, vol. 2, no. 6, Aug. 7, 1919, pp. 180-184, 3 figs. Advises taking into consideration construction, character and arrangement of processes, protection and hazard from adjoining property.

Exits, Fire Alarms and Drills. Textile World Jl., vol. 56, no. 7, Aug. 16, 1919, pp. 47-49 and p. 63, 3 figs. Recommendations of National Safety Council.

Press Accidents. Reducing Press Accidents by Same Treatment. Can. Machy., vol. 22, no. 8, Aug. 21, 1919, pp. 197-200, 14 figs. Description of various safety devices.

Safety Committees. Organization of Safety Committees. Eng. & Indus. Management, vol. 2, no. 3, July 17, 1919, pp. 74-77, 2 figs. Means adopted by large company for accident prevention in their works.

Safety Devices. Report of Engineers of the Northeastern Iron and Steel Works Co-operative Association for 1917 (Aus dem Jahresbericht 1917 der technischen. Aufsichtsbeamten der Nordöstlichen Eisen-und Stahlberufsgenossenschaft). Zeitschrift f. die gesamte Giessereipraxis, vol. 40, no. 5, Feb. 1, 1919, pp. 26-27, 7 figs. Safety devices and safety measures, especially for lathes, winches, stamping presses and turntables.

Sprinklers. Impairment of Automatic Sprinkler Protection in Refrigerator Rooms. Nat. Fire Protection Assn., vol. 13, no. 1, July 1919, pp. 61-74, 9 figs. Basing conclusions on report rendered by several inspection departments and on detailed examinations conducted by Canadian Fire. Underwriters Assn., Montreal, and also developments indicated by test apparatus.

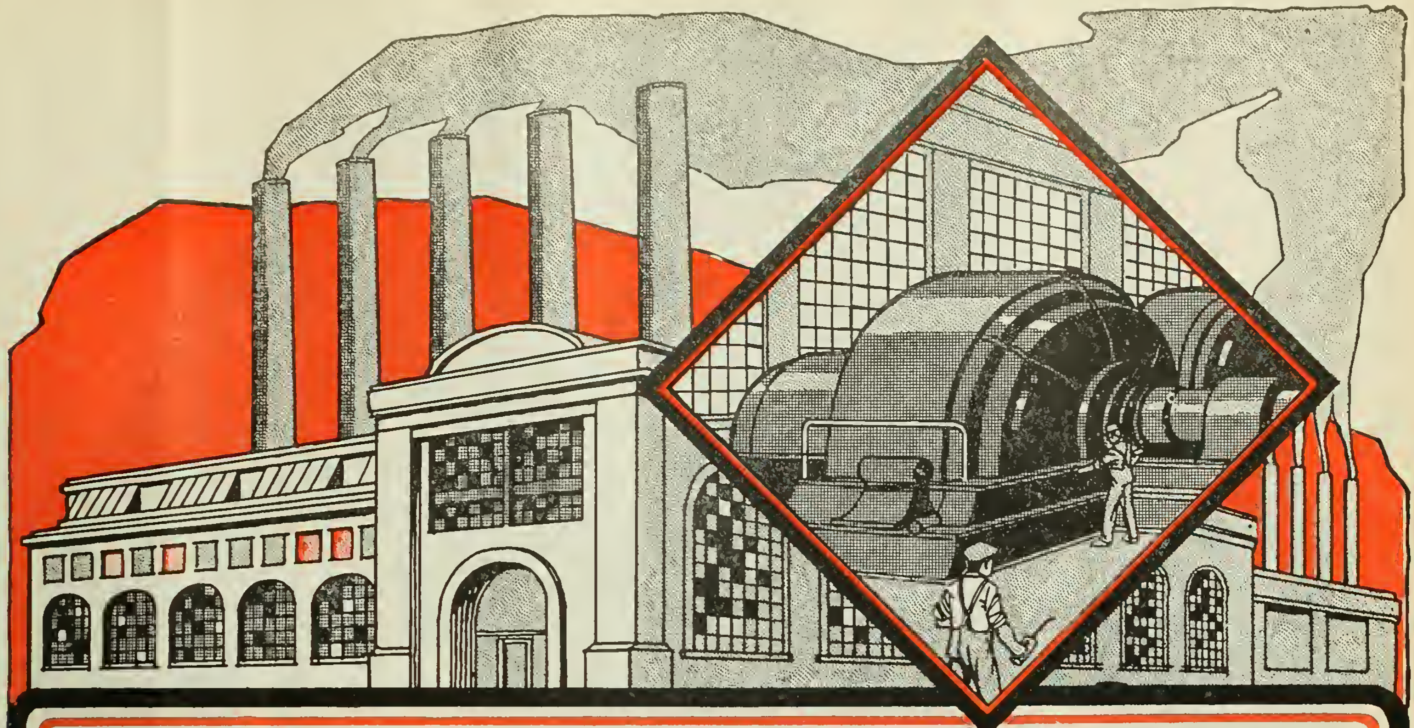
SALVAGE

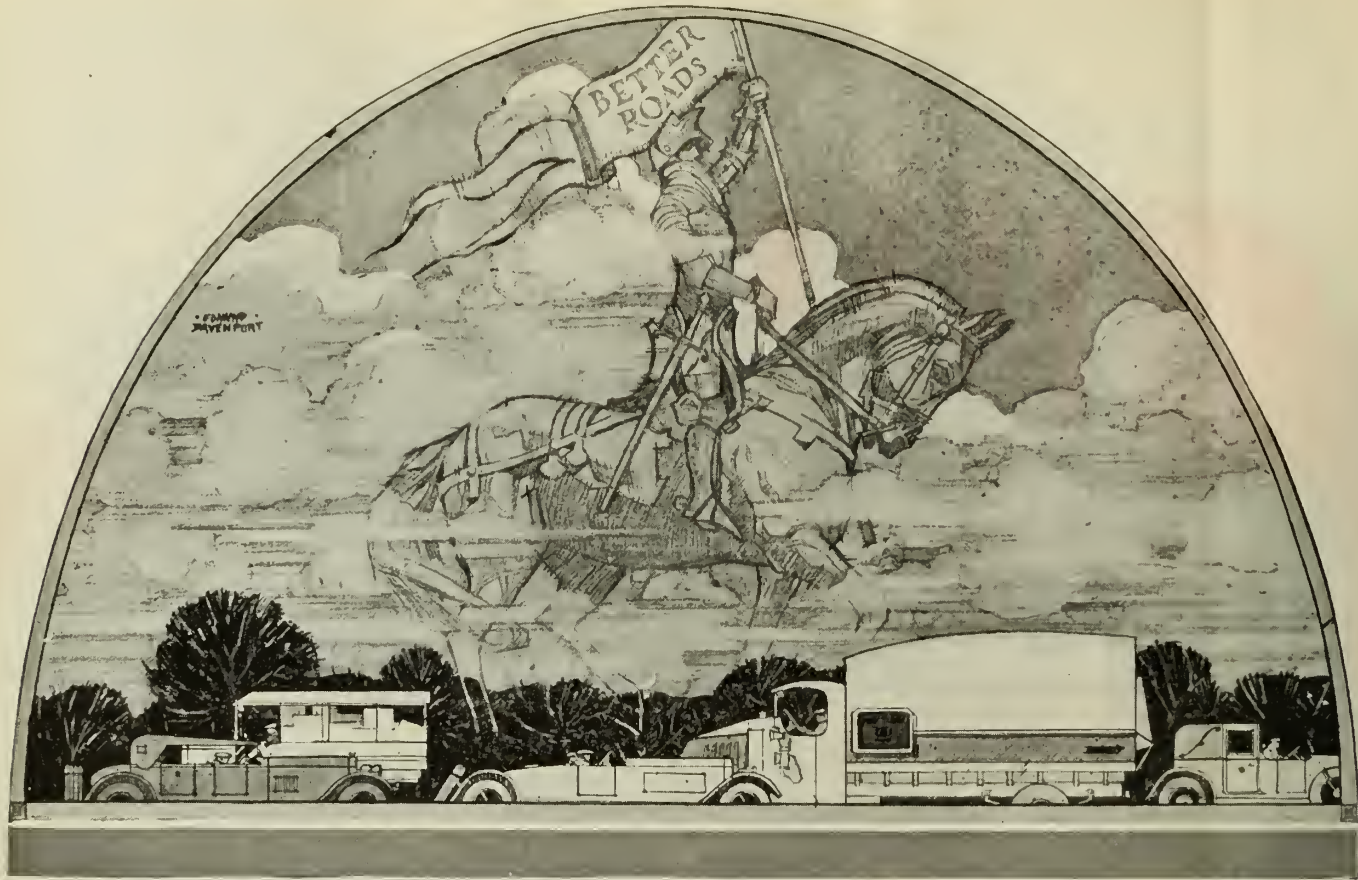
Scrap Reclamation. Scrap Handling and Reclamation, Chicago Rock Island & Pacific Ry., A. T. Kipping. Ry. Rev., vol. 65, no. 7, Aug. 16, 1919, pp. 219-222, 4 figs. Methods of practice employed in conducting operations at Silvis Scrap Dock and reclamation plant at Silvis, Ill.

TRANSPORTATION

Motor Cars on Rails. A Railroad Service for the Automobile, D. A. Hampson. Can. Machy., vol. 22, no. 7, Aug. 14, 1919, pp. 173-175, 3 figs. Results of operating two motor cars on 15-mi. standard-gage road.

Refuse Collection. Horses vs. Motor Trucks in Refuse Collection, E. W. Stribbling. Mun. Jl. & Public Works, vol. 47, nos. 7 and 8, Aug. 16 and 23, 1919, pp. 110-111 and 119-120. Comparison of cost of maintaining and operating each, from experiences of various cities.

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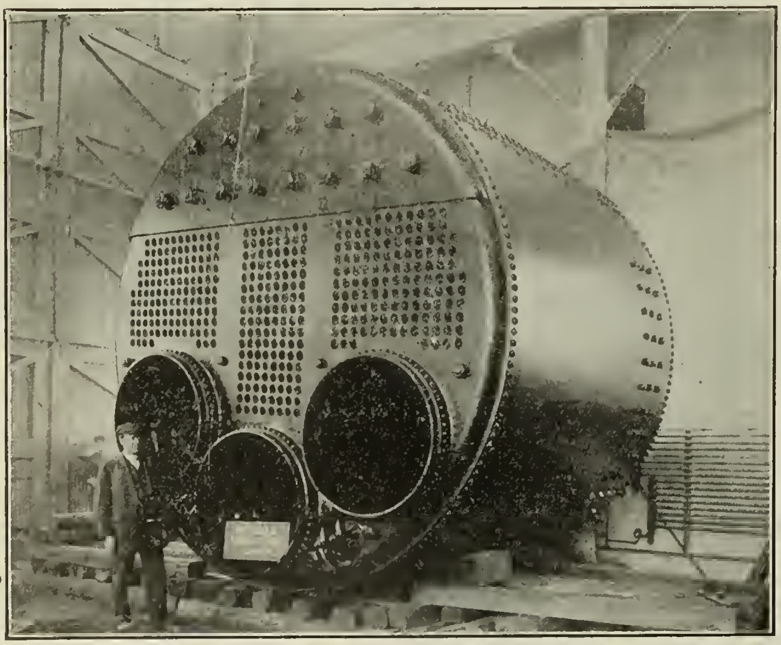

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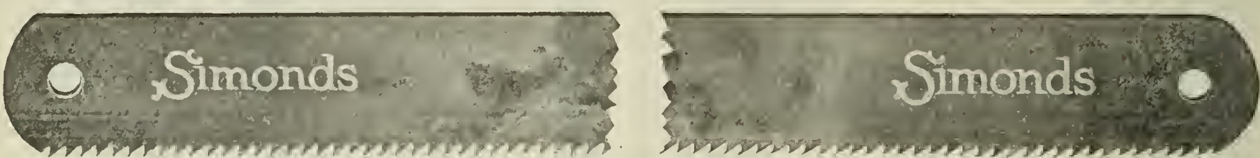

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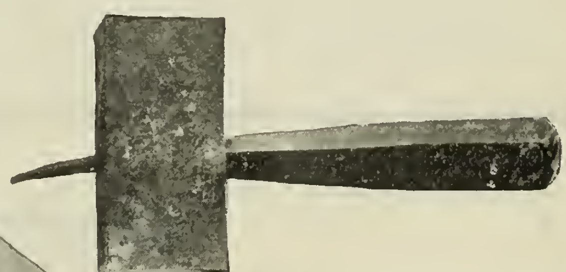


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The Toronto Drifting Sand Water Purification Plant

By William Gore, M.E.I.C., M. Inst. C.E., M. Amer. W.W. Assoc. and William Storrie, M.E.I.C., Assoc. M. Inst. C.E., M. Amer. W. W. Assoc.

Introduction

Recently there has been put in operation what is known as the Drifting Sand Water Purification Plant for the City of Toronto. In view of the fact that this System is entirely new to this Continent, its adoption by the City of Toronto has caused wide spread interest to be taken in the principles involved, the design, construction, and operation of the Plant. It is proposed, therefore, to deal in detail with the whole scheme.

The City of Toronto is situated on the northern shore of Lake Ontario near its western end. In front of the city lies a long low-lying horseshoe-shaped island composed entirely of gravel and sand. A maximum distance of two miles separates the island from the mainland, forming a bay with eastern and western entrances 300 feet wide from Lake Ontario. The water purification plants are situated on this island as shown on Fig. 1.

The two intakes supplying the city lie immediately to the south of the island about 3,400 feet from the shore and in water about 120 feet deep, with inlets 80 and 60 feet respectively below the surface of the water. Both intakes are 72 inches in diameter of steel flanged pipe fixed to timber piles and surrounded with concrete. These intakes lead to the pumping stations connected with both the new filtration plant and an earlier slow sand filter plant. After the water is purified it passes to a pure water reservoir and from thence 72 inch and 84 inch steel flanged pipes convey the water across the island to a tunnel shaft at its northern end near Hanlon's Point and from thence across the bay through a tunnel constructed in bedded shale to the main pumping station on the mainland to be there pumped through the city mains (Figs. 1 and 2).

In 1912, the Slow Sand Water Purification Plant was put in operation, having a maximum daily capacity of 48 million gallons. The capacities of the intake pipes, the pipes conveying the water across the island, the tunnel underneath the bay, and the pumps supplying the city mains are approximately 100 million gallons per day. To bring the normal capacity of the water purification system equal to that of the piping and pumping it was decided, in 1914, to install an additional plant. On the recommendation of Commissioner of Works, R. C. Harris, the City Council awarded a contract for the complete design and construction of a plant for 60 million gallons average daily supply with a maximum rate of 72 million gallons on a ten hour period. This plant will be considered in detail.

Preliminary Investigation

In 1913, the officials of the City of Toronto carried out a series of tests on a demonstration plant of the Drifting Sand type having a capacity of 500,000 gallons per day. This plant was erected at West Toronto and was tested on water taken from the Humber Bay district of Lake Ontario (Fig. 1). The results of these tests were such as to satisfy the city officials regarding the system and were the means of finally enabling the Commissioner of Works to recommend to the City Council the adoption of the Drifting Sand Filters.

Reporting on these official tests, Col. G. G. Nasmith, C.M.G., Director of Laboratories to the City of Toronto, stated:—

Note.—Wherever the word 'gallon' is used, the Imperial gallon is meant.

"The official tests of the Experimental Filtration Plant at West Toronto conducted by us, lasted for an actual working period of 33 days. During that time daily analyses of the water before treatment on Standard Agar was 1458 per c.c., while the effluent showed 15 bacteria per c.c., giving a total removal of 99 per cent.

"B. Coli was removed to the extent of 98 per cent, while 99 per cent. of the red colonies growing on neutral red bile salt agar (Dr. Houston's formula) were removed.

"The amount of alum used, varied from .85 grains to 1.5 grains per Imperial gallon. The effluent was invariably bright and sparkling without any trace of turbidity. From these results it is perfectly obvious that this type of filter is capable of rendering any water as safe as any other type of mechanical filter known."

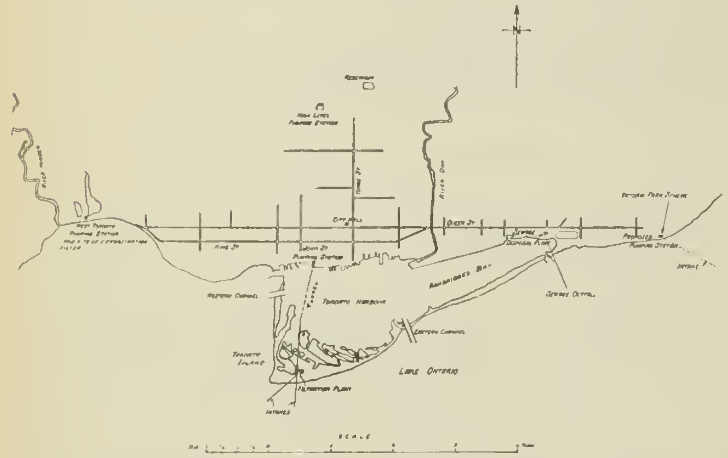


Fig. 1.—Toronto Waterworks System showing the intakes, filters, tunnel and Main Pumping Station; the sewage outfall, the proposed Victoria Park Intake and the site of West Toronto Test Filter.

Commenting on the above report, Commissioner of Works, R. C. Harris, reported to the City Council in part as follows:—

"From the foregoing, you will observe that the result of the test was conclusive, and this when filtering water from Humber Bay of uniformly bad quality, and much worse than that ordinarily found outside Toronto Island at our present intakes.

"During a portion of the time the unit was under test, we increased the turbidity of the water to a point beyond that found in the water at the intake mouth, south of the island, when at its worst. The performance of the unit under these circumstances, never met with in our practice, was remarkab.e."

General Condition

At the end of 1918 the population of the City of Toronto and neighbourhood supplied with water was estimated to be about 500,000.

The average daily consumption of water over 1918 was 63 million gallons, giving a per capita rate of 126 gallons per day.

The maximum daily consumption was 77.49 million gallons and the minimum 45.61 million gallons.

The combined capacity of the Slow Sand and Drifting Sand Purification Plants is 96 million gallons or 18 million gallons greater than the maximum daily consumption during 1918.

The following table shows the estimated population supplied, the water pumped and the per capita rate for a number of years:—

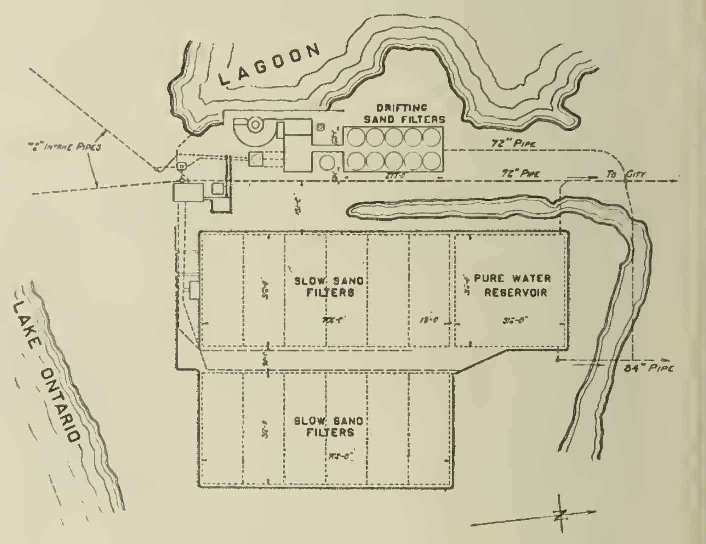
Year	Estimated Population	Daily Average	Maximum Day	Minimum Day	Average per Capita Rate
		Mil.	Imp.	Gallons	Gallons
1890	185,000	14.34	......	......	78.02
1895	190,000	18.19	......	......	95.74
1900	235,000	22.09	......	......	94.01
1905	270,000	25.04	......	......	92.75
1910	360,000	35.03	......	......	97.3
1911	374,667	40.97	60.	......	109.
1912	417,250	47.06	......	......	113.
1913	445,575	48.02	......	......	108.
1914	470,144	50.36	......	......	107.
1915	463,700	48.13	......	......	104.
1916	461,526	49.96	68.84	38.03	108.5
1917	473,829	55.76	70.25	41.8	117.1
1918	500,000	62.41	77.49	45.61	126.

Principle of Drifting Sand Filter

Before considering the Toronto Plant in detail and in order to get an idea of the principles involved in the Drifting Sand Filter, it is considered advisable to describe first of all the design and operation of a typical single unit filter (Fig. 3). The filter is of the rapid or mechanical type requiring a coagulant and is operated at the very high rate of 150 million gallons per acre per day based on plan areas.

Preliminary coagulating or sedimentation basins have not so far been found necessary. The coagulant is introduced as the water goes direct to the filters, invariably on the suction side of the low lift pump supplying the filters where same is necessary. Owing to the operation of the drifting system the sand contained in the filter resolves itself into two bodies—a stationary sand body supported by graded layers of gravel resting on the water collecting system, and a drifting sand body lying between the surface of the stationary sand and the sides of the filter unit. By causing the drifting sand portion to drift

TORONTO FILTRATION PLANTS



PLAN

Fig. 2.—Plan showing the Slow Sand Plant and the Drifting Sand Plant together with the ranging up of the pipes in their immediate vicinity.

across the path of the raw water a large proportion of the impurities are carried out along with a portion of the drifting sand. This drifting sand is washed and returned to the filter, along with the on-going raw water by the constant c rculation of the water and sand. The stationary sand body takes out the remaining impurities. In actual operation the stationary body of sand is found to be hard and compact with a cone shaped-like surface hard to penetrate. On the other hand, the drifting sand body is of a buoyant and spongy nature and offers little or no resistance to penetration. Through time the loss of head in the operation of the filter increases due to the gradual choking of the surface of the stationary sand and as often as conditions determine the whole bed is washed by a reverse flow of filtered water.

The depth of 9 ft. of sand is supported by a 10 inch layer of gravel graded to 3 different sizes. No screens are used between the gravel and sand. Enbedded in the bottom of the gravel layers is a system of sherardised pipes, having round openings in the bottom for the purpose of collecting up the filtered water and also used for bringing the back washwater to the filter.

The treated raw water enters the filter partly by a standpipe running through the centre of the unit, which passes up through a separator or sand-washer in the bottom and delivers above the sand at the top of the pipe, and also partly through a bye-pass. Within the sand-washer the raw water pipe is constructed similar to that of the tube of a Venturi meter and the drifting sand after being collected and washed in the sand-washer is inducted into the raw water at the throat of this Venturi tube. This sand passes up the standpipe with the raw coagulated water and is delivered with it above the top of the sand already there. This sand forms a volcano-like cone that continuously drifts away and is continually being replaced with the washed sand from the sand-washer, leaving a round topped body of stationary sand below, resting upon the filtered water collecting system. This body of stationary sand does the final filtration. The surface of this body is more than twice the plan area of the unit and is the actual filtering surface, thus economising the plan area of the filters. The drifting sand passes down all round the boundary of the stationary sand to a system of slots and continues through a system of converging ports to the outlets on the external extractors and thence by a system of pipes to the sand-washer. At the sand-washer the sand falls to the bottom through a current of raw water and is thus freed from its impurities. It is picked up by the inductor and carried on to the filter as previously described. The dirty water, impurities or suspended matter pass upward and out at the top of the sand-washer by an outlet suitably controlled. In the external extractors sand traps are placed of such a form that the sand is kept out of the piping system except when the inductor is in full operation. That is to say, the sand moves only when there is an abundance of running water to carry it forward to the sand-washer.

The question of sand scour is one of considerable importance. The form of the inductor is such that the sand enters the high velocity water at the centre of the stream and can only come in contact with the sides of the pipe after the sand and water have been reduced to non-scour velocities. The driving head at the inductor or sand-lifter is from 3½ to 5 feet, but the bye-pass arrangement is such that the induction may be varied either at will or automatically in such a way as to suit the amount of the impurities, turbidity and the coagulants in the raw water. In this way the greater the proportion of the total raw water passing up through the stand-pipe the greater will be the rate of flow of the drifting sand so that when the turbidity is very high the sand can be drifted at its maximum rate, while when it is free from turbidity, if necessary, the drifting can be entirely stopped. By doing this, you can physically adapt the filter to sudden changes in the raw water conditions.

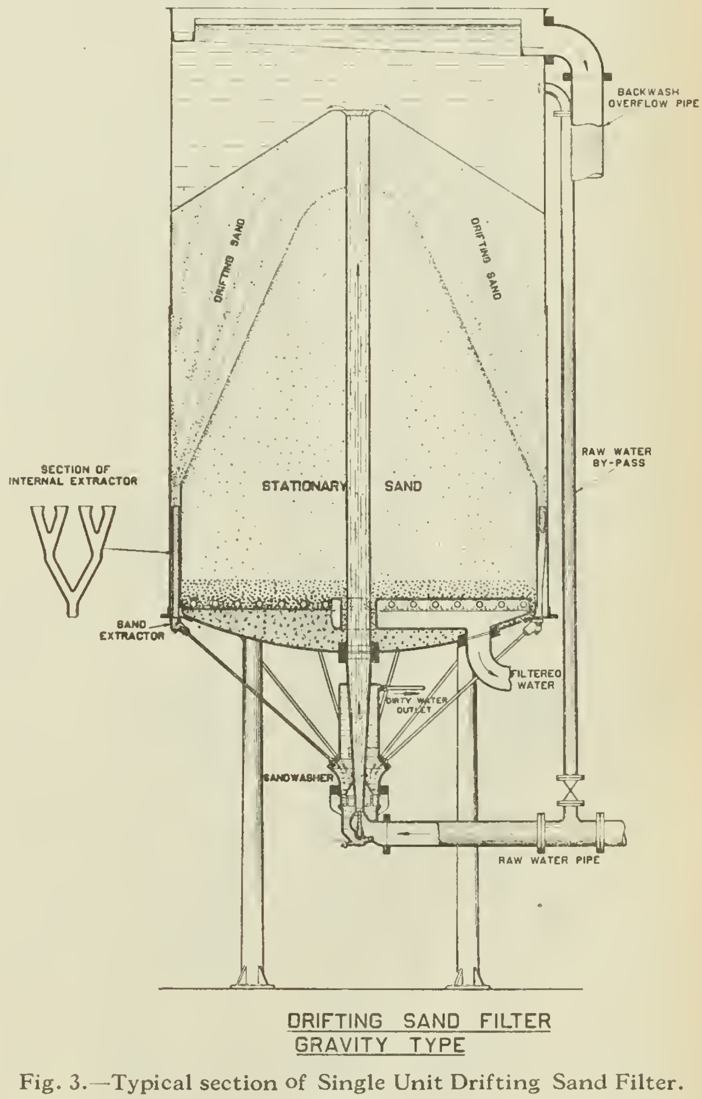


Fig. 3.—Typical section of Single Unit Drifting Sand Filter.

No rate controller is necessary as under average conditions these filters will operate for about one week. Actual practice has shown they will run anywhere from 3 days to 6 weeks without being back-washed. Fig. 5 shows typical rate of filtration and loss of head diagrams of the Toronto Plant and Fig. 6 shows the characteristic curves of the sand circulating system. The largest single unit filter so far constructed is for 500,000 gallons per day.

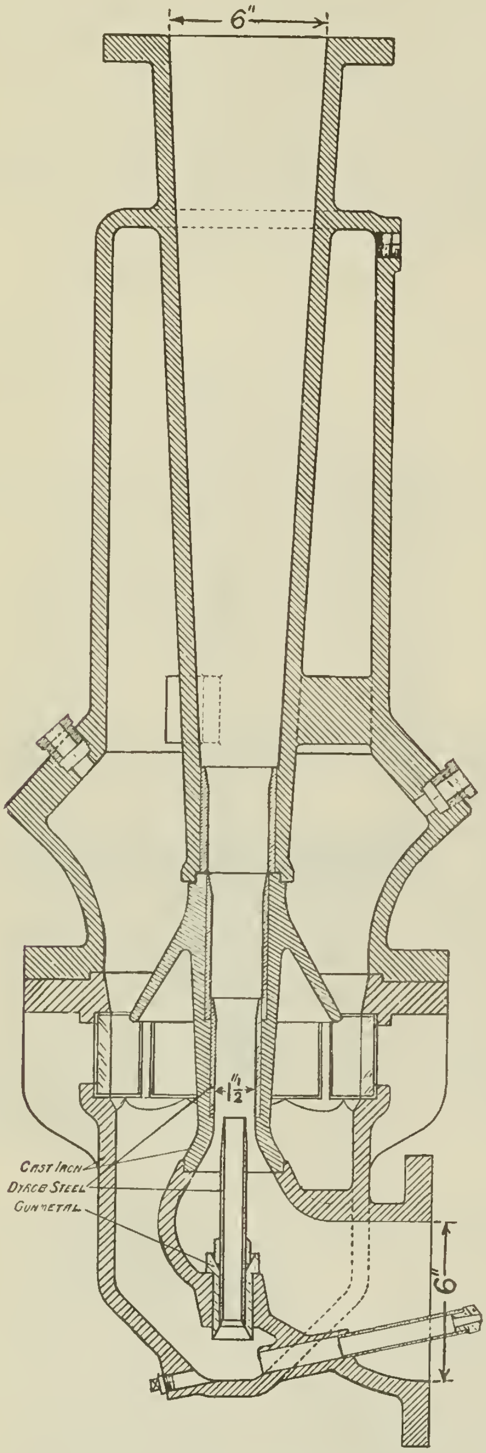


Fig. 4.—Sandwasher section.

In practice it is found that the slope of the drifting surface cone is a minimum of about 32 degrees and the slope of the surface of the cone forming the stationary sand is a minimum of about 64 degrees. These slopes increase with the rate of filtration and the age of the run. There is a minimum depth of stationary sand in each filter of 26 inches. Backwashing the filter takes place when the loss of head in the sand is about 11.0 feet.

Multiple Unit Filter

With the foregoing explanation of the principles involved in the Drifting Sand Filter as shown in a single unit the principles involved in the multiple unit filter as built in Toronto will be more easily understood.

The single unit filter is adopted where the capacities are small. When larger capacities are met with the single unit filter would not be feasible at a reasonable cost. This difficulty is overcome by incorporating a series of these units in one filter. In the Toronto design 30 such units similar generally to the one already described have been incorporated in a filter tank 50 feet in diameter built of steel and supported on cast iron columns. But tanks may be square in plan either of steel or reinforced concrete and containing any convenient number of units.

Each unit has a sand-washer, sand extractor system and inlet and outlet pipes and is separated from the others only in so far as the height necessary for the port openings containing the internal portions of extractors, down which the drifting sand moves. There is no division wall between the sand cones other than that formed by the base. Each filter thus consists when in operation of a number of separate units, containing as many sand cones with square or approximately square bases, but when the back-washing takes place these cones are entirely broken up and have to be formed again once the filter is put back in operation by the drifting of the sand.

General Arrangement at Toronto Plant

The general arrangement of this plant is shown in Figs. 7 and 8. At the south end of the plant is the suction well, to which the 2—72 inch steel intake pipes are connected. To the west of the suction well is the coal and chemical storage building and immediately to the north is the pumping station. The filter house building lying to the north is connected to the pumping station by an underground passage. To the west of the pumping station and coal-chemical house a dock with 10 feet depth of water has been constructed so as to permit of all material being brought by water to the immediate neighbourhood of the plant. A chimney and a wash water tank completes the structures.

The water comes into the suction well through either or both of the 72 inch intake pipes. These intake pipes are controlled by the 72 inch hydraulically operated valves on the end of each within the suction well. After passing through a duplicate row of screens the raw water is treated with alum from the coagulant control apparatus in the chemical house. The alum is conveyed by 2 inch lead pipes laid in a conduit and is distributed over the surface of the water in the vicinity of three 36 inch pump suction pipes in the northern portion of the suction well. From here the alum treated water is conveyed through the

36 inch suction pipes of three 36 million gallon pumps in the pumping station, and after passing through check and stop valves and a 72 inch Venturi meter the water goes into the filter house building and is there distributed to the 10 filters. After filtering the water passes into a bye-pass or inspection tank and from there to the city or to the pure water reservoir and mixes with the filtered water from the slow sand plant.

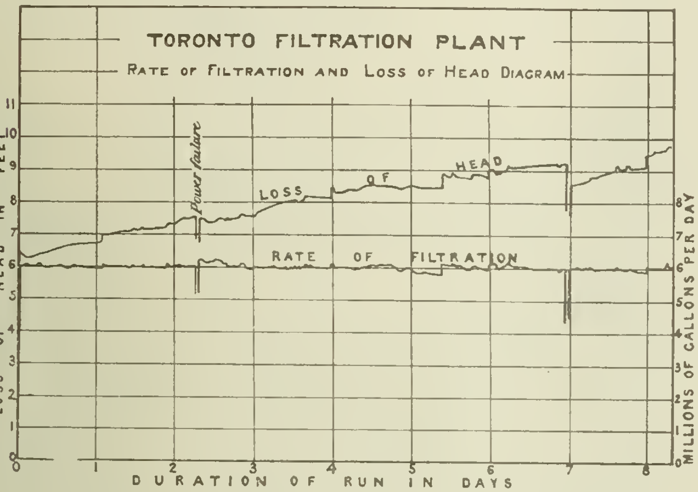


Fig. 5.—Loss of head diagram with rate of filtration diagram accompanying it.

Suction Well

The general arrangement of the suction well building is shown in Fig. 11. The suction well proper consists of a reinforced concrete structure 25 feet in diameter and 24 feet deep. This was sunk as a caisson, being built on the natural ground and having a steel cutting shoe placed around the bottom of the walls. After the concrete to a depth of approximately 7 feet had been placed in the walls and thoroughly set, the forms were removed and by excavating from the interior of the well the same gradually was lowered into position. This was carried out in three successive operations, and after the caisson was sunk to its proper level the floor of the well was placed in position. The building on top of the wall is 36 ft. square in plan and is supported by a cantilever arrangement thrown out from the walls of the caisson.

Across the centre of this well a double row of screens have been placed to prevent any large suspended matter getting from the intake pipes on the filter. These screens are built in sections each 4′ 4″ x 3′ 3″ of 16 L.S.W.G. gauge copper wire, 4 wires to the inch mesh, fixed to oak frames with sherardised corner plates and bolts. A 1 ton hand-operated jib crane 14 feet reach is fixed in the building for the purpose of removing these screens from time to time for cleaning purposes. A washing compartment has been constructed at the west side of the building and there the screens are cleaned from time to time, one set of screens remaining in position while the other is being cleaned. On the end of each of the 72″ pipes is placed a 72″ hydraulically operated valve working under 700 pounds per square inch pressure. To the north of the screens the suction pipes from the main pumps supplying the filters are placed, and at this point the sulphate of alumina from the chemical house is applied to the raw water. At the side of the well at El. 44 a surge overflow is built to take care of the surge caused by any sudden stoppage of the low lift pumps. This surge overflow is connected to the lagoon by a 60″ diameter steel flanged pipe. The type of building is similar to that described for the filter house.

Coal Chemical Building

The coal-chemical building is constructed of reinforced concrete with the western elevation facing the lagoon constructed of buff brick similar to that in the pumping station and other buildings. The coal storage, chemical storage and chemical control apparatus have all been arranged in one group of buildings almost semi-circular in plan with a frontage of 120 feet and a maximum depth of 80 feet. In the centre of this building a 4 ton crane will be operated so as to facilitate the unloading of materials from the wharf and storing same conveniently in the storage portion of the building. A storage capacity has been provided for 1500 tons of coal and 800 tons of sulphate of alumina. General stores are provided in the south-western portion of the building.

The crane will be electrically operated, of the revolving type with a 60 ft. reach, and can dump coal or alum through hatchways provided in the roof of the respective portions of the building. Owing to conditions arising out of the war it has been found impossible to secure anyone to build this crane either in Canada, the United States or Britain, but it is now being put in hand. The roof of the coal storage portion of the building is supported by reinforced concrete columns and down the centre of each column is placed a 2″ pipe branching into 4 near the bottom so that a pipe comes through each face of the column.

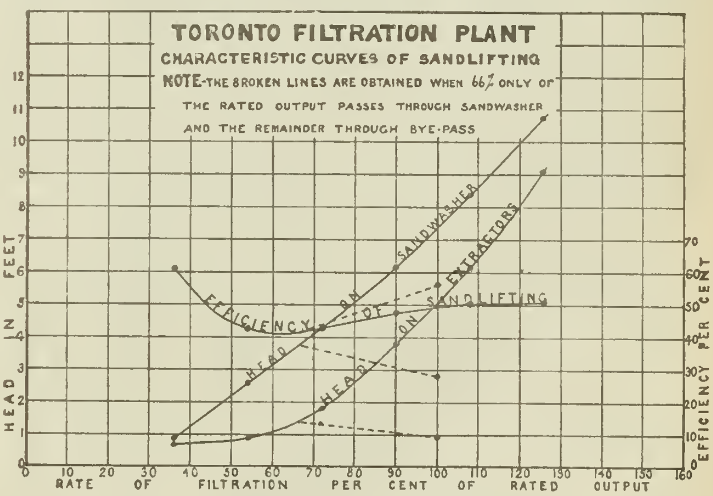


Fig. 6.—Characteristic curves showing the loss of head in the sandwasher, the lead driving the sand between the top of the extractor and the sandwasher and the efficiency of the sandwasher with various proportions of the total water being filtered passing through the sandwasher throat.

This pipe is carried up through the roof and enables the temperature of the coal to be ascertained by placing a thermometer down the 2″ pipe at any time. Spontaneous combustion has already taken place and it is noticeable that at both portions of the storage bin where same was observed that it was due to the coal being placed in storage while in a damp condition.

In the centre of the building the chemical feed supply apparatus is placed in duplicate, which automatically maintain a supply of sulphate of alumina solution proportional to the amount of water to be treated. The strength of this solution can arbitrarily be changed so as to provide any required amount from zero up to 4 grains per gallon.

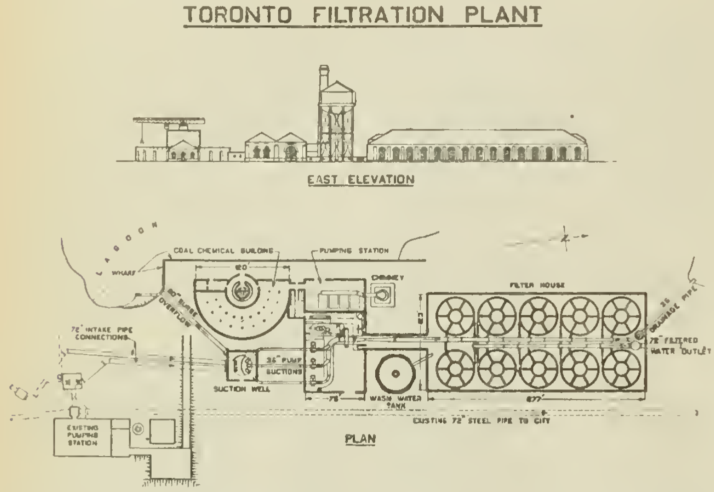


Fig. 7.—General plan and east elevation of the Works as constructed.

The dry sulphate of alumina is allowed to feed down automatically from the storage bin through eight control doors to trays in a dissolving channel maintained full of water by a ballcock in a separate compartment. The solution is fed from the bottom of the dissolving channel into a dilution tank where it is automatically diluted down to the required strength by a hydrometer-like arrangement. From this tank the standard solution is fed into a measuring tank controlled by the 72-inch Venturi raw-water meter in the pumping station through a combined electric and hydraulic relay. From the bottom of the measuring tank the solution gravitates through lead pipes to the suction well and is there distributed over the water as previously described. In the section (Fig. 9) some of the parts have been displaced in order better to illustrate their working. The annular dissolving channel tank is maintained full of filtered water from the wash water tank by a float valve in a separate compartment. From this compartment the water flows freely to the dissolving tank or channel and after dissolving the sulphate of alumina passes through a valve at the top of the hydrometer. At the same time the water also comes from the water tank to a valve at the bottom of the hydrometer. Poised in the solution between the two valves any vertical movement of the hydrometer opens one valve and closes the other. Thus it will let in strong solutions at the top and the diluting water at the bottom. Perfect balance is obtained when the hydrometer just floats. It should be noted that the solution of sulphate of alumina is heavier than water, and it is due to this fact that the apparatus works properly, not only to supply the energy to move the hydrometer, but also to mix the diluting water with the solution already in the chamber. The heavier liquid put in at the top tends to sink rapidly to the bottom, and on the other hand the lighter liquid fed in at the bottom tends to rise rapidly to the top; thus the liquid is maintained in a rapid state of circulation. The hydrometer is suspended through knife-edges from a graduated beam also carried on knife-edges and provided with sliding weights as on a weighing machine. This provides for permanent adjustment and also for altering the density and strength of solution. The scale divisions on the beam are ½ inch apart for each 1/10th grain of coagulant per gallon of raw water being treated and subsequently passing through the main Venturi meter. By simply moving a weight along a beam any desired amount of sulphate of alumina may be added to the water, any change taking place gradually. The hydrometer is very sensitive. It displaces about 6,000 pounds of solution and provides ample energy so that the strength of the solution is maintained to a degree unapproachable by any other means.

The measuring tank (Fig. 10) is of cast iron heavily coated on the inside with paraffin wax. It is circular in plan and provided with a circular opening in the bottom thereof through which passes a hollow trunk or cylinder with a slot at one side through which the alum solution passes. By raising or lowering the slotted cylinder the area of slot exposed above the circular opening may be varied so that the discharges through the slot will be proportional to the indications of the raw water Venturi meter indicator dial. This is done by the double relay, the principle of which is shown by diagram on Fig. 10. Any movement of the meter dial makes an electric contact which lifts by solenoid the supply and exhaust valves of an hydraulic cylinder, the piston of which is directly connected

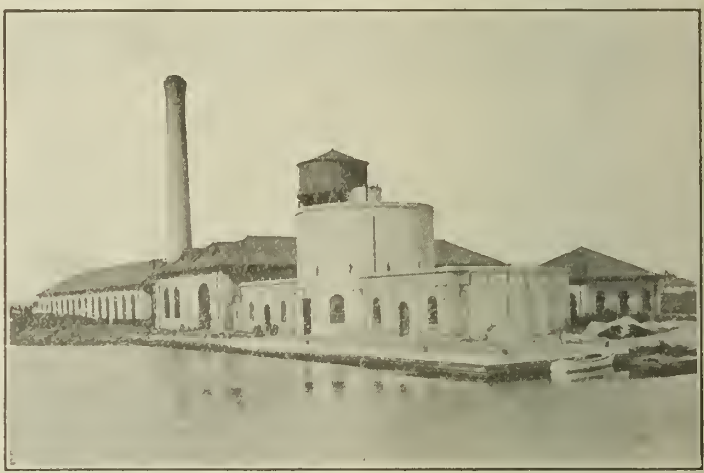


Fig. 8.—Perspective Drawing showing the whole works.

with the measuring slot. This piston moves until by a suitable connection it lifts off the electric contact when all movement ceases. As there is no direct current available a small motor generator working on the lighting circuit and delivering current to a 6 cell storage battery with control apparatus has been provided and mounted on the frame-work of the measuring tank apparatus. The hydraulic pressure of a minimum of about 25 pounds per square inch is obtained from the overhead wash water tank.

Pumping Station

The pump room and boiler room are placed under one roof and are separated by a br ck division wall. The entire bu lding is 142 feet long by 75 'eet wide and the roo is in two equal spans. The boiler room portion is 75 feet by 40 feet long and the pump room 75 'eet by 100 feet 6 inches.

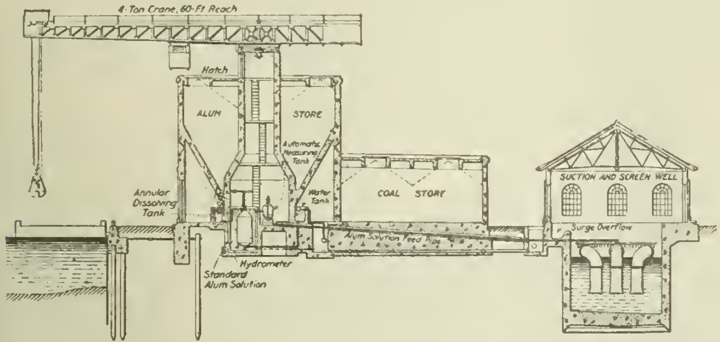


Fig. 9.—Section of the Coal-Chemical Building and Suction Well.

This pumping station is of interest in that while it is designed to operate with electric power supplied from Niagara Falls by the Ontario Hydro Electric Power Commission there has been installed a Steam Turbo-Generator Set which when required supplies electric power for the Drifting Sand Plant, the Slow Sand Plant as well as the Domestic Water Supply of the Island, and on occasion the Domestic Electro Supply of the Island, which has a summer population of approximately 10,000. The need for an uninterrupted service at this point is a real one as the available capacity under normal working conditions of the Pure Water Reservoir which serves for both plants, is under 3 million gallons or less than 1 hour's supply at present maximum rates of pumping in the city. So far as possible the power operations of the Slow Sand Plant have been transferred to and centralized in the pumping station of the Drifting Sand Plant. This has been carried out by transferring most of the auxiliary machinery from the old to the new pumping station and by the provision of the necessary switchboard arrangements in the new pumping station to operate the main pumps in the old. These arrangements make the new pumping station more ambitious than would have been necessary for the Drifting Sand Plant alone, and at the same time the capital cost has thereby been increased but the facilities of the whole system have been greatly improved and the operating costs reduced thereby.

Boiler Room

In the boiler room have been installed 4 dry back return tube Marine type Robb Boilers each of 300 horse power 11 ft. 6 inches diameter 15 feet long, provided with two 50 inch furnaces, and are designed for a working pressure of 150 pounds per square inch. The coal is brought in dump wagons and deposited on the floor and fed to the furnace by hand. The boilers are connected by 6 inch pipes to a 12 inch main header divided at its middle by a stop valve and piping arrangements so that two of the boilers alone may be made to supply steam for the plant, the other two with half the main header being completely isolated. An auxiliary steam pipe to the old pumping station has been put in for the purpose of driving the stand-by steam pump therein. Space has been provided for a fifth boiler.

To supply the boiler feed water a Smart-Turner Steam Duplex Pump 10 inches by 6 inches by 12 inch stroke double acting outside packed, has been provided which delivers through a Cochrane Heater. A 3 inch injector has also been provided.

In the pumping room the following machinery has been installed:—

(*a*) For general power purposes of the whole filter system:—

1.—Delavel multistage impulse turbine of 1800 B.H.P. running at 3600 revolutions per minute with Wheeler jet condenser having centrifugal circulating pumps and Thyssen air pump on the same shaft operated by 50 B.H.P. 550 volt 3 phase 25 cycle induction motor 1450 revolutions per minute.

The turbine is connected by a speed reducing gear of 3600 to 500 to a Lancashire Dynamo Alternator of 1200 Kilowatts capacity 3 phase, 2200 volts, 25 cycle, 500 revolutions per minute, with an exciter of 150 amperes, 110 volts, 500 revolutions per minute. Excitation is also obtained alternatively from a synchronous motor generator sett forming part of the Island Domestic Water Supply system.

All the necessary apparatus has been provided for synchronizing the alternator with the Hydro Electric system, but so far this has not been found desirable and owing to the many miles of line variably loaded and subjected to interferences between the plant and Niagara Falls, the possibility of satisfactorily synchronizing is an open question. Tests of this Turbo-Alternator Sett

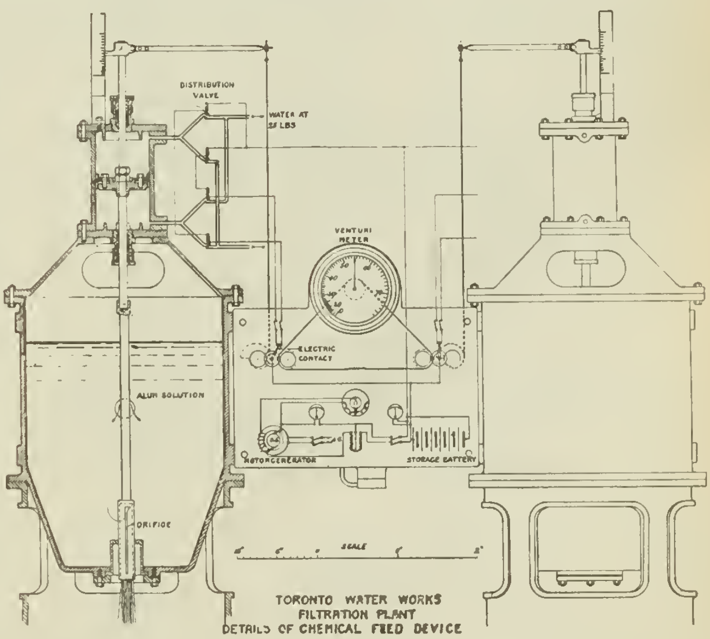


Fig. 10.—Details of chemical feed device.

showed a steam consumption of 17.90 pounds per kilowatt hour at full load with a steam pressure at the turbine of 123.8 pounds per square inch and of 19.94 pounds per kilowatt hour at half load with a steam pressure of 128 pounds per square inch. During the full load test the steam contained 1.94 per cent of moisture of which 1½ per

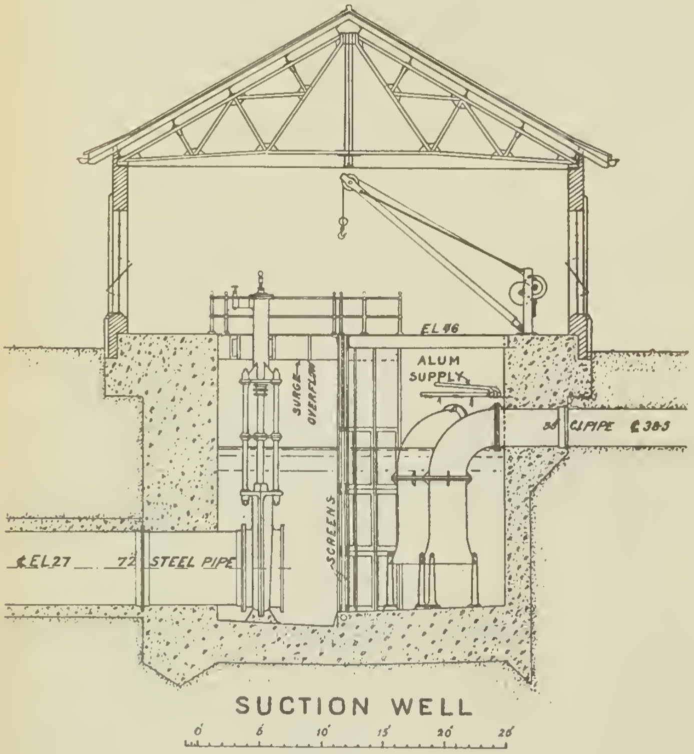


Fig. 11.—Suction and Screening Well.

cent was charged to the turbine. The output of the turbo-alternator adopted was the net output after

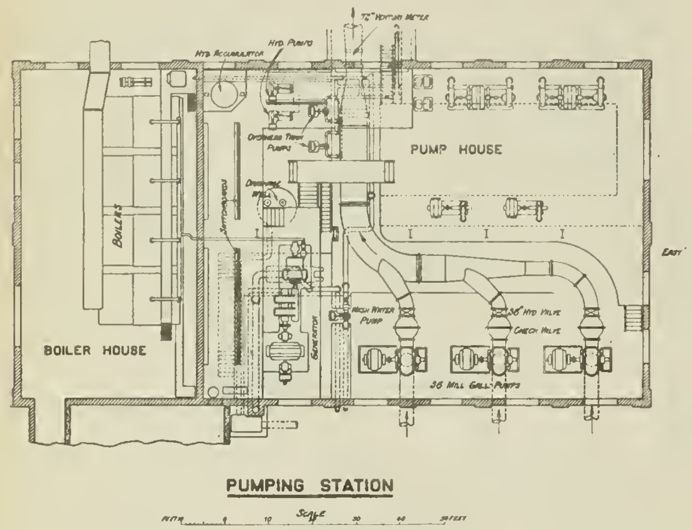


Fig. 12.—Plan of Pumping Station.

deducting the power required to drive the condenser pumps with the 50 B.H.P. motor and transformers.

2—12 ton hand operated travelling cranes of 36 feet span, which traverse the two bays into which the pump room is divided.

(*b*) *Pumps installed for the Drifting Sand Filters*

No.	Type and use	Diar. of inlet & discharge pipes Inches	Capacity gallons per day	Total Lift Ft.	B.H.P. of Motor	Speed Revolution per min.	Voltage
3.	De Laval Centrifugal Pumps with Westinghouse Motors Pumping to Filters............	36	36,000,000	32	325	360	2200
1.	do do	10	2.000,000	32	20	1450	550
2.	do do	5	500,000	100	20	1450	550
	Wash Water Tank pumps and general service.						
2.	do do	6	1,000,000	20	7½	1450	550
	Vertical axis drainage pumps.						
2.	Hydraulic Supply.... Three throw Glenfield plunger pumps driven by Lancashire Dynamo Motor through worm gearing pumping to 6″ diameter 6 ft. stroke accumulator.	1½	8,640	700 lbs.	7	pumps 60 motor 1450	550
1	Hydraulic Supply Smart Turner direct acting Duplex plunger pump, steam driven..	1½	8,640	700 lbs.	..	..	..

(*c*) *Pumps installed for the Slow Sand Plant*

No.	Type and use	Diar. of inlet & discharge pipes Inches	Capacity gallons per day	Total Lift Ft.	B.H.P. of Motor	Speed Revolution per min.	Voltage
2	Sand washing supply..	8	1,000,000	125 lbs.	100	1450	2200

(*d*) *Pumps installed for the Domestic Water Supply of Island*

No.	Type and use	Diar. of inlet & discharge pipes Inches	Capacity gallons per day	Total Lift Ft.	B.H.P. of Motor	Speed Revolution per min.	Voltage
1	Mather & Platt Turbine pump with booster pump for fire service	12	2,500,000	125 lbs.	225	1500	2200
1	Duplex direct double acting compound steam driven condensing pump............	12	1,500,000	125 lbs.	..	..	.

Fig. 13 shows the characteristic curves of one of the 36 inch pumps, which lift the water from the suction well to the filters It is to be noted that the highest efficiency shown by this pump amounted to 86 per cent, which is remarkable. These pumps are erected upon a floor at a lower leve than the general floor to permit of a low suction lift and direct undershot delivery without vertical bends and enables the 72 inch raw water main and 72 inch Venturi meter placed therein to pass just under the main floor levels. All the centrifugal pumps are without foot valves but check valves and gate valves are provided on the delivery sides. The gate valves on the main 36 inch pumps are operated hydraulically from a switchboard platform either by hand or automatically by a pilot valve device moved by a float riding in a chamber connected up with the water levels of the filters.

The Turbo-Generator platform is raised above the general floor level. Its platform forms a step and a means of access between the general floor level and a raised platform 13 ft. 6 inches wide running along the boiler room end of the pump room and along part of its northern side, which carries the three switchboards and gear, 72 inch Venturi Indicator Recorder Meter and water level and pressure recorders, telephone, office accommodation and pilot valve device for controlling the 36 inch gates on the delivery side of the main pumps. All the high pressure work

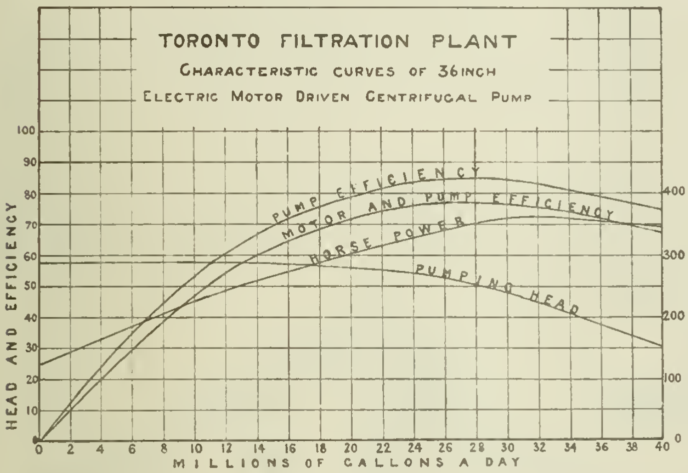


Fig. 13.—Characteristic curves of a Main Low Lift Pump.

(550-2200) volts, busbars, switches, etc., are either mounted at or on the division wall between the pumping and boiler room and the oil immersed switches are operated by remote control with bell crank levers and connections under the Switchboard platforms. The switchboards themselves are in three groups with panels of blue vermont marble. The first group of 15 panels controls the turbo-alternator and the drifting sand pumps. The second group of 10 panels controls the slow sand pumps in both stations, and the starting transformers for all 2200 volt motors. The third of 7 panels controls the domestic water supply of the island and the plant lighting system. These switchboards are accessible with wide spaces on all sides. Underneath the switchboard platform are placed the necessary transformers for the 550 volt motors for starting the 2200 volt motors and for lighting.

Filter House Building

The filter house building is 277 ft. long by 123 ft. wide. It is connected up to the pumping station by a corridor which provides a covered access and serves to carry part of the 72″ Venturi meter and its continuation as a 72 inch raw water main and several smaller mains. The building contains 10 steel filter tanks arranged in two rows, each tank being 50 ft. in diameter and 14 ft. deep with a normal rated output of 6,000,000 gallons daily. Between the two rows of filters is the piping gallery, on top of which is the operating gallery. This operating gallery extends the full length of the building, in the centre and at the same level as the top of the filters. The whole building is divided into 3 spans. The roof over the operating gallery is composed almost entirely of wired glass, which gives it a well-lighted appearance.

The floor and the walls up to within 1 ft. of the finished ground level are built of reinforced concrete. As the building is below lake level and, therefore, subject to upward pressure the foundations had to be designed so as to prevent any lifting of the building due to the water standing around the walls. It was not safe to let the water rise around these walls to lake level until such times as the filters inside were completed and loaded with the filter sand. The load was then of such a nature as to more than counter-balance the upward hydraulic pressure. The building is built of buff coloured pressed brick with steel sash windows and steel trussed roof. On top of the roof boarding has been placed Ludowici-Celadon tiling of a red colour, which gives a very pleasing appearance. The main entrance is at the south end and from this level one stairway leads up to the operating platform and one leads down to each side of the filter house to give access underneath the filters. Somewhat similar but smaller stairways are provided at the north end and midway there are steel ladders on either side of the gallery.

The filter house building is constructed similar to the pumping station and suction well buildings previously described.

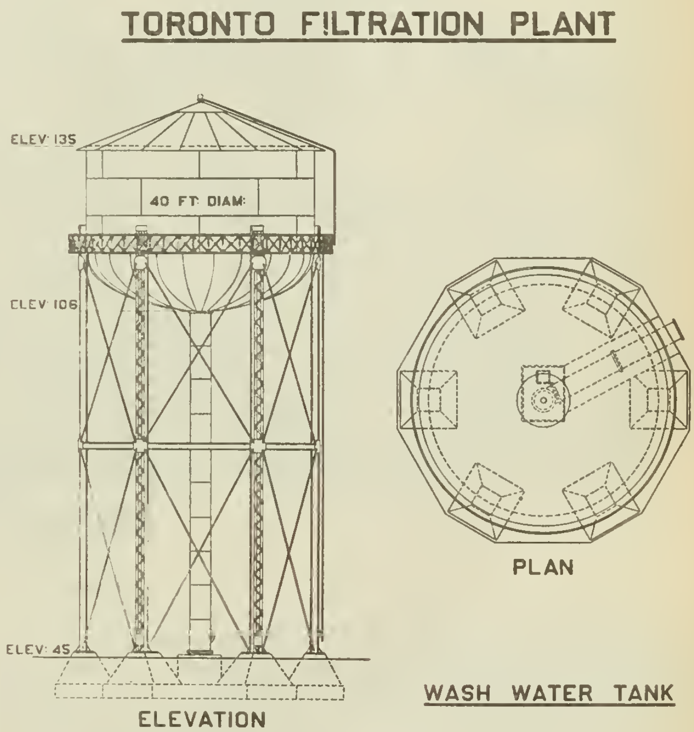


Fig. 14.—Overhead Wash Water Tank.

The 50 ft. diameter filter tanks (Figs. 14 and 15) are constructed of steel plates $\frac{3}{8}$″ thick at the side and $\frac{1}{2}$ inch thick at the bottoms. Each tank has a central opening 16 feet 8 inches diameter, leaving an annular plan area of 1745 sq. ft. between the two vertical cylinders 14 ft. deep. In forming the bottoms of these tanks the annular space is divided up into two rings, the inner ring being again divided by radial lines into 12 compartments and the outer into 18 compartments, making a total of 30. Each compartment has a dished bottom of

½ inch plates and sides of ⅜ inch plates carried to a height of 3 feet. The compartments are all rivetted up together and to the inner and outer tank cylinders at the edges at the bottom, with ½ inch over-lapping strip plates, leaving spaces on all sides of 2¼ inches width. In between these spaces the internal portions of the extractors, that is the converging cast iron ports, are placed and cemented therein The dished bottoms are concreted up level to form a support for the under-drain system, gravel and sand.

Each of the 30 compartments form a separate approximately quadrilateral unit with sand extractors, sand-washer, and filtered water collecting system. Each tank is supported by 120 cast iron columns, one being placed towards the corner of each of the 30 compartments. The columns are of such a height to provide for the necessary piping and proper access under the filters.

Overflow channels 15 inches wide varying in depth from 3 ft. 5 in. to 2 ft. 6 in. are placed all the way round within the 50 ft. and without the 16 ft. 8 in. cylinders together with 6 radial channels and provides a total length of overflow sill of 364 feet. Each has an independent outlet but in addition the channels are carried through from tank to tank to get a more free discharge.

Partly embedded in the concrete in the bottom of each compartment is a cast iron collector for the filtered water. Running out radially from this collecting pipe is a series of 1½ inch W.I. sherardised pipes, having ⅜ inch holes drilled on the underside spaced about 6 inches apart. These pipes have a sherardised cap on the outer end, and the inner end is screwed into the cast iron collector. About these pipes is placed rounded gravel in 3 grades—varying from ¾″ to 3/16″—to a depth of 10 inches and above this the filter sand to a depth of 9 feet. This sand is well rounded water-worn sand containing some limestone, the remainder being mostly quartz; some was obtained from pits in the vicinity but most was obtained in the immediate neighbourhood of the works. It was all passed through screens of 14 meshes per lineal inch; it has an effective size of .35 to .4 mm and a uniformity coefficient of about 2. The sand was prepared on the site, the material too coarse being eliminated by a system of mechanically operated screens working with about one-third of the depth of the screens immersed in water The sand that was too fine for filter purposes was rejected by washing out in the preliminary preparation of the sand or by back-washing after it was placed in the filters. Each filter contains 600 cu. yds. of sand.

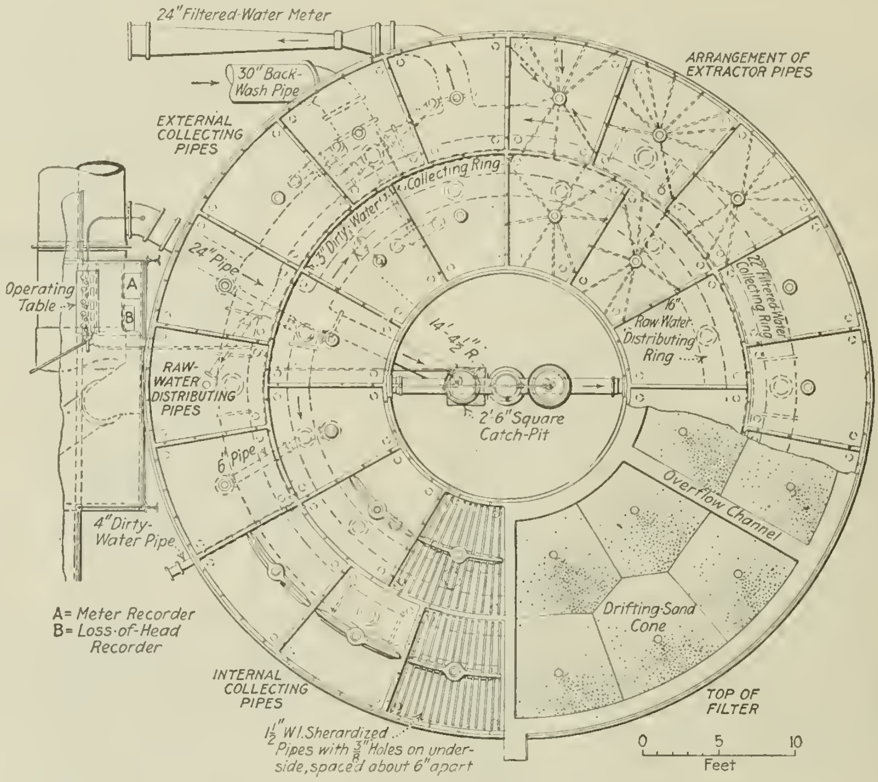


Fig. 15.—Plan of the filter.

The drifting sand is withdrawn from the filter by a system of converging ports of cast iron, termed extractors, down which the drifting sand flows. These extractors pass through the bottom of the filter unit; at this point the port has a vertical kink in it which acts as a sand trap for the purpose of withholding the flow of the sand to the sand-washer when the system is not in operation. At this trap a water jet furnishes the necessary amount of water to carry forward the sand to the washer through internal ½″ actual diameter W.I. pipes, and underneath the part of the sand-washer where each pipe discharges a glass inspection port is provided. In this way the flow of the sand from each can be observed.

The sand-washers are of cast iron as shown on Fig. 4. The throats are relined as shown from time to time with W.I. pipe liners in 3 steps. These liners are hardened right through by the Dyrob process. These last a minimum of four months continuous wear before renewals. Most of the scour observed has been traced to a tail eddy which forms at the back of the sand nozzle by the water passing it and modified sandwasher bases are being installed, from which much longer runs are anticipated.

The raw water goes to the filter partly through the 30 sandwashers and partly through a 16 inch bypass controlled by a water ballast loaded relief valve, which also acts as a float regulator. By increasing the water ballast a larger proportion of the water entering the filter passes through the sandwasher accelerating the drifting of the sand; on the other hand any level of the water is maintained by the float which is carried on the reverse end of the lever, holding down the relief valve by the water ballast tank. This apparatus works with the pilot valve device controlling the main pumps. The filter gate valves are 24″ diameter operated hydraulically from a white marble operating table with nickel plated fittings. A 24 inch Venturi meter is placed in the filtered water main with indicator recorder and register placed together with a loss of head recorder behind the operating table, each apparatus being self-contained. The dirty water from the sandwashers and from the overflow channels pass by independent raised drains to a measuring tank with recorder at the north end of the filter house and away to the lagoon. The backwash rate provided was for 24 inches vertical rise per minute, but 18 inches have been found sufficient to liquify the whole of the sand. As the floor of the filter house and some parts of the other buildings are below the level of the lake drainage pipes are embedded in the concrete floors which discharge to a drainage well in the pumping station, where the water is taken care of by the vertical axis drainage pumps.

Chimney

To carry the flue gases from the four boilers, a circular hollow brick chimney has been constructed 123 feet high and 7 feet inside diameter at the top, all as shown on Fig. 8

The foundation of the chimney is constructed of reinforced concrete, 11 feet deep, with a base of 30 feet square, tapering to 20 feet at the top. On this concrete foundation a rectangular brick structure has been erected, carried up to a height of 25 feet. This rectangular portion of the chimney is faced with buff coloured pressed brick so as to conform with the brickwork in other buildings. On top of this the circular chimney is placed.

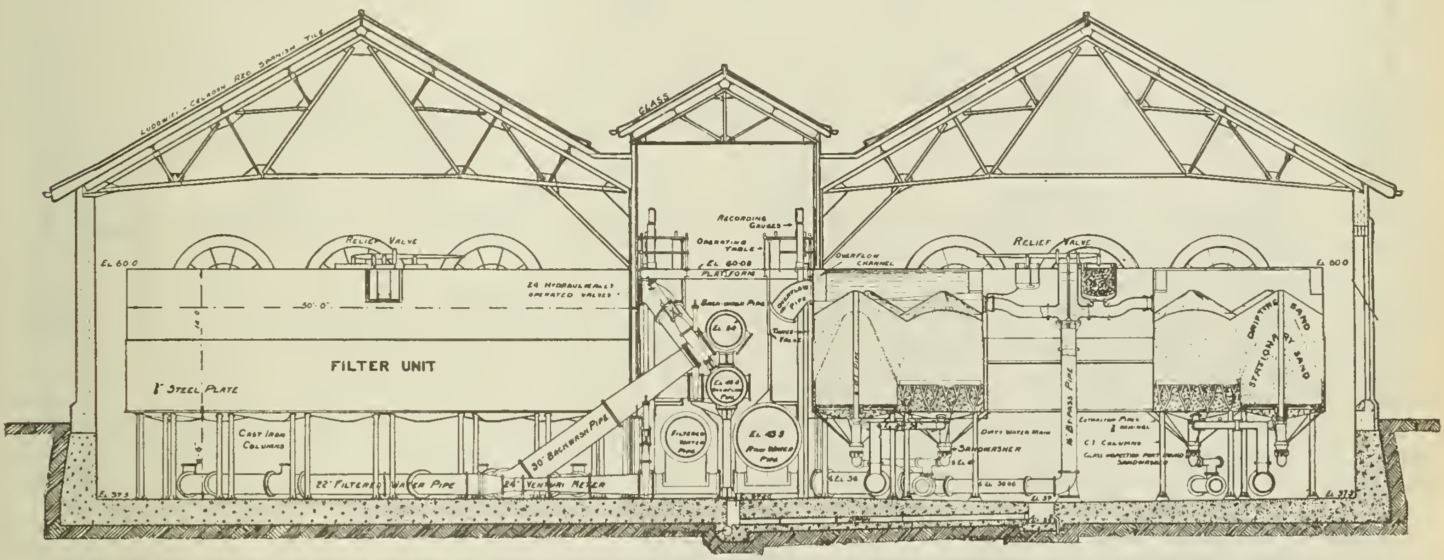
Wash Water Tank

For the purpose of back washing the filters a steel tank has been erected, having a capacity of 200,000 gallons. The tank is 40 feet in diameter with 19 feet sides, an elliptical bottom 10 feet deep, and supported on steel columns. The tank is elevated 60 feet above the ground level. Two pumps each with a capacity of 500,000 gallons per day are provided in the Pumping Station for filling the tank with filtered water. The maximum rate of discharge from the tank is 31.4 million gallons per day and for this purpose a 36″ outlet upstand pipe is provided. A 2″ steam pipe is connected to the 36″ upstand pipe to prevent freezing during cold weather.

The tank foundation consists of a concrete mat on which are erected the concrete pedestals to support the steel columns.

Wharf

On the western side of the plant a wharf, having a total length of 373 feet, has been built. This wharf allows the material necessary for the operation of the plant to be unloaded in close proximity to where it is needed, and also acts as a protection to the coal-chemical



SECTION THROUGH FILTER HOUSE

Fig. 16.—Section of filter house

and pumping station buildings. The face of the wharf is constructed of steel sheet piling 23 feet long, behind which is driven two rows of timber piles 26 feet long for the purpose of supporting the reinforced concrete wall. This wall is 7 ft. high, 5 ft. wide at the base and 2 feet at the top. About 20 feet behind the face of the wharf timber piles have been driven in pairs for the purpose of attaching 2 inch anchor tie rods, which are connected to the face of the steel sheet piling.

A depth of 10 feet of water is maintained in front of the wharf, and in behind the filling is of sand and gravel.

Steam Heating System

All the buildings have a steam heating system installed of the low pressure vacuum type. The steam is obtained from a valve on the boiler header and passes through two reducing valves. The first valve reduces the pressure to 80 pounds and the second to 10 pounds per square inch. No unusual features occur in the lay-out of the system generally, except in the filter house where the large surface of the steel tanks and water area had to be taken into consideration. The glass surface on both sides of this bulding is large and attention had to be given to the matter of wind pressure on the filter house tending to drive the heat to the opposite side of the building, thus causing inequality of temperature. The total amount of radiation provided is approximately 18,000 square feet, most of it being in the filter house where 15,000 square feet is provided. Except in the filter house a temperature of 70° Fahr. is maintained when the outside temperature is zero.

In the filter house the temperature is maintained at 50° Fahr. when the outside temperature is zero. The floor of the filter house is 8 ft. below the surrounding ground level and also on the average 4 ft. below the lake level of the water surrounding the walls on the outside. On the ground floor a system of radiators suspended to the walls under the windows have been provided. Similar radiators are provided on the operating gallery and immediately under the skylight windows of the central roof. Additional heating has been obtained by running a series of pipes attached to the underside of the roof trusses. The heating of the entire building is controlled from a point in the centre of the operating gallery. The main steam line coming from the boiler room is 9 inches in diameter. The control system is such that heat can be cut off from any section.

A 8″ x 10′ x 10″ vacuum pump is installed in the Boiler Room for drawing the returns from the system from under a 10 inches to 15 inches vacuum to a header installed in the boiler room. This pump is controlled by a vacuum governor. All main steam lines are covered with an air-cell covering.

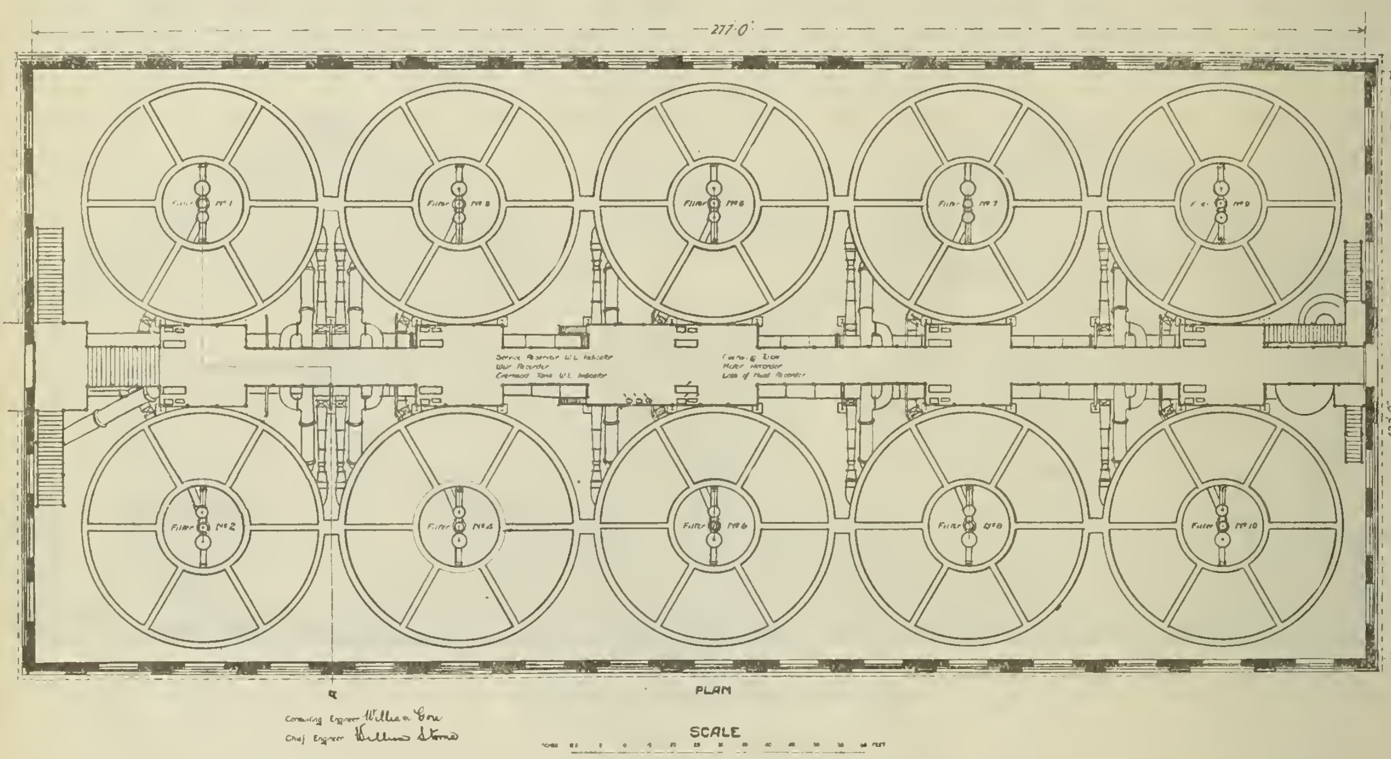


Fig. 17. General arrangement of pipes in filter house.

Lighting System

The lighting is on the 3 wire 110-220 volt single phase distributing system. The main control is on the third switchboard platform in the pumping station and the distributing mains are run from this switchboard to the various buildings. The wires are carried in galvanized conduits. On the whole the lighting system is simple, consisting in most of the buildings of 40, 60 or 100 watt lamps with reflectors The suction well is lighted with a cluster series of 5—100 watt lamps. In the pumping station, besides local lighting, there are 10 wall brackets each with 200 watt nitrogen filled lamps and angle reflectors. In the filter house there is one cluster light containing 5—100 watt lamps over the centre of each filter unit equipped with special reflectors. There is also a system of local lighting over each operating table and along the central gallery, and provision has been made for lamp sockets for use underneath the filters. The wharf is illuminated by a series of 9—300 watt lamps mounted on brackets fixed to the walls of the pumping station and coal-chemical buildings.

Cost of Plant

The contract sum amounted to $1,066,282.00 and the Extras to $11,408.43, making a total cost of $1,077,690.43. It is as well to point out that this includes the complete cost of designing and constructing the plant including all equipment but excludes the cost of the city's engineering and inspecting staff on the works.

Operation of the Plant

The raw water as obtained from the intake pipe varies greatly in chemical content, bacteriological count, turbidity and suspended matter. These fluctuations are relatively sudden, sometimes changing several times from extremes in the course of the day. The direction of the wind and past history thereof determines the nature of these fluctuations. Most of the city sewage is discharged after partial settlement into Lake Ontario at a point about 4 miles to the east of the waterworks intakes. When an easterly wind occurs for any length of time the intake pipe receive considerable pollution from this source. Unless the wind is high and the surface of the lake rough this heavy pollution is accompanied with very litle turbidity except during the spring thaws when the whole lake front may be turbid. When the wind blows strongly from the west or south-west there may be high turbidities without great pollution. The amount of alum to be applied to the raw water is determined largely by the ree ammonia contents which correlate fairly well with the bacteriological contents. At other than laboratory hours a judgment is made from past experiences of the effect of the wind on the water The turbidities from clay brought down by the spring thaws require much less alum than equal turbidities due to fine silica caught up into the water by wave disturbances of the foreshore. A complete scale has not yet been determined. The silica turbidities also choke up the stationary sand in filters much more quickly than the clay turbidities.

Official tests were made during December, 1917, and January, 1918, and the results are given in Appendix 1 attached to this paper. These speak for themselves. In this appendix is also given some particulars of laboratory tests. These tests with Lake Ontario water point to two important conclusions; that the colder the water and the cleaner the alum the better were the corresponding bacteriological efficiencies.

The works described above were designed by the John verMehr Engineering Co. Ltd., and were constructed by that Company jointly with the William Cowlin & Son (Canada) Ltd. The writers acted as Consulting and Chief Engineer respectively for the former Company. R. C. Harris, Commissioner of Works, G. G. Powell, B.Sc., M.E.I.C., Deputy City Engineer, James Milne, M.E.I.C., Mechanical Engineer,in charge of the Water Works System and A. U. Sanderson, B.A.Sc., looked after the City's interests while the official bacteriological and chemical tests were carried out by Col. G. G. Nasmith, C.M.G., Director of Laboratories and N. J. Howard, F.C.S., Bacteriologist and Chemist in Charge of the Filtration Plant Laboratories.

Moisture-proofing Aeroplane Propellers with Aluminium Leaf.

It is well-known that wood is a hygroscopic material. For instance, wood stored out of doors in the northern United States will retain 10 to 12 per cent. of moisture and, in the drier and more arid districts, such as the States along the Mexican border, will possibly retain only 5 to 6 per cent. on the average.

If, then, a propeller is constructed under certain conditions and shipped to localities which are drier or damper, it will absorb or lose moisture according to the new atmospheric conditions. As a result it will lose its balance, and the wood will shrink or swell and otherwise distort the blade.

A moisture-proof coat, therefore, is exceedingly desirable—(1) to produce a propeller unaffected by moisture changes, and (2) to utilize cheaper and more abundant woods such as gum, red oak and other common native hardwoods.

An extensive series of tests on moisture-proofing was made, including tests of many different types of coatings such as spirit, oil and cellulose varnishes, enamels, linseed oil and wax treatments, impregnation treatments, and sprayed and electroplated metal. None of these coatings proved to be entirely satisfactory, but as a result of the tests an exceedingly effective and easily applied coating was developed in the form of a layer of aluminium leaf incorporated between coats of varnish.

A diagram showing the effectiveness of aluminium leaf coating compared with the effectiveness of various other coatings is given. It shows the absorption of moisture to be almost negligible compared with the maximum specified when the U. S. A. entered the war. The tests were made by exposing test penals in an atmosphere of relative humidity 95 to 100 per cent. and taking their weights at regular intervals.

Proceeding, the articles describe in detail, and with illustrations, the method of applying the aluminium leaf, which is exceedingly thin and light, there being about 12,000 to 15,000 leaves per inch. The leaves are in 4 to 5½ in. squares.

For open grained woods a coat of filler should be used, after which an undercoating of shellac varnish should be applied. Next comes the size on which the aluminium leaf is placed when the size has become "tacky". After the application of the leaf two coats of a shellac colour varnish should be applied, followed by a finishing coat of aeroplane spar varnish. The compositions recommended for filler, size, and varnishes are given, and it is suggested that in certain cases it might be desirable to use oil varnishes or enamels in lieu of the shellac. This modification would result in a more durable coating, but would necessitate a longer time for its application.

Heating Problems Produced by some of the Modern Methods of Building Construction

The early history of the modern sciences is more or less legendary and traditional, which leaves much to surmise. The primitive races in the valleys of the Tigris, Euphrates and the Nile, were many decades upon their way towards civilization, as we know it, before we began to learn anything of their history. This we know, however, that as the human family grew, it spread out and there are now branches of the original peoples in every quarter of the globe with remnants of their ancient mythology still observable. Sufficient for our purpose is the fact that we find human beings living under remarkable and severe conditions. The Esquimo in the far north, who is compelled to go without fire for months at a time, and the people of the Tropics who never see snow, and know nothing of frost. The ranges of temperature are from 60 below Zero, to 120 degrees above—a full range of 180 degrees in the extremes.

The civilization of every country has been largely determined by the geographical conditions; the characteristics of the land and climate in which any race dwells, shape the mode of living and thus influence their intellectual culture.

It is said of Egypt that the climate is equable and of warm temperature, snow and frost being wholly unknown, while storm, fog and even rain are rare. This is true in a measure of the other valleys, so that whilst some protection against heat was necessary, there was no necessity to provide against inclement weather, hence the climate developed the qualities of their architecture.

The mention of the use of fire in their history is largely the sacrificial fires of their ancient philosophy. They recognized the part which the sun, the source of heat and light played, recognized it to this extent that it was a large part of their religion. The following extracts from a book on their ancient philosophies serves to show the veneration of that great luminary:—

"The Syrian damsels sat weeping for an Adoni, mortally wounded by the tooth of winter." Adoni was the name of the mythical creature representing the sun. Indeed the worship of the sun was the basis of all ancient religions. Almost every nation in the cradle of the human race had mythical beings whose strength or weakness, virtues or defects more or less described the sun's career through the seasons. To those ancient peoples light and heat were profound mysteries, as indeed they are to us. As the sun caused the day and his absence the night, when he journed north, spring and summer followed him, and when he journed south, autumn, inclement weather, cold and long dark nights ruled the earth. As his influence produced the leaves and flowers and ripened the harvest and brought the regular inundation, he necessarily became to them the most interesting object of the material universe, author of life, heat and ignition. The sun was to them the efficient cause of generation, for without him there was no movement, no existence, no form. He was the inate fire of bodies, the fire of nature. He was to them immense, indivisible, imperishable and everywhere present. It was the need of his light and heat and of his creative energy that was felt by all men and nothing was more fearful than his absence. The sun's influence, so beneficient, caused it to become identified with the principal of all that was good."

North to them was the place of death. The abode of winter and desolation, and naturally so because with such an easy means of livelihood as was provided by irrigation and the fertile land of the valleys mentioned, there was little incentive to explore beyond in the unknown north. But as time marched on and with the development of the present day civilization, we find in the north temperate zone, the place once looked upon with fear and trembling by the simple-minded ancients, the greatest race on the face of the earth, the Anglo-Saxon, whose sons successfully fought the enemy under every sky and in every climate, in peace as well, we can proudly think of the achievements of Scott at the South Pole, Perry at the North, Livingstone and Stanley in the heart of Africa, and countless others, and more intimately to Civil Engineers, Colonel Everest, who, nearly a century ago began the wonderful trigonometrical survey of India. As mentioned before our geographical location has had a great deal to do with the development of that wonderful and mysterious "power of resistance," in fact the medical fraternity has coined the phrase very much as we more generally speak of "the Human factor."

Going over the history of architecture, practically nothing is mentioned about any system or systems of heating, except in isolated cases. Quite evident the earliest race adapted themselves by food and raiment to withstand the extremes of temperature; but there are instances such as the Roman Thermae or Baths of Rome, particular mention is made in a non-technical way to the system, the remains of which are found in the Baths of Caracalla, here is found hot water and warm air heating, but note the difference from the methods employed to-day. The heated air was passed through a system of tile ducts under the floors, and did not enter directly into the room. The hot water was circulated around the rooms in open troughs covered with a bronze grating. These baths served the same purpose as our modern Turkish bath.

An extract from Architectural History on the Wonders of Roman Architecture regarding the use of Fountains, is quoted here. "Additional interest was given to the interiors by the perpetual streams of running water issuing from the mouths of sculptured lions in marble or brightly polished silver falling into capacious marble basins and producing a delicious cooling effect in the hot, sultry weather." The significance of this will be dealt with later.

It, however, remains to be said that the use of brassiers, burning charcoal was more generally the means of heating in cold weather. The remarks often made regarding fine raiment worn by these people refers only to that used while inside, when outside they clothed themselves with coarse heavy garments.

Referring to England in the 14th Century, mention is made of the open fire in the center of the building in that part known as the "great hall," provision being made in the roof by louvers to carry off the smoke. Later on a greater increase of warmth was found necessary, as greater comfort was demanded, and the opening out of the coal industry by cheapening fuel, led to each room having an open fire-place with chimneys, which later on became architectural features carefully treated. In the time of Elizabeth the great hall fireplace was richly carved with the coat of arms of the owner. For physicological effect, huge tapesteries and draperies with their warm colors were hung about the walls and, it is said, that in winter, straw or rushes were strewn over the floors of these great baronial halls.

It will be seen that the open fire has come down through all the ages and still plays a part even to this very day. Much sentiment is attached to this system of heating, the sole benefit of which is derived from the radiant heat of the fire.

Stoves made of cast iron on the principle of an open fireplace improved the effect by the addition of exposed heating surface, making the result obtained more economical and less wasteful.

The advent of steam, and the progress made in the last few generations, have made their demands upon all branches of applied sciences. The demand for more effective and more efficient heating and also the necessity of more applicable methods at the same time minimizing the fire hazard, has brought about the development of the various systems we have to-day. Their modern application is very recent, with their rapid growth on more or les unscientic lines. Briefly and generally we make use of the elements air and water.

The sun is nature's heating plant and accomplished all the things the ancients attributed to it. Man's substitute was the open fire. Your own observations of the effects derived are easily recalled. In both cases it is the application of direct heat of a radiant kind, so intense at times as to blister and burn the parts of the body exposed to it, yet with only minor effect on the surrounding atmosphere.

The systems of heating now involved in engineering problems and applied to our modern buildings are of a vastly different character. We use circulations of water, the vapour of water and air with the application of some of the basic laws of physics.

Applying heat to a building in these days is not only to keep body and soul together, and supply warmth and comfort, but is in reality the attempt to create ideal summer conditions in winter. In fact we might go still further . . . rob winter of its cold and summer of its heat. In other words producing an equable climate, conducive of the best results of maximum attainment or production, with the minimum of stress and fatigue.

Benefited by the experiences of the past we have today efficient and rather wonderfully contrived systems of heating, vastly improved.

Many conditions arise that require special treatment. The adopting of any one particular system to meet all conditions is hardly practicable, therefore a study of the exact conditions as they exist or may come into existence, is the first step in the design of a heating plant. We have for choice heating by hot water, by steam, or by warm air.

Hot water heating is divided into several classes, ordinary open tank gravity circulation, accelerated circulation by putting a system under pressure, and forced circulation by means of circulating pumps. The first is usually applied to residences or small buildings, the second is merely an attempt to create a more rapid circulation and extend the effectiveness to include a greater area. Each have their field, principally where constant heating is required. The wide range of temperatures, available in the heating medium, make these systems flexible enough to meet all the usual winter conditions, and when the piping system is properly installed, give good results. Of course, with such a slight force exerted it is necessary to keep well within the limits laid down by the laws of gravity. Forced circulation combines all the advantages of the ordinary gravity system and at the same time overcomes all the restrictions of the same. It has many commendable features, particularly flexibility, as the water temperature may be varied over a wide degree and even the circulation increased or decreased slightly making it further adaptable. The arrangement of the piping may be anything that will accommodate itself to structural conditions:—pipe sizes are small and the radiating surface need not be so generous as in the case of the gravity system. It is a system well adapted to certain kinds of central heating as the grades of the piping can follow the natural grade. All special apparatus required, in fact everything except piping and radiators can be located at one point, at all times under the observation of the man in charge. Where the waste heat of exhaust steam is available as is generally the case, it is used to heat the water and the condensation is returned to the boiler feed pump, without having to first travel all through the heating system and radiators. It obviates the necessity in underground conduits of having drips and drip traps at low points and inaccessible places. But, like all other systems, has disadvantages and limitations, it must be kept in operation constantly in cold weather to prevent freezing up at the most exposed parts.

The proportinating of the piping system for forced circulation of hot water involves a rather nice, intricate problem in hydraulics, the difficulty experienced is increased by the lack of data on the friction of small piping, steam fittings, valves, etc., at low velocity, all of which must be considered in order that the circulation be adequately equal to and well balanced with centrifugal pumps designed for the exact head, so as to operate noiselessly and without vibration. The motive power is usually direct connected steam turbines with the exhaust steam passed into converters and used to heat the water, a separate live steam heater being provided as a make-up when the exhaust is not sufficient and as a standby.

There are instances where the boilers are used as hot water boilers and the water circulated by motor driven pumps. There are also cases where the jacket water from large gas engines is utilized.

Regarding steam plants, there are also classifications. The simple one-and-two pipe systems, supplied direct from low pressure boilers, or from high pressure lines through pressure reducing valves or, supplied direct from the exhaust side of an engine. The principal weakness of these one-and-two pipe systems is the tendency of air binding and short circuiting, frequently causing the condensation to be held in suspension, giving rise to the annoyances of water hammer.

With the gravity return system, where steam is taken direct from the boiler and the condensation returned back by gravity, the boilers must be set low enough to give clearance between the water line of the boilers and the lowest point of the mains, sufficient to provide against flooding the mains by the deferentials of pressure between the flow and return.

With systems supplied through pressure reducing valves, or from exhaust, the condensation is usually returned, for economy to a hot well or receiver, to be returned to the boilers as feed water.

As mentioned before, air-binding is the chief difficulty. Steam will go anywhere it is piped, without much urging if the air can be easily displaced.

The systems just mentioned are dependent upon automatic air valves to vent the air from each radiator and other parts of the system. The best of these valves are delicate in their parts and adjustment, the orifices in some cases being as small as a needle and are easily put out of commission by the accummulation of dirt or grit, either from inside or outside the system. Two pipe systems with hand operated valves on both flow and return, are easily upset. If some person happens to close either valve and forgets to close the corresponding valve, in some cases requiring a complete shut down to allow the water accummulated, and held back in the system to flow out. Aside from hammering and banging in the system, these vents are liable to sputter and spit water occassionally, or hiss steam, to the decided annoyance of the occupants of the room. These conditions have been slightly improved by the use of an air line system in which all venting valves were coupled to a system of small piping and connected to a vacuum pump or exhauster, of which there are numerous types.

The more improved and the latest development are two pipe vacuum and vapour systems, in which each radiator is equipped with a radiator trap at the return end of the radiator which passes condensation and air only, into the system of the return piping, and closes against the escape of steam. Similar traps of larger capacity are provided to relieve the mains of condensation at the extremities and at intermediate points where necessary.

The most successful radiator trap is the thermostatis disc type, which is actuated by the temperature of the steam. The disc contains a volatile fluid especially compounded to respond to wide ranges of temperature and is hermetically sealed. The disc is always deflated when cold so the trap is always open, except to the passage of steam.

Both vacuum and vapour systems are almost identical in design. Where the magnitude of the plant demands, the condensation and air are pumped out of the system, creating a low vacuum making it possible in the case of exhaust steam heating to do away with any back pressure. In either case they are essentially non-pressure systems, as invariably the piping is designed for a deferential working pressure of from 4 to 16 ounces pressure. These plants will safely carry or operate up to 10 lbs. pressure, or will work on 8 to 10 inches of vacuum, but no advantage is gained; with the increased pressure, a slightly higher temperature is available, but only slight. With the higher vacuum, unless everything is absolutely tight, the vacuum pump is required to do the extra work of pumping the infilitrated air out of the system. Vacuum systems may be extended to include almost any number of buildings requiring to be heated from the one source and is easily made adaptable to overcome any conditions or obstacles. Its general use is the outcome of experience gained, and offers possibly the greatest opportunities of effecting the highest economies. One distinct advantage with vacuum or vapour systems is the fact that when the plant is not in operation no possible harm can be done to either it or the building by freezing up

The first cost of installation is also in its favor.

We now come to warm air heating, laying aside the ordinary domestic installation, there is found in very general use, hot blast systems, in which the heated air is circulated by blowers. Examples of these installations are found in machine shops, foundrys, roundhouses and other establishments in which there are tremendous leakages of air by opening large doors. There are, however, examples of blower heating systems, which have been brought to a very high degree of refinement, in which the air is carefully conditioned, all dust and impurities removed and a stated degree of humidity and temperature maintained under automatic control. These systems are applied to schools, theatres, auditoriums, churches, art galleries, etc., of the more expensive kind, as well as certain factories for special process work.

It may be said that for certain classes of work and certain conditions requiring to be produced, blowing heating offers the greatest advantages. For instance in the Ford Plant, the heating was accomplished by locating the apparatus on the roof with the ducts run along, branching off and passing down through the centres of the columns, discharging air through small openings for each floor, thereby occupying practically none of the cubical contents or floor space of the building.

By the use of air washers it is not only possible to provide clean, pure, humidified air in winter time, but it is also possible to cool the air on hot summer days, making the plant effective both summer and winter. This is particularly true in textile fabric weaving plants, where the necessity of a proper atmosphere brought about the development of the modern air washing apparatus, which, scientifically applied to some of the principles used by the Romans in their fountains. In the air washer, cooling by evaporation is the chief principles.

Time does not permit any lengthy discussion of any particular application of these systems, they are, however, intensely interesting and worked out on rather unique lines. The application of these systems require skilled judgment of a mature and well-reasoned kind being used in order that the economy and the best results are obtained. Combinations of this with other systems are frequently used to obtain certain results.

law of supply and demand which holds the trunk of the tree in place more firmly than it can the branches and if you succeed in raising the trunk above its natural position, you will get the same result as if you had lifted the old apple tree out of its position so that the roots could not take up the nourishment necessary for life. Under present abnormal conditions, machinists are receiving from 60 cents to $1.25 per hour, while house carpenters and painters may be working for 40 to 60 cents, locomotive drivers on fast trains have for years received over twice as much per hour as the Superintendent who was responsible for the passengers, not only on one fast train, but possibly on a hundred other trains. The possibility of artificially increasing the cost of articles produced by skilled labor is my reason for not including more of these articles in the list of those making up the value of navillus.

PART V

How it will Work.

You may say this is alright as a theory, but how could such an idea be put into practice? Not a very difficult matter. All that is necessary is for any Government that has control of the making of contracts to pass laws embodying the following ideas;

> A bill for the equitable equating of the value of letters of credit and promises to pay, which change in value on account of the fluctuation of the value of the dollar.

SHORT TITLE

An Act to Stabilize the Measure of Value Necessity.

People and Governments entering into long time contracts suffer great damege and sometimes financial ruin by their obligations becoming greater on account of the *appreciation of the value of the measure of value.*

Object

To stabilize the measure of value so that no injustice be done the maker or the payee of long time notes or contracts by the fluctuation in the value of money and further to make the average value of a dollar during the past two years the unit of this more stable measure.

Article 1 On and after date of passage of this bill, the unit of value for all time contracts shall be navillus.

Article 2 The value of the navillus shall be as set forth in Schedule "A."

Article 3 All contracts involving the promise to pay a consideration in the future where the time is six months or more shall be written in terms of navillus and the payment of both the principal and interest on same shall be in navillus.

Article 4 In all life insurance policy notes, bonds or other forms of contracts involving the payment of a consideration in the future, which were written since January 1st, 1916, wherever the word dollar or dollars appear it shall be changed to navillus and the interest or premiums on all such contracts shall be payable in navillus.

Article 5 If at any time within the next ten years, the holder of any life insurance policy, bonds or other form of contract involving the payment of a consideration, desires that payment be made in navillus instead of dollars, he may apply to any court having jurisdiction for an order authorizing the change, and t shall be the duty of such court to issue an order that the words dollar or dollars mentioned in the consideration be changed to navillus, unless there be some circumstance or conditions connected with the contract, that in the opinion of the court, would make the issuing of the order an inequitable transaction. After the date of the order all premiums or interests on bonds or other like contracts shall be paid in navillus. All of the above subject to the application for the order being made two years before the date of the expiration of the contract. Once an order has been issued neither party will have the right to ask or have the terms of the contract reverted to the former state, it being the intention of this act that in as far as possible all contracts written with dollars as the consideration shall be changed to navillus, but that under no circumstances shall a contract be written with navillus as a consideration be changed to read dollars.

Article 6 The Government will at once appoint a commissioner of finance, whose duty it will be to keep a daily record of the prices of the various items at the various points mentioned in Shcedule "A." At the end of each three months from the average price during that time he shall announce the rate of exchange between navillus and a dollar. This rate of exchange shall be proclaimed by the Government as the legal rate of exchange for the next three months and during that time all payments of whatever nature, be they premiums on life insurance interest on notes or bonds or final settlements made on account on contracts, the consideration in which is written in terms of navillus shall be made at this legal rate of exchange.

Article 7 By a vote of three in favor to one against the change, changes can be made in Schedule "A" by the Legislative Representatives of the people when legally assembled for the enactment of laws.

Article 8 It will be a criminal offence to be parties to any agreement or contract not in accordance with this bill or having for its object the nullification or evasion of the intent of this bill, and upon conviction of such crime the penalty will be imprisonment for a term not less than five years up to life sentence with any fine that the court may see fit to impose.

PART VI

Discussions of Objections.

It would be utterly impossible to guess at and discuss all the objections that may be made to this proposition, but we will anticipate a few of them:

The most important will be the general claim that such a plan would revolutionize business, demonetize gold or turn business topsyturvy.

Quite the contrary, gold is not demonetized, it is an excellent medium of exchange, no laws are proposed to be changed, 23.22 grains of gold still remains the standard value of a dollar. All business is done in terms of dollars and cents, cheques issued as usual, the only difference in the banking of the country, is that when you give a note to the bank for a period of over six months, at prices it is considered they should sell at the present time so that to start with the Navillus equals the present value of one dollar.

Let it be distinctly understood that what is proposed is *not a new medium of exehange, that is, money or its equivalent.* All business will be transacted exactly as at present only that *The value of promises to pay will be equitably equated by means of the proposed new measure of value, Navillus.*

Sehedule " A "

Typical schedule of proposed navillus, (Unit of Value)

Navillus Equals price of:

- 0.1 parts or .023 grains of gold at New York.
- 0.8 parts or 3.400 grains of Silver at New York..
- 0.1 parts or .004 grains of Platinum at New York.
- 3.0 parts or 2.0 oz. of Copper at New York.
- 3.0 parts or 6.0 oz. of Lead at New York.
- 3.0 parts or 5.0 oz. of Spelter at New York.
- 3.0 parts or 4.0 oz. of Tin at New York.
- 6.0 parts or 3.36 lbs. Steel Rails at Pittsburgh.
- 6.0 parts or 4.44 lbs. Pig Iron at Pittsburgh.
- 5.0 parts or 25.00 lbs. Anthracite Coal, Scranton.
- 5.0 parts or 30.00 lbs. Bituminous Coal, Pittsburgh.
- 5.0 parts or 6.65 lbs. Portland Cement, Mill N.J.
- 10.0 parts or 2.75 lbs. Wheat at Chicago.
- 5.0 parts or 2.50 lbs. Corn at Chicago.
- 4.0 parts or 3.40 lbs. Oats at Chicago.
- 3.0 parts or 1.80 lbs. Barley at Chicago.
- 2.0 parts or 0.33 lb. Flax at Chicago.
- 1.0 part or 0.60 lb. Potatoes at Rochester, N.Y.
- 1.0 part or 0.80 lb. Apples at Rochester, N.Y.
- 6.0 parts or 0.50 lb. Prime Steers at Chicago.
- 4.0 parts or 0.33 lb. Prime Hogs at Chicago.
- 4.0 parts or 0.33 lb. Sheep at Chicago.
- 5.0 parts or 0.33 oz. Wool at Chicago.
- 5.0 parts or 2.5 oz. Cotton at New Orleans.
- 4.0 parts or 8.0 oz. Sugar at New York.
- 3.0 parts or 1.5 oz. Best Coffee at New York.
- 3.0 parts or .75 oz. Best Tea at New York.

100.0

In the above typical example we have a measure of value in the writer's mind a thousand times more stable than 23.22 grains of gold.

The most pessimistic advocate of the gold standard who will admit that the value of gold can vary, will have to admit that there is not an item in this list but what is intrinsically of as much if not more value to the world than gold. If that is admitted, why then is not any item on the list, with the exception of the two perishable ones (apples and potatoes) just as good a measure of value as gold? If that is so, Navillus is at least twenty-five times as stable as 23.22 grains of gold, even that ratio would be a good start towards an improvement. There are a few other features of this example that should be elaborated on, the idea of allotting different proportions to different items is to give the more important of the necessaries of life more prominent positions. Wheat being a universal food and grown over the greater parts of the world, is given the centre of the stage, potatoes and apples being perishable articles, are given a less prominent part. The precious metals being the least essential items on the list are given still less to say in the measure of value. The relative stability of the Navillus (with only 27 items instead of two or three hundred that could be taken) will be appreaciated by a study of this example. You will see that gold would have to appreciate in price a thousand times, that is, 100,000% to make the value of navillus double or increase 100%. Wheat, the most important item would have to increase tenfold or 1,000% to double the value of navillus. It is plain that if the number of items be increased tenfold that the fluctuation of the price of one single item will not appreciably affect the value of navillus. These proportions are only suggestions that would be corrected when a hundred or more other items were added to the schedule, also the prices would have to be given careful study. It would not be right to put steel in at the abnormal price at which it is now selling, something like four times the price of 1896, when we do not believe the value of the dollar has depreciated in that ratio, however, that feature would not be so important, for if a price was taken too high or two low, it would simply have the effect of giving a less or greater part to that item in the determination of the value of navillus. The important thing is to get the total at the start to represent a value of navillus that it is intended it should have. Another feature is that instead of giving one market point, the average price of the market at several centres should be taken, for instance: wheat instead of the price at Chicago, Should be the average price at Chicago, Minneapolis, Duluth, Fort William, etc. Other items should be treated in like manner. It will be noted that finished articles have in general been omitted from the list, the object of this is the uncertainty of conditions that may result from further development of trades unionism. To better illustrate the idea, let us imagine a tree of labor instead of the family tree which is made to appear like the old apple tree. The trunk of such a tree would be common labor, the very top would represent those who had achieved all their ambitions and could go no higher, the rest of the world's workers would be represented by the intervening branches among which would be the skilled laborers. On such a tree you can, by artifical means, raise these branches above their normal level the same as you can those of the old apple tree, but the minute you attempt to raise the trunk you meet with an almost irresistible force which is the

It has been said on good authority:—"The laborer is worthy of his hire" and "Thou shalt earn thy bread by the sweat of thy brow." The writer believes that in free countries like the United States and Canada, governed by the will of the people, that the laborer doing a fair day's work is rightfully entitled to compensation sufficient to support himself and family in comfort and besides have enough to buy some of the so-called luxuries of life. It may occur to some that a fair day's labor could be used as a measure of value (note that the writer has dropped the word "Standard" as he cannot suggest any measure of value that would be worthy of the name "Standard") that would not be such a bad idea if there was any way of determining what is a fair day's labor; the employer would measure it by results, that is amount produced. The unionized idea is to get your name on the pay-roll for as much money as possible for the least amount of time and for the smallest amount of production. Aside from this condition there is the matter of efficiency.

The writer was severely criticized one time by his superior officer because some Swede laborers loading ties on flat cars at piece work were making six times the wages of common Italian laborers. His cation was approved when it was shown that the contract price was one third the cost of loading the ties with common Italian labor. We are not trying to prove that one Swede is as good as eighteen Italians, for the case might have been just reversed if the Italians were working at piece work and the Swedes on time. Another feature is that the efficiency of labor is inversely proportional to the price of labor. Ask any old roadmaster in the United States or Canada how many ties on an average he can put in the track per man to-day when the wages are from $3.00 to $3.50 per day, and how many he was able to put in per man when the wages were $1.50 per day.

There has been enough said to show why this God-approved feature of our economic life is not a good measure of value, but it suggests to the writer's mind a measure of value, that is, make the object of this "sweat" namely, the necessities and luxuries of life the measure of value. Our opponents will say at once why you oppose the free silver idea and that only proposed two standards, while you propose a thousand or more. That is not the case; we only propose one measure of value made up of a hundred or a thousand parts. Remember that there is a vast difference between a thousand armies composed of one man each and one army composed of a thousand men and we know which one you would prefer to face.

Now to develop the idea, if the free silver people had said:—A dollar equals the combined cost of:

11.61 grains of gold
412.5 grains of silver

they would have been, in the writer's mind, a long way on the road to improvement: Note further that the value of silver is placed at commercial value at that time and not at the fictitious value the free silver people would give it, the idea being that it is not advisable to change the value of the measure from what it is at the time you change laws.

Had the would be reformers of that time gone a little further and said:—Value of the dollar shall be ten cents worth of the following ten metals, that is,

One dollar equals the cost of:—
- 2.32 grains of gold at New York
- 82.5 grains Silver at New York
- 100 lbs. of coal at mine
- 11 lbs. of Steel Rail at Pittsburgh
- 3.3 lbs. of Lead at New York
- 1 lb. of Copper at New York
- 2.5 lbs. of Zinc at New York
- 8.3 oz. of Tin at New York
- 16.5 lbs. of Pig Iron Pittsburgh
- 0.5 lbs. of Aluminum at New York

We cannot believe that the dollar of to-day would be worth only 50% of the value of the dollar of 1896. as we must all admit is the fact. If you were asked which metal in the above list could the world best afford to give up if it were necessary to dispense with the use of one, the unanimous answer would be gold. Does that not go to show that gold is the least valuable in the list as a standard? If you were to increase your army ten fold with all better men than the original unit, have you not an army to resist attack more than ten times as strong as the original unit?

PART IV

A Proposed Improvement.

What has been said will illustrate in a general way the writer's idea of how the measure of value can be improved, but instead of taking ten items, take a hundred or a thousand if found advisable, but give more prominence to more important items: That is, make the things that we live for the measure of value. Give the important necessaries of life a larger factor in the making up of the unit of value. What shall we call this unit of value? A dollar? No. That will lead to more confusion. Exchange would be a logical name, but on account of that word having different meanings, depending on the specific use, it might also lead to misunderstanding, so for want of a better word let us call the unit of value "Navillus," it has no significance and means nothing in itself, but it will do for a name and will be used in the remainder of this paper to mean the unit of the measure of value. In order to more clearly illustrate the writer's idea, the following assumed value of Navillus is given, taking only 27 items instead of a hundred or more that a properly constituted investigation commission would doubtless use and further no argument will be put forward for the absolute correctness of the comparative importance given to various items, nor to the price that various items are quoted at, only to explain why more importance is given to some items and less to others. In this example the unit is divided into one hundred parts, if it was thought advisable to divide it into a thousand equal parts all that would be necessary is to move the decimal point one place to the right in the column of parts taken. If it was thought better to have the sum of the parts in unity, all the change to be made would be to move the decimal point two places to the left in the column of number of parts. It will be noted that the figures in the column of parts taken of each item equal the number of cents worth of that article clothing and luxuries of life go up, measured by the gold standard, your wages go up accordingly. The answer to that question is easy. If the business of the world was done on a cash basis, that is, if there were no mortgages, bonds or long time notes, it would not make such a vast difference except to the idle rich or the comparative few living on fixed incomes, but our motto should be:—"The greatest good to the greatest number." As an example: In good times we have what is termed inflated values and money is easy, although strange to say, interest rates are high, in other words credit is good. Most everybody has some credit and that is the time the poor man is tempted to buy a home or use his credit in undertaking some other obligation at inflated values, promises to pay high rate of interest and may, as an example, agree to pay $20.00 per month. He is getting, say, $4.00 per day and with the aid from the family, who are working at good rates, he is able to meet his obligations and live; then comes hard times and his wages are cut to $2.00 per day and that of his family in proportion. What happens? He is now compelled to pay 40% of his month's wages while he only contracted to pay 20%. Mr. Gold Standard Man, do you mean to tell me that this man is only paying what he actually agreed to pay? We cannot believe it, for we see the result every day in hard times, homes of the poor sold under the mortgage or the life insurance allowed to lapse.

Speaking of life insurance reminds us of another example in that line: Some twenty years ago a very popular form of insurance was one payable in a twenty year 5% gold bond with coupons. At that time such a bond was worth from 130 to 140 and the insurance companies charged premiums on that basis, that is such a policy cost 30% to 40% more per thousand than a similar policy payable in cash. What has happened? To-day Government Bonds in the United States bearing 4½% selling less than par, in Canada 5½% bonds are selling less than par. Look at your daily paper for the quotation of gilt edge 5% and 6% bonds. Is the policy holder whose policy expires now getting the value of his money? Most emphatically no. You may state that these examples quoted might have worked in the opposite manner. Yes they might, but they don't. The poor man does not undertake an obligation in hard times and if the insurance companies were to issue such a policy to-day, the chances are that they would look out for such contingencies by placing the rate high enough to protect themselves. However, as was said before, it is the most good to the greatest number that we are after and that brings us to the main issue.

Most Governments of the world are spending money like the proverbial drunken sailor, only more lavishly and with far worse results, the destruction of property and in the taking of human life. Every man, woman and child on earth must help pay for this waste. In what kind of money are we going to pay this debt? Can there be any fault found with the debtor who pays the equivalent of what he received? There is only one way to keep that debt uniform and that is to devise some means of keeping the present purchasing value of 23.22 grains of gold on the same basis as it is to-day. There never was a more opportune time when less hardship would be brought about by such a move for the reason that large manufacturing industries are now adjusted to the high prices if you will it that way or to the reduced value of the dollar as the writer views the case. The transportation interest of the United States and Canada are adjusted or being adjusted. The only large interests that would seriously suffer are street railway companies and the owners of gold producing properties. The rates of the former could be adjusted by the Government and the latter might be compensated in some way by reductions in taxation. Officials working for the Government or Corporations on an annual salary would be adversely effected as they are at present, but that is a minor detail that would soon adjust itself.

PART III

What is the Remedy?

This is a matter that must be carefully through out and no move made without giving due consideration as to what the effect will be of every movement. Let us profit by the experience of the last great movement, having as its object the adjustment of the Standard of Value. As an illustration of the fickleness of public opinion, the writer happened to be on Robert Street, St. Paul, Minn., in the summer of 1894, when a branch of Coxy's Army marched through the street, among that company was one colored gentleman. An old colored woman standing close to the writer called out: "Come out of dat, you nigga, youse no business with dat white trash." At the corner of the street they halted and one of their number harangued the crowd with the usual rot you would hear from such a man. He was hissed by the crowd who gathered there through curiosity. Two years later when the writer attended a public political meeting in Spokane, Wash., and listened to substantially the same arguments that the hobo used in St. Paul, clothed in a little better English by a man who later became a United States Senator and he was cheered to the echo by what appeared to be an intelligent audience.

To-day, only twenty-two years later, a man who would preach "Demonetization of the People's money" "Crime of 73" or "Cross of Gold" would be looked on as a brainless wind bag. Let us take a warning and go cautiously in this matter, but on the other hand fearlessly. If after careful study we come to the conclusion that 23.22 grains of pure gold is not an unalterable and unchangeable standard of value, let us not be put off by the adherents of that standard who may say if driven too hard. Yes we know gold is not an unchangeable standard, but what better can you suggest? This is a fair and reasonable argument and it is the problem that we have to solve. At the present time there does not appear to be any physical thing in nature or anything controlled by natural laws that can be taken as a standard of value, the same as are found for other standards of measure mentioned in the beginning of this article. Therefore, for the present, failing to find any unchangeable standard, the next best thing is to try and improve what we have.

Criticism without constructive ideas is of very little value and in order to start the movement and to bring out discussion, the writer will give you his ideas of how he thinks the standard of value can be improved.

Can the Standard Measure of Value be Improved?

PART I

Existing Conditions.

Now that war conditions are such that people are begining to think the end is in view, it is time that stock be taken and plans made for the future.

Scientific men have long since devised standards for the measuring of time, distance, weight, quantity and other physical features of nature that are measurable with such degrees of accuracy that we can tell to a minute years in advance when an eclipse will take place. If all the yard sticks, clocks, scales and measures of quantity in the world were suddenly destroyed, the standards on which they are based are so scientifically designed that all the measures could be reproduced exactly as they now exist, in other words, all these measures are based on unchangeable standards. On the other hand, have our bankers and financial men succeeded as well in their attempts to make a standard for the measure of value? Have you ever met a thinking man who would even argue that the standard of value gave satisfactory results? This general dissatisfaction with the standard of the measure of value is my excuse for bringing this important matter to your attention in the hopes that with your minds trained along economic and scientific lines, you engineers will not only help to win this war but may help in showing our Government and those of our Allies how to more easily bear the burdens imposed on them by this terrible war.

The writer wishes you to consider carefully the next three or four paragraphs, for therein you will find the basis of all my arguments and as there is no desire or object to be gained by any untrue or misleading assumptions, it is necessary that we approach this subject from a correct point of view and start from a correct base.

The writer's conception of a correct standard is something that is unchangeable by any artifical means: to illustrate by an example:—the circumference of the earth or any definite part of the same, at the equator at the sea level is a fixed distance that man or any laws that man may make cannot change; now the earth's crust may be shrinking or expanding, in that case nature would slightly change the distances mentioned. The basis of the standard of time is the time it takes the earth to make a complete revolution on its axis. No act of man or laws made by man can change that time.

The present so called standards of value are not in a class with those mentioned above, on the other hand, they are subject not only to change by act of man, but they also fluctuate and change from other causes. This last statement will be challenged and by large numbers. Possibly half of the people in the United States and Canada believe that 23.22 grains of pure gold is an unalterable standard of value.

Let us analyze this point:—23.22 grains of pure gold to-day will purchase only 50% or 60% of the necessaries and luxuries of life that it would purchase during the period between 1893 and 1896. The gold standard man will say that is because the prices of everything else has changed. The value of a dollar is the same because it represents 23.22 grains of gold which is an unchangeable standard. Did it ever occur to you that he may be mistaken and that there is a possibility that the value of 23.22 grains of gold has depreciated 40% to 50%? To a thoughtless man the argument of the gold standards advocate appears reasonable and more so from the unfortunate fact that in this case alone the standard is to a certain degree also used as a medium of exchange.

In the United States and Canada the writer would expect to find that over 99% of the business transacted is done through the medium of notes in the shape of paper money and by cheques, which in themselves have no intrinsic value. The use of the standard as a medium of exchange leads at once to confusion, so many are apt to think that they are one and the same thing, while as a matter of fact, *there is no need or necessity why the standard of value should also be used as a medium of exchange.* Suppose for the sake of argument that there was no such thing as gold: the world would go on just the same, there would be the same commerce and business done as at present, and if it were to be decided what would be the standard of value, some might suggest a bushel of wheat; such a suggestion would to-day be met with ridicule and derision, but stop to think a minute, is not wheat a million times more useful to the world than gold? It can be stored and kept for a long space of time. You say no. We must have a precious metal for a standard. Well, what shall it be, iron, lead, zinc, silver, platinum, mercury, coal or what? The gold standard man tells you that none of these would do for a minute because they all change in value. That settles it if they change in value, then we must admit that they are not a standard. But in what particular does any of these vary from gold? None whatever, only that the most of them are more useful than gold and would, therefore, make just as good if not a better standard. Suppose that the dream of the alchemist would come true and he was able to cheaply change clay to gold. What then becomes of your gold standard? You will answer that such a thing is absurd and that even if it should transpire that it would be an unusual occurrence. Even so it proves that 23.22 grains of gold is not an unchangeable standard.

There are gold producing properties that paid well in the past that are idle to-day. If the owners turned the properties over to the miners they could not work them for the reason that although they are producing your standard of value with the same amount of exertion as before, what they would produce would not to-day clothe and feed the producers.

PART II

Why an Unchangeable Value is Desirable.

You may agree that the value of 23.22 grains of gold is a variable measure of value and still ask what real difference does that make? As the cost of living, These are the factors commonly treated to determine the size of the radiators, glass, wall and air changes. Incidently a room of this character would have, in winter weather, a complete air change, due to infitration directly, and from other sources, of approximately once every thirty minutes.

In the process of off-setting these heat losses, the cubic contents of the room in the air contained, must carry the heat content necessary to provide for the loss and leave as a net result, the desired temperature for comfort, usually measured five feet from the floor (the breathing line) at a point near the center of the room, where the average will prevail.

It is easy to imagine still further what the result will be if the barrier between the inside and outside be rendered less effective by increasing the glass area and decreasing the insulating qualities of the wall construction; greater heat must be added to the cubical contents to supplement the extra loss; getting further away from natural atmospheric conditions.

The excessive heating required to meet some of the conditions becoming more common every day, causes a rather serious dispersal of the humidity contents, and this tendency leads to nervous irritability, lassitude, dryness of the throat and nasal passage, additional strain on the glands secreting moisture, also the effect of decomposing the organic matter in the air, giving it that dry, burnt, stuffy sensation; also natural dust robbed of the neutrilizing effect of the humidity, causes irritation.

The amount of moisture contained in a natural atmosphere of 70 degrees, is generally about 5 to 6 grains per cubic foot, corresponding roughly to 50-60 per cent saturation. The amount contained varies considerably, at 32 degrees for instance, 100 per cent saturation will give only 2 grains per cubic foot, and at zero, only .5 grain, so that with air at 30 degrees outside and a natural humidity of 60 per cent. the effect of heating this air up to 70 degrees, reduces the humidity to about 15 per cent, or less than the dryest climate known.

The variations in humidity give rise to the sensible temperatures registered by the body. It has doubtless been observed that certain rooms are comparitively cool at a high relative temperature, while other rooms are warmer at a lower temperature. On examining the psychrometric chart, 58 degrees at 60% humidity corresponds to 75 degrees at 30% humidity, both of these would maintain the same sensible temperature as far as the body is concerned.

The deduction resolves itself in to this: If the character of the exposure and construction produce high transmission losses, we depart far from the natural conditions; the comfort zone creeps higher up the scale, necessitating higher inside temperatures being maintained, increased cost of heating plant, increased expenditure of fuel.

If in designing and constructing our modern buildings, more thought be given to the insulating qualities of the materials used and even if, in the choice, the first cost be slightly increased, there will be good returns on the extra outlay. It will be saved in plant, fuel, etc., and at the same time the effect upon the artificial atmosphere will be less drastic, adhering closer to the natural, lessening the physical strain of adjusting ourselves to the conditions that must, of necessity, be produced that we may carry on.

These remarks are directed particularly to the industrial situation, as there is an earnest desire on the part of everyone to create better working conditions.

The human factor is the vital problem, produced by some of the methods of modern building construction.

In olden days the construction of buildings, and even the furnishings, were made to accommodate themselves to the heating and the limitations were recognized. In these days, in many instances, no thought is given to the various phases of the conditions produced and very sketchily outlined herein.

This subject is very deep, covers a broad field; any part of which would readily enlarge itself into a subject of its own.

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* Mechanical Equipment of Buildings, Harding and Williard Volume 1.
John Wiley and Sons,
New York

It is recommended that the works of Messrs. Harding and Williard and others who have devoted intense study to the practical side of heating problems, be procured and kept as a reference, as they will provide valuable assistance in determining the proper treatment required, but often overlooked in designing and equipping the modern building.

Molasses Tank Failure.

This article describes the collapse of a riveted steel tank in Boston, 90 ft. diameter and 50 ft. high, which was fully charged with molasses. A flood of 2,300,000 gallons of molasses spread over the adjoining street and filled the cellars of houses. Steel plates from the tank wrapped themselves round the steel standards of the elevated railway, one standard being sheared right through. Many casualties occurred, and the elevated railway was put out of commission for several weeks. The Court of Inquiry found that the tank design was wholly insufficient in structural strength, and this is confirmed by the details of the riveted joints given in the article.

It had been suggested that the accident was caused by an explosion, or by a freight car running into it, or by the vibration of the elevated trains. A description of the locality is given and data relating to the weight of molasses in the tank. Molasses are considered as weighing 11.75 lbs. per gallon, and it was shown that the plates near the tank base were from ½″ to ⅝″ thick, lap-jointed with 1″ rivets. The tank was full up to a height of 48′10″ and the unit stress on the net section of the ½″ plates near the base of the tank would equal 50,000 lbs. per sq in., a figure approaching the ultimate strength of the steel plate. The tank was built on concrete, which was not damaged by the accident.

in the lungs is not dependant upon outside conditions, but is regulated by the amount of carbon dioxide dissolved in the blood, and this in turn acts upon certain nerve centers, which control the depth and rate of breathing. If the carbondioxide falls too low, stimulation of the nerve centers ceases, and the process of respiration does not take place till the proper proportion has again been accummulated. The normal proportion of carbondioxide in the air of the lungs is about 5 per cent, and is automatically kept at this point by the action of breathing.

Under these conditions the effect of " impure air " so called is an unnoticeable increase in the action of the lungs through faster and deeper breathing; thus, the function of breathing is dependant entirely upon internal, rather than external conditions.

The evil smell of crowded rooms has long been accepted as proof of the existence of harmful poisons; as a matter of fact, such odors come from secretions of the skin; from food eaten, decayed teeth, foul breath of dyspepsia, soiled clothes, etc., etc. While such a mixture of odors is offensive and disgusting, it has been proven to be harmless in so far as its direct effect upon health is concerned.

Recent investigations show that the effect usually attributed to foul air and poor ventilation is due to the physical condition of the air rather than the chemical condition.

As mentioned before the body must be relieved of the heat produced and experiments show that an ordinary adult will produce, and must be relieved of enough heat in the course of an hour to raise one thousand cubic feet of air fifteen or twenty degrees. This heat is constantly carried away from the body, partly in the air exhaled, but chiefly through the skin by convection, conduction and evaporation of perspiration. It is evident that the prompt removal of this heat will depend very largely upon the atmosphere surrounding the body: upon the temperature, humidity and the movement of the air.

The physiological effect upon the human body of over-heating is a derangement of the vaso-motor nerve system. For example, a cool wind striking the skin will stimulate through the sensory nerves, the vaso-motor constrictors, which in turn cause the small vessels near the surface to contract and drive the blood deeper in the tissues and so preserves the bodily heat. A warm wind or other source of external heat causes dilation and draws the blood to the surface, thus cooling it more rapidly. It will be seen that with no two human beings alike, with the complicated and intricate nature of the human body, the strain and nerve tension of some classes of work, the tremendous variations, etc., etc., lead us to believe that we are up against hopeless conditions in attempting to produce ideal summer climates inside, during winter weather.

Humidity has a decided effect upon conditions. Too much humidity accompanied by a high temperature, will retard the cooling of the body as is usually the case in a poorly ventilated room, and becomes doubly harmful because of the combination. You have probably observed women in an overcrowded theatre with the temperature high, gasping for breath and almost fainting, fanning themselves to overcome the effects and bring relief (temperature, humidity and movement of air again). Women, on account of an extra layer of fatty tissue, which nature has omitted from man, will show signs of distressing conditions more rapidly than men in the above instances, yet will feel quite comfortable outside, with much lighter clothing.

Due to the alteration of the percentage of humidity in the air in a heated room, a perceptible movement of the air will cause a heavier convection loss from the exposed parts of the body, which frequently causes congestion or colds, due to the uneven cooling of the body. Yet, these conditions could be magnified many times in a natural atmosphere where nature has compensated the temperature and humidity, with the opposite effect and pleasing sense of exhiliration. Such, for instance, as driving in an open automobile.

We are confronted with these facts that the remedy is an exact knowledge of all the factors entering into the problem, not separately, but as a co-relative and collective whole, and what relation each bears to the whole. In this there is room for some valuable research work.

Possibly the best summary of this paper, will be to examine in what manner of means does the construction of our modern buildings effect the occupant.

In the present day, we have some wonderful buildings and further heated by systems the very acme of mechanical perfection. The builder is justly proud of his accomplishment, the engineer has achieved success in the application of mechanical skill, yet that human element frequently called the "Layman," having to perform the daily task of living and working in the atmosphere enclosed by the building, is frequently far from satisfied. Call up to your mind those constant and familiar remarks from all sources and all kinds of people, heard on every side; these questions are logical, but have we the answer ready? It is feared much must be gone through before the answer is unfolded. Let us analyze briefly the room in which this meeting is being held. It is easy to imagine a condition tc begin with, where the temperature inside and outside are equal, the walls and windows are neutral, and there is no transmission of heat: now follow the action as the outside temperature drops, a loss of heat is caused inside as well, the walls transmitting the residual heat to restore the balance inside and outside; as the outside temperature keeps dropping a point is reached, where in order to be comfortable we must resort to supplying artificial heat. Let the outside temperature keep on dropping, we simply supply more artificial heat to maintain the comfortable temperature inside; as the difference between the inside and outside temperatures increases, so is the heat loss increased in a slightly greater proportion, the amount lost has to be added by artificial means.

The walls, windows and other surfaces of this room exposed to the lower temperatures, are the barriers purposely constructed to conserve the heat loss and upon the character of the construction will depend the amount of heat that will be required to maintain the comfort zone inside.

In addition to the heat loss another factor is encountered, namely, infiltration of outside air increasing as the temperature outside drops, displacing air already heated, with air requiring to be heated.

Modern building construction has undergone many changes of which you are all familiar. The following are brief comparisons of heat losses from various materials commonly encountered:—

An equal thickness as far as possible has been taken to more readily compare the relative heat losses expressed in B.T.U's per square foot per degree difference per hour.

Thickness and Character of Walls	(Factor)
12″ Limestone, Furred and Plastered..........	.52
12″ Sandstone or Concrete, Furred and Plastered	.47
12″ Marble or Granite, " "	.40
12″ Marble or Granite–Hollow " "	.30
12″ Ordinary brick wall, " "	.30
12″ Ordinary brick, plastered on the brick......	.29
12″ " " Furred and Plastered......	.24
12″ Hollow brick " "	.22
Brick veneer, sheathing, studs, lath and plaster...	.17
Frame, Sheating, paper, clapboard, no plaster....	.27
" " " " Lath & Plaster	.24
" " " " " " —back plastered....	.21

Miscellaneous

3″ slab of solid concrete....................	2.00
3″ " " cinder "	1.04
3″ " " Gypsum..........................	.40
Glass....................................	1.00

The above factors are compound factors and may vary considerable, for instance porous brick is by virtue of the confined air cells, a better insulator than the more solid and impervious material, but by absorbing moisture will materially change.

Confined dry air is the best insulator as for example the best commercial pipe covering for steam piping is 85% Magnesia, because of the large percentage of minute air cells held in suspension and unable to circulate.

In working out the details of a heating system, it is first necessary to ascertain the heat losses from the various rooms or apartments to be heated, and apply the proper amount of radiating surface to offset the loss for a stated set of conditions, which are usually determined from the local conditions or requirements.

To attempt to give any arbitrary rule is entirely out of the question, as it would prove more misleading than enlightening. There is, however, this statement to be made in the interests of economy:—

All buildings constructed of such materials as are subjected to heavy transmission losses, must be very thoroughly insulated, otherwise the effects on the occupants subjected to the artificial atmosphere produced, often overlooked and not easily understood, is deterimental even beyond our recognition.

The characteristics of the present systems of heating are of an entirely different nature to the radiant heat derived from the open fireplace. With the open fire, as before mentioned, the heat is of a radiant kind, but with direct radiation, in either water or steam heating, the heating effect is derived entirely from the circulation of air collecting the heat from the radiators by convection.

There is a physicological side which must be considered, produced by prevailing conditions, often causing severe strain and enervating fatigue. The purpose of the atmosphere is to keep our bodies in a state of health and areate the blood. The food we eat is chemically changed by the various processes, and with every chemical action heat is generated and the body must lose this heat, if the normal blood temperature is to be kept constant.

In the opening paragraphs of this discourse mention was made of the extremes of heat and cold, not unusually met with, yet the tempeature of the blood remains absolutely constant when a person is in good health.

There is spread over the whole surface of the body, an elaborate nervous system, which nature has saddled with the responsibility of maintaining an absolutely constant blood temperature. The body looses heat by conduction, radiation, evaporation, as well as small quantities being carried off by breathing and the moisture contained in the breath.

Nature has placed in the atmosphere three physical functions, namely, temperature, humidity and movement of air, which are the all-important factors and it is only when we seriously disturb any one of these three factors that we experience trouble, and if persisted in, causes a breaking down of the human system, giving rise to serious disorders. For instance, if a person is so placed that the body is unable to be cooled by the presence of an envelope of stagnant air, the sun's rays will quickly produce sun stroke or heat prostration. In certain cases, under similar conditions, the heat from an open fire place will produce the same effect in a more modified degree.

In order to better understand the effect of the physical properties of the atmosphere, let us examine the chemical characteristics as related to bodily health and comfort. It is necessary to have a clear understanding of the process of respiration or breathing and the changes which take place in the air in the respiratory tract———At the beginning it should be clearly understood that the lungs are never filled with pure air, even under the most favorable conditions, because breathing is only a frequently repeated slight dilution of the air remaining in the throat and larger bronchial tubes after expiration.

The air that is exhaled out of the lungs after being mixed with a certain proportion of outside air is again drawn into the lungs as a mixture which does not even remotely approach chemically pure air. This results in making respiration a continuous instead of an intermittent process and so provides for a constant supply of oxygen, necessary to the life of the tissues.

It will be seen that any changes in the proportion of oxygen and carbon dioxide, which is likely to occur in the air of a poorly ventilated room will have no appreciable effect upon the air within the lungs.

Pure outside air is a mechanical mixture of oxygen and nitrogen with traces of CO_2. The oxygen content is about 21 per cent and hardly ever falls below 20 per cent in the poorest ventilated rooms. As the air in the lungs contains about 16 per cent oxygen under normal conditions, it is evident that any changes which may take place in the oxygen content of the surrounding air will have but slight effect internally. Furthermore, the supply of oxygen the consideration would be navillus and when you put your money in the savings bank it would be put in terms of navillus all at the legal rate of exchange. The bank in loaning Bill Jones, John Smith's money, acts simply as an agent and at the end of five years Bill Jones pays back the equivalent of what he borrowed instead of twice the amount. If the transaction on had been in dollars and the value of the dollar had been doubled in the meanwhile, as it has been known to do, the bank turns over to John Smith exactly what it got from Bill Jones, and who is hurt, John Smith is getting what he put in with his interest, no more or less.

It is not desirable or advisable to do anything that would have the least tendency to upset or disturb business, but on the contrary, if we can devise any means that will stimulate business, that should be our aim and if we can by any possible means get a method of equitably equating the value of time contracts, it appears to the writer that such a scheme would stimulate business, for the reason that it would encourage people to assume liabilities that they would otherwise hesitate in undertaking when they know not even approximately what value the obligation might involve on account of the change in the value of the dollar. It might be said that navillus is a mith or how could a bank keep their accounts in something that has no physical existence? No trouble whatever, all open accounts are kept in dollars as at present the dollar is the medium of exchange in all transactions. If you have a $1000.00 and you wish to place it in a savings account, you go to the bank, they tell you that the legal rate of exchange is 98 and give you credit for 1020.41 navillus, all other payments to or drafts from this account are made in the same manner. As an example, suppose no deposits or withdrawals were made and rate of interest was 3% compounded every six months, at the end of ten years your account would stand to credit 1.34686 for every navillus deposited exactly as if the account had been kept in dollars or a total of 1374.35 navillus, there may have been a great expansion of business and the legal rate of exchange is 120, you can draw out $1649.22 but this is only the equivalent of what you deposited, it has the same purchasing power as the money you invested plus the interest. If on the other hand business has contracted and the purchasing power of a dollar was such that rate of exchange was 80, then you would draw out $1099.48 but the purchasing power of this is the equivalent of what you deposited plus interest. The bank has neither lost or made more than they are legally entitled to. The loans they had out were treated in like manner.

How would this scheme effect life insurance, one of the largest businesses in the world. It is difficult to guess what attitude the companies would take in this case, for regardless of fluctuations, the companies charge such high rates that no matter what the fluctuation in the value of a dollar, they stand to win in any case. Take for instance the case of the 5% twenty year gold bond mentioned previously: The owner of such insurance falling due at this time instead of getting in dollars 70% to 75% of what he paid for, would receive in dollars about 140% to 150% more than the face value of the policy would show in dollars, but the insurance company nor any of the previous or subsequent policy holders would be the loser, as all the company's loans and investments would be treated in like manner, as the case is now, the man who paid out for twenty years, dollars that had from 100% to 200% of the purchasing power of the present dollars will only receive 70% to 75% of what he would had he purchased an ordinary policy and that in money that has only 50% of the purchasing value of the dollars he first paid.

The writer read only yesterday an advertisement in large type in a daily paper advising everybody to get insurance at once while it was cheap, that insurance was the only thing that had not gone up in price. Was there ever a more deceiving statement made or one more at variance with facts. Let us analyze the workings of life insurance: You pay your premium, part of it goes to pay the cost of securing the business usually on a percentage basis, part of it goes to cover the cost of the risk taken that you will die before you come to a given age, a rather small percentage goes to pay expense of conducting the business, the balance goes into loans and investments which creates the funds to pay claims. Most companies do all their figuring on a 3% basis and do business accordingly. In 1896 when money was worth about 3% or sometimes less, they charged you an extra 30% or more when they agreed to pay you in a bond drawing 5% interest, proving that the rate of interest is a dominant factor in determining rates. What do they do to-day? When money is worth from 5% to 10%. Do they reduce their rates accordingly? No, but on the contrary tell you that you should be thankful they have not raised them. The writer has no grievance against or desire to quarrel with any insurance company for they are filling a most essential part in the economic world, nor does he expect the insurance companies to change their rates with every fluctuation of the value of the dollar or rates of interest, realizing that insurance bought and paid for in times like these and coming due in times of depression work to the advantage of the policy holder. This is not the fault of the insurance company, nor can it be controlled by them, it is the fault of our money system. The navillus will equitably adjust that matter and it is the writer's firm belief that business will increase due to the fact that people will assume obligations that they otherwise would not when they see that the value of these obligations will not be increased, this will more than compensate the companies for what they gain by poor people or others who are compelled to drop their insurance on account of not being able to meet their obligations in times of depression when the value of a dollar may be twice what it was then the insurance was written.

The proposed legislation is all self explanatory with the possible exceptions of Articles 4 and 5. The reason that it is not suggested in Article 4, that all existing contracts made in dollars should be changed to navillus, is that all bonds issued prior to 1916 were purchased with money more valuable than at the present time and it would not be equitable to enact laws compelling the holders of these bonds to accept money of the present value. That is really what the adoption of the navillus amounts to. Many may say, what do we care for the bond holder, let us change everything? But, if you will consider a moment, you will see that the policy holder of life insurance has also paid out better money than we have at present and if there is a chance of their getting more value out of their policies than is represented by the present value of a dollar, we must not take that chance from them. On the other hand if for any unforeseen reason, expansion should continue after this war or as a result of other wars and the value of the dollar should become less than it is at present, then bond holders and policy holders alike are protected by Article 5. By taking advantage of the terms in this article they are assured at least the present value of the dollar.

The writer can imagine that he now hears the thunder of the roar that will be let out by the shylocks if such a plan as is here proposed was brought up in congress or parliament, and dear people their protest will not be in form that it was unfair to them. On the contrary it will be put in a form to show that you are going to be the losers, they will probably say, what will your Government do about their finance, what will become of the reserve, will it be subject to fluctuation, etc? My dear people, do not let that worry you for a moment, just consider how insignificant the paltry millions of gold held in reserve is compared with the billions of money you owe. Ask yourselves this question, which is better for us, that there should be a fluctuation in the value of the reserve (which there is now under the present system, only that everybody cannot see it) or that there be a fluctuation in the value of the billions we will pay out in interest and principal on our national debt, which may result in our paying two or more times the actual value of the debt.

As has been said before, let us keep before us the motto, "the greatest good to the greatest number" and where can you find greater number than among the tax payers?

They will also doubtless say that what is proposed is not a fixed value, the very plan of the scheme provides for fluctuation. That brings us back exactly to the starting point. It is our opinion that the value of 23.22 grains of gold is a variable quantity and it is the comparison of the navillus in terms of this variable quantity that makes necessary a variable rate of exchange. How does the gold standard advocate explain why a United States dollar to-day is worth 102 cents in Canadian money and a Canadian dollar is only worth 98 cents in United States money, when they are both based on the same so called unchangeable standard? It will doubtless be claimed that the adoption of this suggestion will be taken advantage of by the changing of securities in navillus to securities in dollars in times of expansion when the rate of exchange would be high and resulting in the hoarding of money until money became more valuable; that may be true, but in the writer's opinion that would not be done to any greater extent than at the present time, when the shrewd man will change all the holding he can that are selling at high price into securities, the value of which is designated in dollars and will reverse the operation in times of depression, taking advantage of the rise and fall in the value of the dollar.

PART VII

Other Means.

It may be argued that there is no necessity of this new law, that we can accomplish the same object through the present organization of the Government with their fuel, food control boards, etc., that is the Government can place a minimum price on common labor, say 30 cents to 35 cents per hour and also a minimum price on articles of food and commerce, the same as they now control prices by placing a maximum. The general idea is that the object of placing a maximum is to keep prices down, as a matter of fact, the real object is to keep the value of the dollar up, that is to keep the purchasing power of a dollar as high as possible, therefore the result of placing a minimum on prices would have the opposite result, namely, keeping the purchasing price and consequently the value of the dollar down. If the Government has the right to keep the value of a dollar up, surely they have the same right to pass laws to keep it down. There are several very serious objections to this plan; in the first place it would cost the Government millions to successfully carry out such a plan, while to adopt the navillus would be the work of a small commission for a short time to adopt a proper schedule and after that a $200.00 a month clerk could keep the records necessary to determine the rate of exchange. In the second place, the placing of a minimum of rates of pay for common labor, would not give the right kind of results, just the minute the minimum becomes maximum, that is, when the supply became greater than the demand, the inefficient man is discharged and the efficient man works harder, becomes more efficient and produces a great deal more than he had previously done and the result is that more men are discharged and the idle become a charge on the public. The employer is not hurt very much, he can get his work done at approximately the same cost as if he employed more men at less salary who would not be as efficient. It is much better for the community to have everybody working at wages they can get, even if they produce only what half their number could produce for the same money.

In the third place it would require the co-operation of almost the entire world to make such a plan a working success, while any country or state can adopt the navillus without regard to the action of any other country or state. The reason for this is that minimum differs from maximum in this feature; one state cannot adopt a minimum without it becoming a hindrance to trade if it is an effective minimum. For instance, take wheat which is a non-perishable article and can be stored for years in Government elevators etc., suppose the present maximum should be adopted as a minimum, what becomes of the wheat of an exporting country when the market price in all other countries is lower than the minimum? If the Government took the surplus and hoarded it, it would only be a question of time when they would be compelled to sell at possibly a great loss and the people would have to make up the deficit by taxes, nothing would be gained. Enough has been said to illustrate the difference between the working of a maximum that is higher than the cost of production and a minimum that is above the selling price of a commodity.

Conclusions.

All the foregoing can be summed up in a few words:—

1st. 23.22 grains of gold is a variable measure of value.

2nd. Great injustice and hardships are the result of the appreciation of the value of the dollar to those who assume liabilities when the value of a dollar is low and the rate of interest usually high.

3rd. It seems impossible at this time to devise a real standard of value, that is, one that will be an invariable standard.

4th. Instead of taking a certain amount of a really unessential article as a measure of value, it would be more advisable to take a certain amount of a hundred or more of the essential and necessary articles of life.

Final.

The writer has had this problem in mind for over twenty years, but never before attempted to work out in detail a solution and at the time of starting this paper it was simply the idea to place the problem before the engineers of this country with a few suggestions, but as interests in detail grew the arguments and suggestions developed to such an extent that the writer now feels that he has placed himself in the same position as the Irish Priest who was a dear friend of a Protestant Clergyman, both of them working among the soldiers in the trenches somewhere in France. One day some evil spirit tempted them to discuss Theology with the inevitable result that the discussion ended in a quarrel and the friends were not on speaking terms. After a few days the Priest wrote as follows:—" My dear friend: I am sorry that we quarrelled, I wish to make up and be friends again, in fact I can see no reason why we should not be friends, we are both working for the same end, doing the work of Christ, you in your way and I in His."

One might get the impression from this paper that there was nothing left for you to do, such is not the case. The writer believes that the problem will never be properly solved until we get a real standard of value. The writer has no axe to grind or personal interest to serve, in fact his personal income is made up of more or less fixed fees and a small interest in a gold producing property, from which the income has fallen from a reasonable sum to almost nothing. It is therefore plain that the writer's personal interest will be adversely effected by any adoption of his suggestions, but believing that the welfare of humanity should come before personal interest, the writer thanks you for the attention you have given to his paper and hoping that you will all do your bit in attempting to solve this problem, having as our motto, " The greatest good to the greatest number."

Winnipeg, October 10th, 1918.

P.S. The above paper was entirely the result of the personal observations and deductions of the writer, who at first thought that there might be some original ideas expressed in the same, but after submitting the same to a number of friends, the writer learned that this is a pretty old subject and that as early as 1825, Lowe & Scrope of England advocated the idea of the " Multiple " Standard and since that time numerous writers have advanced the same idea. Among those were Jevons about 1865, Simon Newcombe, the astronomer, Alfred Russell Wallace, the naturalist and at the present time it is a very live question among political economists of whom the recognized leader is Professor Irving Fisher of Yale University. He has on the press at the present time a book on this subject. In 1918 he issued a phamplet on the same subject called " Stabilizing the Dollar in Purchasing Power," published by E. P. Dutton & Co., 681 Fifth Ave., New York. Professor Fisher's arguments are very similar to those given above. His remedy however, is much bolder and far reaching. In brief he proposed to do away with the coinage of gold into money and legally changing the weight of gold that represents a dollar as the purchasing power of gold varies as is indicated by " Index Number " kept by the department of labor. This plan is endorsed by a large number of college presidents, professors, lawyers, bankers and business men, and has the advantage over the plan suggested by the writer, that it not only remedies the troubles of those who make time contracts but it at once stabilizes the value of fixed incomes, such as salaries of officers and others working for more or less fixed salaries, but more important it stabilizes the incomes of all businesses that receive their income from more or less fixed rates, such as railway, street car companies, telephone and telegraph companies, the only adverse feature that I can see is the effect that the constant changing of the weight of gold in a dollar will have on our foreign exchange. This however, is a small matter compared with the benefits to be gained from having a dollar of uniform purchasing power and I do hope to see this plan endorsed by this Institute in the near future when the members have had time to properly study the question.

Winnipeg, Feb. 1st, 1919.

Shifting a Gas-Holder.

An engineering undertaking, worthy of note by reason of its unusual character, is reported from Portland, Ore., U.S.A. The problem was to transport a complete gas-holder from one location to another — a distance of three miles having to be covered by water-carriage. The holder is 70′ in diameter and 75′ in height, and weighs 300 tons. It was first lifted a height of 15′ and loaded on rollers; then it was moved two blocks of houses north and two east, and lowered from the street to dock-level, a distance of 28′. Here it was rolled on to two barges lashed together, using hardwood rollers with block and tackle, and a large gasoline engine. The barges were then towed three miles to the North-west Steel Shipbuilding plant, where the holder was unloaded and raies 26′, moved across newly made ground a distance of 2,000′, crossing on the way a line of railway, and placed on its new foundations. The whole of this work was done in 71 days.

* *

Reinforced-Concrete Transmission-Poles.

In 1917-18 a high-tension transmission-line of 40 km. length was constructed from Striesen to Dresden for 60,000 volts using reinforced-concrete poles.

The poles were constructed by a centrifugal process by Dyckerhoff and Widmann, of Dresden. Their height varied between 15 and 18m. In the longer poles joints had to be made by iron rings fixed in position by screws. Photographs of the poles are reproduced.

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

Vol. II. November 1919 No. 11

President Leonard's Message

In the Bush, Sept. 16, 1919.

To the Members
The Engineering Institute
of Canada.

Affiliates of Branches

The President desires to call the attention of members of Branches to the desirability at the present time of increasing the number of affiliates.

In the Charter By-Laws etc. 1918 page 15, Sect. 50 under " Membership " is the following:—

" In addition Branches may at their option admit persons not members of *The Institute* who shall be termed " Affiliates of the Branches."

In the proposed standard Branch By-Laws published by headquarters under "Membership," section (b) reads as follows:—

" Any person interested in the engineering profession may become an "affiliate of the Branch." Affiliates shall be elected by vote of the Executive Committee upon nomination by two corporate members of the Branch. The fee shall be per year which shall include the annual subscription of $2.00 for *The Journal* of *The Institute.* Affiliates may attend all meetings of the Branch but shall not discuss or vote upon any matter affecting the administration of the Branch."

The Institute now has seventeen Branches located at the principal industrial centres from Halifax to Victoria and a number more in early prospect.

All engineers who have had actual charge of public works or of industrial establishments realize how much we owe to the individual walking bosses, mine captains, foremen and skilled mechanics for intimate knowledge of many details which is so essential to the successful professional engineer. As individuals we reciprocate by helping them with their problems. Can this mutual assistance not be greatly increased by more generally welcoming these men into our ranks as " Affiliates of Branches ?"

Before *The Institute* had Branches and a *Journal* of its own it had nothing to offer to such a class of membership; but under present circumstances the advantages we have to offer to affiliates are real and apparent.

The advantages to the present membership of *The Institute* are — as stated above — organized and regular interchange of professional and technical knowledge, and greater importance and influence of our *Institute* and of its membership in the national life.

In these times of class controversies it is well for members of the engineering profession to realize the unique position they hold as being members of the only organization, nation wide, which can be considered as representative of the great majority of the population which excludes capitalists and workmen in the Trade Union sense of the term. *The Institute* is almost exclusively made up of salaried men in intimate business relationship daily with " capitalists " and " workmen " understanding from personal knowledge and experience the problems of both and in a position to sympathize with both. From this point of view also there is an added link of interest between the professional engineer and the affiliate which should be made much of for the welfare of Canada as a whole.

Educational Films Available

In order to vary the programme of branch meetings it will be of interest to branch members to learn that films of an educational character are available through the Bureau of Commercial Economics, Department of Public Instruction, Washington, many of which deal with various industries and offer a new source of interest to gatherings of engineers.

The Bureau of Commercial Economics is an altruistic association using the facilities and instrumentalities of governments, manufacturers, and educational institutions in the disseminating of useful information by the graphic method of motion pictures displayed invariably to audiences admitted free. The use of the films are subjected to the following stipulations: payment of transportation charges from and to the distributing center, the films shall be used on standard motion picture projectors handled by competent operators, a report of the films used and attendance shall be mailed after each performance to the distributing center, the films shall be returned immediately after use, no admission fees to the public are permitted to be charged nor are collections during or after the exhibition permissible from the public, and, no fee is charged or accepted for the use of the films of the Bureau.

A list of the visatures available may be had from A. Maris Boggs, Dean of the Bureau.

Engineer Gets Important Diplomatic Appointment

In the language used in Washington last year at one of the Niagara Hearings before the House of Representatives' Committee on Foreign Affairs, a gentleman there described as " a very able engineer," has just lately been appointed to represent Canada in connection with a large and important work which will doubtless soon be actively in hand.

The gentleman in question is W. J. Stewart,M.E.I.C., Chief Hydrographer of the Naval Department, and the work is the preparation, in collaboration with Gen. Keller of the Corps of Engineers of the U. S. Army, of a Reference to be submitted jointly by the Canadian and United States Governments to the International Joint Commission in connection with an investigation into the deep water canalization of the St. Lawrence river, together with the development of power thereon. This reference is being made partly in pursuance of a resolution of last year's Congress asking that the matter be investigated, and partly that one comprehensive scheme of development may be settled upon before any further rights, public or private, are granted for power developments. Obviously the question is one of tremendous importance from every side, engineering, commercial, navigation and power, and it is expected that as soon as the terms of the proposed Reference have been settled and the Reference made, the matter will be gone into very fully from every point of view, so that a complete and final international plan for the navigational and power development of the St. Lawrence may be evolved.

Another recent appointment of Mr. Stewart's is that of Canada's representative in drafting the final agreement with the United States on the Lake of the Woods reference. This reference, which has been recently reported upon by the International Joint Commission, is but one of the many international questions on which Mr. Stewart has acted as Consulting Engineer to the Department of External Affairs.

The Journal and Mr. Stewart's fellow members of *The Institute* extend him their congratulations on the above two appointments.

Ontario Provincial Meeting

At a meeting of the officers of the Ontario Provincial Division held at the University Club, Toronto on Friday, October 24th, it was decided to call a meeting of the Executive of the Provincial Division to be held on Saturday afternoon, November 22nd, at 3.00 P.M., at the Engineers' Club, Toronto. The Executive of the Ontario Provincial Division consists of:—

His Royal Highness the Prince of Wales, Honorary Member of the Engineering Institute of Canada, elected by Council on October 28th whose gracious acceptance of Honorary Membership has been received.

Chairman, J. B. Challies, M.E.I.C.; Vice-Chairman, E. R. Gray, M.E.I.C.; Secretary-Treasurer, Geo. Hogarth, M.E.I.C. Councillors:—President, R. W. Leonard, M.E.I.C.; Vice-President, H. E. T. Haultain, M.E.I.C; Prof. Peter Gillespie, M.E.I.C., Toronto; G. A. McCarthy, M.E.I.C., Toronto; John Murphy, M.E.I.C., Ottawa; James White, M.E.I.C., Ottawa; M. H. Macleod, M.E.I.C., Toronto; G. Gordon Gale, M.E.I.C., Ottawa; W. A. McLean, M.E.I.C., Toronto.

Major W. H. Magwood, A.M.E.I.C., Cornwall; G. R. Munro, A.M.E.I.C., Peterboro; J. L. Morris, M.E.I.C. Pembroke; R. J. McClelland, A.M.E.I.C., Kingston; G. H. Bryson, A.M.E.I.C., Brockville; A. C. D. Blanchard, M.E.I.C., Niagara Falls; T. H. Jones, M.E.I.C., Brantford; J. L. Weller, M.E.I.C., St. Catharines; S. B. Clement, M.E.I.C., North Bay; James A. Bell, M.E.I.C., St. Thomas; R. L. Dobbin, M.E.I.C., Peterboro; L. M. Jones, M.E.I.C., Port Arthur; V. A. Belanger, A.M.E.I.C., L'Orignal.

The latest Honorary Member of the Institute His Royal Highness the Prince of Wales in a characteristic position now familiar to Canadians.

Compensation of Engineering Services

Since the last issue of *The Journal* went to press there has been received at headquarters a memorandum from Alfred D. Flinn, Secretary of Engineering Council, headed Compensation and Classification of Engineers, which deals with the work of the Committee of Engineering Council and also embodies a summary of a report from the chairman of the Council's Committee on this subject. One feature which is of outstanding interest in the report referred to is the reports from the various departments of the railroads, Federal Governments, State and Municipal Governments in respect to the morale of the service.

In the case of 8 services the morale is reported to be good but in most of these it appears that the organization reported is a new one or that radical changes in compensation have recently been effected. In 20 reports no comment is made as to the present morale while in 17 instances the general conditions are said to be as follows:

"Morale would be improved if adequate salaries were allowed."

"Practically all men are clamoring for more pay, but as our budget was fixed while the country was at war we are unable to secure the additional funds necessary to raise salaries further."

"Impossible to hold first class men at these rates. Morale is generally good."

"All want more money. Dissatisfied on account of low pay."

"Our organization is in a condition of unrest and change owing to small appropriation."

"Loyal enough generally, but dissatisfied with pay, and accept better offers readily. Difficult to fill their places at same rates."

"Excellent, but all employees desire increase in compensation over that already granted. New men cannot be obtained at previous salaries."

"Dissatisfied with present compensation."

"Force depleted. Employees leaving to take positions at greater compensation. Men remaining uneasy and dissatisfied."

"I might say that I thoroughly agree with the men in New York City who demand a flat raise of $500. yearly in all classes of the service."

"There is a decided spirit of unrest and dissatisfaction due to the fact that engineering salaries have not been increased in proportion to the advance in the cost of living, and to salaries and wages paid to non-professional men and skilled labor."

"Rate of pay tends to drive more active and self-reliant younger men out of this service — lowering general average."

"Majority of men feel they are underpaid."

"Lack of consideration for services rendered has discouraged the force."

"A general increase of $150. to $400, effective Sept. 16, 1919, has improved the morale of the force, which was affected both by a general reduction of force and the economic situation."

"Increasing restlessness on the part of the entire force due to lack of proper salary increases to meet growing expenses."

"While men for the most part do their work satisfactorily, there is a general feeling of unrest and discouragement as the result of what they consider failure to recognize their efforts."

Impurities and Clinkering in Coal.

Tests made by the Illinois Central Railroad show that when coal is high in sulphur and lime in proportion to the silica, iron oxide and alumina present, the ash fuses at about 2,200 °F., whereas in the converse case no clinkering occurs even at 2,900 °F. However, the clinkering tendency can be counteracted by increasing the draught so as to keep the temperature in the fire bed below the fusing point of the ash. Such coals should therefore be consumed in shunting engines, local freight engines and for other light work.

Toronto Branch Salary Schedule

At the opening meeting of the session of the Toronto Branch the report prepared by the Salaries Committee of the Branch dealing with the Classification of Engineering Organizations and proposed Qualifications and Remuneration for Engineering Services was presented. This Committee has been at work continuously since its appointment on March 5th last and has spent a great deal of time and energy in the consideration of this subject, which at the present time is of vital interest to all members of the profession. The Committee is composed of the following members of the Toronto Branch;— George T. Clark (Chairman), H. A. Goldman (Secretary), A. F. Stewart, Professor Arkley, E. G. Hewson, F. B. Goedike, G. G. Powell, Thomas Taylor, N. L. Crosby, James Milne, Lieut.-Col. H. J. Lamb, and Ex-Officio A. H. Harkness and W. S. Harvey.

It has been stated that this salary schedule is based on the pre-war cost of living and does not take into account the very great increase which has occurred during that period. It represents the advice of many engineers and is presented by the Toronto Branch to the membership in general in the hope that sufficient discussion may be aroused on this subject and that it will result in *The Institute* taking a definite stand regarding the adoption of recommended schedule of salaries for the Engineering profession throughout Canada.

Classification of Engineers Employed in Railway Work

1. Chief Engineer.......... $10,000.00

2. Assistant Chief Engineer.......... 7,200.00

3a. Engineer of Maintenance.

Should preferably be a graduate from an engineering school recognized by *The Institute* and should have 8 to 10 years practical experience in engineering work, or, if not a graduate should have from 12 to 15 years practical experience and should be thoroughly familiar with the mathematics of engineering.......... 6,600.00

3b. Engineer of Construction.

Same qualification as for Engineer of Maintenance.......... 6,600.00

3c. Bridge Engineer.

Same qualification as for Engineer of Maintenance.......... 6,600.00

3d. Principal Assistant Engineer.

Same qualification as for Engineer of Maintenance.......... 6,000.00

4a. District Engineer.

Should preferably be a graduate from an engineering school recognized by *The Institute* and should have 6 to 8 years practical experience in engineering work, or, if not a graduate, should have from 10 to 12 years practical experience and should be familiar with the mathematics of engineering.......... 4,800.00

4b. Signal Engineer.

Should preferably be thoroughly familiar with the theory and practice of signalling and of train operation, and should have had, in addition, at least five years practical experience in mechanical and electrical signal work on railways.......... $4,800.00

4c. Architect or Engineer of Buildings.

Should have sufficient architectural training to design railway stations, shops, round houses, dwellings, etc., of normal types, and should have 6 or 8 years practical experience in responsible design of railway buildings.......... 4,000.00

4d. 1st Assistant Engineer.

Same qualification as for District Engineer. 4,200.00

4e. Assistant Bridge Engineer.

Should preferably be a graduate engineer with from 5 to 6 years practical experience in the office and in the field.......... 4,800.00

5a. Division Engineer.

Should preferably be a graduate engineer with 3 or 4 years experience of practical engineering, or, if not a graduate, should have 8 to 10 years practical experience and should be well grounded in the mathematics of engineering.......... 3,600.00

5b. 2nd Assistant Engineer.

Same qualification as for Division Engineer. 3,000.00

5c. Chief Draughtsman.

Should have a thorough knowledge of general draughting, but not necessarily knowledge of design, and should be able to control a number of subordinates and supervise their work.......... 2,500.00

5d. Designing Engineer in Structural Department.

Should be thoroughly grounded in the theory of design and detail in his particular department, and should be able to control a number of subordinates and supervise their work.......... 3,600.00

5e. Leading Draughtsman in Architectural Department.

Same qualification as given for Leading Draughtsman in Structural Department. 2,400.00

5f. Signal Supervisor.

Should be thoroughly familiar with the mechanical and electrical details of signalling, should have sound elementary knowledge of the principles of signalling and should be qualified to carry out and supervise construction and maintenance of all types of signal plants.......... 2,400.00

6a. Resident Engineer (Construction only).

Should preferably be Graduate Engineers or have 3 or 4 years practical experience in the junior branches of Engineering work. exp. $2,700.00

6b. 3rd Assistant Engineer.

Same qualification as for Resident Engineer. 2,400.00

6c. Draughtsman.

Should be able to plot accurately from field notes or notes and sketches supplied to him by a Senior Officer............... 1,800.00

6d. Inspector — Class A.

Should have a thorough knowledge of the class of work that he is employed to inspect and in the case of steel or reinforced concrete structures, should be a man of sufficient intelligence to understand the elementary principles of design and realize the necessity for close adherence to plans, and must be able to read and interpret plans correctly................. exp. 2,400.00

7a. Junior Assistant or Instrument Man.

Should have sufficient training in the use of level, or transit, or both, to do accurate work at a reasonable rate of speed, and should be thoroughly grounded in the mathematics required for the proper reduction and application of his instrumental work.......................... exp. 1,800.00

7b. Inspector — Class B.

Should have some practical experience in the class of work that he is employed to inspect, and have sufficient intelligence and firmness to enforce the carrying out of specifications....................... 1,800.00

7c. Junior Draughtsman.

Should have passed through his training as a Tracer, and should have working knowledge of the use of draughting instruments.. 1,500.00

8a. Chainman.

No previous experience required........... 1,200.00

8b. Rodman.

No previous experience required........... 1,500.00

8c. Tracer.

No previous experience required........... 1,200.00

Classification of Engineers Employed in Municipal Work

1. Chief Engineer of Municipality.

1a. Cities greater than 300,000.

Should preferably be a graduate from an engineering school recognized by *The Institute* and should have had 15 years practical experience covering two branches in municipal engineering, and should have served for about 5 years in the capacity of Deputy City Engineer, or of First Assistant in municipalities of over 300,000, or as Chief Engineer in municipalities of over 100,000 and should possess proven executive ability...................... 12,000.00

1b. Cities 100,000 to 300,000.

Should preferably be a graduate with 10 years experience covering two branches in municipal engineering, 3 years of his experience should be in the capacity of either one of the following: — Chief Engineer in municipality of over 50,000— First Assistant in municipality of over 100,000 — or Second Assistant in municipality of over 300,000, and should possess proven executive ability........ $8,000.00

1c. Cities less than 100,000 and towns graded according to population into:—

1. 50,000 to 100,000.

Should preferably be a graduate with 8 years experience in municipal engineering, 2 years of which should be in the capacity of any one of the following:— Chief Engineer in city of over 10,000 — First Assistant in city less than 100,000 — or Second Assistant in city under 300,000 and should possess proven executive ability............................... 6,600.00

2. 25,000 to 50,000.

Should preferably be college graduate or licensed Land Surveyor with 5 years experience in municipal engineering and possess proven organizing ability........ 5,400.00

3. 10,000 to 25,000.

Should preferably be college graduate or licensed Land Surveyor with 3 years experience in municipal engineering or should have completed apprenticeship to municipal engineer and subsequently was placed in responsible charge of engineering work, must have ability to handle men................................. 4,200.00

4. Less than 10,000.

Same qualifications as for cities between 10,000 and 25,000 unless work is confined to routine construction and maintenance, in which case he should have had 5 years experience as First Assistant in similar work, and should have ability to handle men................................. 3,000.00

1d. Other Municipal Engineers, (employed part time) Daily Rate.

Land Surveyors — requirements prescribed by law. For routine construction and maintenance, qualification to be same as for Chief Engineer of city less than 10,000. Other casual work probably done by Consulting Engineers................

2. Deputy City Engineer, or Principal Assistant, in cities over 300,000.

Same qualification as for Chief Engineer in city of from 100,000 to 300,000.......... 8,000.00

3. First Assistants, having charge of Roadways, Sewers, Water Works, Light, Transportation, Structures, Testing and Inspection.

3a. Any one of above in cities over 300,000.

Should preferably be a graduate with 8 years experience in municipal engineering, 4 years of which should have been in the capacity of First Assistant in municipality of 100,000 to 300,000, or, as Second Assistant in municipality of over 300,000, should be able to handle office, construction and maintenance forces............ $5,000.00

3b. One or more of above in cities 100,000 to 300,000.

Should preferably be a graduate with 6 years experience in engineering, 2 years of which should have been in the capacity of First Assistant in city of less than 100,000, or, as Second Assistant in city of over 100,000, should be able to handle office, construction and maintenance forces............ 4,000.00

3c. One or more of above in cities less than 100,000.

Should preferably be a graduate with 4 years experience in engineering, 2 years of which should have been in the capacity of Second Assistant, and should be able to handle office, construction and maintenance forces.............................. 3,000.00

4. Second Assistants, reporting to the First Assistants in larger municipalities, and to the Chief Engineer in smaller municipalities. In responsible charge of:—

4a. Design, Drafting and Engineering Records.

1. Cities over 300.000.

Should preferably be a graduate with 6 years experience in engineering, 4 years of which should have been as Second Assistant in city under 300,000 or as Resident Engineer on construction with designing experience, or as Designer, should be able to handle office staff for designing, drafting and keeping of records..................... 3,600.00

2. Cities less than 300,000.

Should preferably be a graduate with 4 years experience in engineering, 2 years of which should have been either as Designer or as Resident Engineer on construction with designing experience, should be able to handle office staff for designing, drafting and keeping of record............... 3,000.00

2b. Surveys.

1. Cities over 300,000.

Should preferably be a graduate engineer or licensed Land Surveyor with 4 years experience as Instrumentman in municipal work, preferably on construction, and should he able to handle several parties and to keep them employed to advantage. 3,000.00

2. Cities less than 300,000.

Should preferably be a graduate engineer or licensed Land Surveyor with 2 years experience as Instrumentman in municipal work, preferably on construction, and should be able to handle several parties and keep them employed to advantage... $2,400.00

2c. Construction, Operation, Maintenance, (one or more).

1. Cities more than 300,000.

Should preferably be a graduate with 6 years experience in engineering, 4 years of which should have been as Inspector or as Resident Engineer on Construction, and should be able to handle construction and maintenance forces................. 3,600.00

2. Cities less than 300,000.

Should preferably be a graduate with 4 years experience in engineering, 2 of which should have been as Inspector or as Resident Engineer on construction, and should be able to handle construction and maintenance forces.................... 3,000.00

5. Resident Engineers on Construction.

Should preferably be a graduate with 3 years experience in municipal work, or should have completed apprenticeship in municipal work. Should have ability to use survey instruments, make calculations arising therefrom, and keep track of quantities and labor.................. 2,400.00

6. Designers.

Should preferably be a graduate with 4 years experience and should be familiar with the mathematics and practice of the branch of work in question.............. 3,000.00

7. Draftsmen.

Should be High School or College graduate and should be able to plot accurately from field notes and produce correct working drawings from designers sketches and computations......................... 1,800.00

8. Inspectors.

Should have a thorough knowledge of the class of work that he is employed to inspect, and in the case of steel or reinforced concrete structures, should be a man of sufficient intelligence to understand the elementary principles of design, and realize the necessity for close adherence to plans, and must be able to read and interpret plans correctly........ 2,100.00

9. Instrumentmen.

Should be High School or College graduate and should have sufficient training in the use of level, or transit, or both to do accurate work at a reasonable rate of speed, and should be thoroughly grounded in the mathematics required for the proper reduction and application of the instrumental work. In case of construction he should understand the special requirement for the class of work in question.............................. $1,800.00

10. Chainmen and Rodmen.

No previous experience required........... 1,200.00

11. Tracers.

No previous experience required........... 1,200.00

Classification of Engineers Employed in Industrial Work

A. Chief Engineer.

1a. Research Engineer.

Should preferably be a graduate from an engineering school recognized by *The Institute*, with from 10 to 15 years experience in his special line............... 10,000.00 down to 3,600.00

2a. Mechanical Engineer.

Same qualification as for Research Engineer.

3a. Electrical Engineer.

Same qualification as for Research Engineer.

4a. Chemical Engineer.

Same qualification as for Research Engineer.

5a. Metallurgical Engineer.

Same qualification as for Research Engineer.

1b. Assistant Chief Engineer in large industries only.

Preferably technical graduate with from 5 to 10 years experience—75% of Salary of Chief Engineer with a minimum of........ 3,000.00

2b. Engineer in general charge of all outside construction.

Preferably technical graduate with from 5 to 10 years experience—75% of Salary of Chief Engineer with a minimum of........ 3,000.00

3b. Efficiency Engineer. — Usually a Consulting Engineer, but occasionally on the permanent staff.

C. Designing Engineers, having responsible charge of all design, in any one of the following branches:—

50% of Salary of Chief Engineer with a minimum of........................... 2,700.00

1c. Mechanical Engineering.

Should preferably be a technical graduate with 5 years practical experience in his special line, or, should be a high school graduate with 10 years practical experience, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering..

2c. Electrical Engineering.

Same qualification as for Mechanical Engineering.

3c. Structural Engineering.

Same qualification as for Mechanical Engineering.

4c. Heating and Ventilating Engineering.

Same qualification as for Mechanical Engineering.

1d. Engineering in charge of Estimating, Figuring Costs, etc.

Should preferably be a technical graduate with 3 years practical experience in his special line, or, should be a high school graduate with 8 years practical experience, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering—35% of Salary of Chief Engineer with a minimum of............................ $2,400.00

2d. Testing Engineer, in charge of Tests.

Same qualification as for Engineer in charge of Estimating.

3c. Resident Engineer on Construction.

Same qualification as for Engineer in charge of Estimating.

4d. Chief Draughtsmen, responsible for all working drawings.

To be qualified by training and experience for the special work required of him.

5d. Designers, Assistants to Designing Engineer.

Should preferably be a technical graduate with 2 years practical experience,or should be a high school graduate with 4 years practical experience, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering..........................

1e. Estimators, Assistants to Engineer in charge of Estimating.

Should preferably be a technical graduate with 2 years practical experience, or should be a high school graduate with 3 years practical experience and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering........................ 2,400.00

2e. Squad Bosses, in charge of small squad of Draughtsmen.

Should be a high school graduate with three years practical experience, 1 year as checker, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering.

1f. Chief Shop Inspector, in charge of shop inspection.

Should preferably be a technical graduate with 1 year's experience, or should be a high school graduate with 3 years experience as inspector, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering.......................... 2,100.00

2f. Checkers, responsible for correctness of working drawings.
Similar qualification as for Chief Shop Inspector..............................

1g. Draughtsmen, making detailed working drawings.
Should preferably be a technical graduate or 3 years experience in drawing, tracing, etc.................................. $1,800.00

2g. Shop Inspectors.
Should have some practical experience in the class of work that he is employed to inspect, and have sufficient intelligence and firmness to enforce carrying out of specifications..............................

3g. Field Inspectors.
Same qualification as for Shop Inspectors..

H. Tracers.
No previous experience required........... 1,200.00

Classification of Engineers Employed on Larger Public Utilities

1. Chief Engineer.......................... 12,000.00

1. Assistant Chief Engineer................. 9,000.00

3a. Departmental Engineers having charge of surveys, specifications for and design of Hydraulic structures, drafting and Engineering records, and Hydrometric records.
Should preferably be a graduate from an Engineering School recognized by *The Institute* with from 10 to 15 years experience in his particular work............... 7,500.00

3b. Specifications for, and design of electrical work, substations, powerhouses, and switching stations.
Same qualifications as for *a*............... 7,500.00

3c. Surveys and design of transmission lines—high tension and low tension.
Same qualifications as for *a*............... 5,000.00

3d. Construction.
Should preferably be a graduate from an Engineering School recognized by *The Institute* with from 10 to 15 years experience on construction with requisite executive ability to organize and handle large forces of men on the various works indicated by *a, b, c,* above................. 7,500.00

3e. Research and Tests.
Same qualifications as for *a*............... 5,000.00

3f. Operation and Maintenance.
Same qualifications as for *a*............... 7,500.00

3g. Power Contracts.
Same qualifications as for *a*............... 5,000.00

4a. Deputy Departmental Engineers having charge of surveys, specifications for and design of hydraulic structures, drafting and engineering records, and hydrometric records.
Should preferably be a graduate from an Engineering School recognized by *The Institute* with 8 years experience in his particular work........................ $4,800.00

4b. Specifications for and design of Electrical work, substations, powerhouses and switching stations.
Same qualifications as for *a*............... 4,800.00

4c. Surveys for and design of transmission lines—high tension and low tension.
Same qualifications as for *a*............... 3,000.00

4d. Construction.
Same qualifications as for *a*............... 4,800.00

4e. Research and Tests.
Same qualifications as for *a*............... 3,000.00

4f. Operation and Maintenance.
Same qualifications as for *a*............... 4,800.00

4g. Power Contracts.
Same qualifications as for *a*............... 3,000.00

5a. Assistant Departmental Engineers having charge of:—
Should preferably be a graduate from an Engineering School recognized by *The Institute* with 4 years experience in his particular work........................ 3,600.00

5a. 1. Design of hydraulic structure and records.
5a. 2. Power surveys and field Engineering on construction.
Same qualifications as for *a1*.............. 3,000.00

5a. 3. Hydrometric investigation and records.
Same qualifications as for *a1*.............. 2,400.00

5b. (1) Specifications for and design of electrical work.
Same qualifications as for *a1*.............. 3,600.00

5b. (2) Specifications for and design of buildings.
Same qualifications as for *a1*.............. 3,000.00

5b. (3) Field Engineering on construction.
Same qualifications as for *a1*.............. 2,400.00

5c. (1) Design of high tension lines.
Same qualifications as for *a1*.............. 3,000.00

5c. (2) Design of low tension lines.
Same qualifications as for *a1*.............. 2,700.00

5c. (3) Surveys for and field Engineering on transmission lines.
Same qualifications as for *a1*.............. 2,400.00

5d. (1) Construction of hydraulic structures.
Same qualifications as for *a1*.............. 3,000.00

5d. (2) Construction of electrical work.
Same qualifications as for *a1*.............. 3,000.00

5d. (3) Construction of building.
Should be a High School graduate with 5 years experience in building trades....... 2,400.00

5e. (1) Electrical testing.
Same qualifications as for *a1* $2,400.00

5e. (2) Structural testing.
Same qualifications as for *a1* 2,400.00

5e. (3) Chemical testing.
Same qualifications as for *a1* 2,400.00

5e. (4) Field and shop inspection.
Same qualifications as for *a1* 2,400.00

5f. Operation of District or System.
Same qualifications as for *a1* 3,000.00

5g. Power Contracts of District or System.
Same qualifications as for *a1* 2,400.00

5h. Right-of-way Surveys.
Same qualifications as for *a1*, and should hold his provincial Land Surveyor's certificate. 2,700.00

5i. Cost estimates and Power estimates.
Same qualifications as for *a1* 2,400.00

6. Designers and layout men.
Should preferably be a graduate from an Engineering School recognized by *The Institute* with 2 years experience 2,400.00

7. Draftsmen, Instrumentmen and Inspectors.
Should preferably be a technical graduate or 3 years experience 1,800.00

8. Tracers and Chainers.
No previous experience required 1,200.00

Classification of Engineers Employed in Public Works

1. Chief Engineer.
Graduation in engineering from a school of applied science of recognized standing; at least twelve years of experience in engineering survey, design, estimate, and construction work, seven years of which shall have been in responsible charge of such work; thorough knowledge of Canadian engineering problems, the highest degree of administrative ability. 12,000.00

2. Asst. Chief Engineer.
Graduation in engineering from a school of applied science of recognized standing; at least ten years of experience in engineering design, estimate, construction and maintenance work, five years of which shall have been in responsible charge of such work, thorough knowledge of dredging work and the general engineering problems of Canada; ability to organize, supervise and manage large engineering works.... 8,000.00

3. Supervising District Engineer.
Education equivalent to graduation in engineering from a school of applied science of recognized standing; at least seven years of experience in engineering survey, design, estimate, construction, and maintenance work, four years of which shall have been in responsible charge of such work; considerable knowledge of marine engineering work; ability to make constructive criticisms and reports on proposed works and supervise the construction of large works $6,000.00

4. Senior Engineer.
Education equivalent to graduation in engineering from a school of applied science of recognized standing; at least seven years of experience in engineering design, estimate, and construction work, four years of which shall have been in responsible charge of such work; wide knowledge of public works construction and maintenance work and ability to manage and supervise engineering works of considerable importance 5,000.00

5. District Engineer, (Grade 2).
Education equivalent to graduation in engineering from a school of applied science of recognized standing; five years of experience in engineering estimate, survey, and construction work, two years of which shall have been in responsible charge of such work; preferably thorough knowledge of local conditions and works; firmness, tact, good judgment, and ability to manage men 4,000.00

6. District Engineer (Grade 1).
Same qualifications as for District Engineer (Grade 2) 3,500.00

7. Dredging Engineer.
Education equivalent to graduation in engineering from a school of applied science of recognized standing; at least five years of experience in engineering survey, construction, dredging, and maintenance of a dredging fleet, three years of which shall have been in responsible charge of such work; thorough knowledge of dredging operations; firmness, tact, and ability to manage men... .... 3,500.00

8. Engineer Ottawa River Storage.
Education equivalent to graduation in engineering from a school of applied science of recognized standing; at least five years of experience in engineering survey, construction, and maintenance, three years of which shall have been in responsible charge of such work; thorough knowledge of river regulation works; firmness, tact, good judgment, and ability to manage men 3,300.00

9. Senior Assistant Engineer.
Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with three years of experience in engineering design, estimate, and construction work, two years of

which shall have been in a position of professional responsibility, or five years of practical experience in engineering design, estimate, and construction work, two years of which shall have been in a position of professional responsibility; firmness, tact, good judgment, and ability to manage men.......................... $3,200.00

10. Resident Engineer.

Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with three years of experience in engineering design, estimate, and construction work, two years of which shall have been in a position of professional responsibility, or five years of practical experience in engineering design, estimate, and construction work, two years of which shall have been in a position of professional responsibility; thorough knowledge of railway and harbour works; tact, good judgment, and ability to manage men................. 3,140.00

11. Chief Draftsmen.

Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with four years of experience in an engineering drafting office, three years of which shall have been in responsible charge of such work, or six years of experience in an engineering drafting office, three years of which shall have been in responsible charge of such work; ability to visualize proposed engineering works; familiarity with various types of structures which will best serve local needs; firmness, tact, and ability to manage men.......................... 2,500.00

12. Assistant Engineer.

Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with three years of engineering experience, one year of which shall have been in a position of professional responsibility, or five years of engineering experience, one year of which shall have been in a position of professional responsibility; firmness, tact, and ability to manage men................. 2,100.00

13. Chief Inspector.

Education equivalent to graduation in engineering from a university of recognized standing; at least four years of supervisory experience in general construction work; supervisory ability, integrity, tact and good judgment; good physical condition............................. 2,100.00

14. Junior Engineer.

Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with two years of engineering experience, or four years of engineering experience in design, estimate, construction, and maintenance work............. $1,800.00

15. Inspector.

Education equivalent to high school graduation; at least two years of experience in building construction work; ability to read and interpret blue prints and to judge concrete mixtures; supervisory ability, integrity.............................. 1,800.00

16. Instrumentman.

Education equivalent to high school graduation; attendance for two years at a school of applied science of recognized standing or passing of the preliminary Dominion Land Surveyors' examination with one year of experience as Rodman or Junior Instrumentman, or three years of experience in a survey party as Rodman or Junior Instrumentman; thorough knowledge of the transit and level and ability to make all adjustments to either instrument 1,800.00

17. Draftsman.

Education equivalent to high school graduation; either attendance for two years at a school of applied science of recognized standing with one year of subsequent experience in a drafting office or three years of experience in a drafting office; ability to make neat, accurate, and complete plans and drawings from notes or sketches..... 1,500.00

18. Junior Instrumentman.

Education equivalent to high school graduation; either a course of one year in engineering in a school of applied science of recognized standing with the passing of the preliminary provincial or Dominion Land Surveyors' examination and one year of training with a survey party, or two years of training with a survey party.......... 1,500.00

19. Engineering Helper.

Preferably primary school education; willingness and energy, in some cases a good sense of direction and locations and ability to handle a boat or canoe; good physical condition.............................. 1,200.00

Large Danish Motor-Ship of Reinforced Concrete.

A new company in Copenhagen specialising in concrete ships has received an order for a vessel of 1,250 tons burden, stated to be the largest of this type yet built in the Scandinavian countries, viz., 193 ft. long by 33 ft. wide. The weight of the hull and machinery is estimated at 1,050 tons, of which 150 tons represents steel required for the reinforcement. It will be propelled by a six-cylinder Diesel motor developing 400 h.p. at 190 r.p.m. Delivery of the vessel is expected this fall.

BRANCH NEWS

Niagara Peninsula Branch

R. P. Johnson, A.M.E.I.C., Sec'y.-Treas.

Dinner, Dance—Clifton Hotel

A very enjoyable social function was held for members and ladies at the Clifton Hotel, Niagara Falls, on Saturday evening, September 20th. Thirty-four sat down to an excellent dinner in a private dining room of the hotel at 7.45 and for an hour and a half, amid the hum of voices and strains of the orchestra, a gay scene was presented. After dinner the party adjourned to the ball room and joined in the regular Saturday evening dance of the hotel. It was felt by all that an unusually pleasant evening had been spent.

Trip to the Welland Ship Canal

Forty members of the Branch gathered at Thorold early in the afternoon of Saturday, October 4th, for a trip over the Welland Ship Canal construction work.

The contractors on the rock work of Section 3 at Thorold had a shot with about three tons of dynamite all in readiness for the members to see. This was greatly admired by the spectators.

The party then boarded a flat car fitted with seats and drawn by a locomotive over the construction railway. An excellent view of the whole work between Thorold and Lake Ontario was obtained from the car and Members of the canal staff explained the various features as they were passed. A stop was made at the large stone crushing plant and this was throughly inspected from the large primary, gyratory crusher, the elevating system, smaller secondary crushers, conveyors, tailing crushers and finally the screens, bins, and stone storage piles. The second stop was on Section 2 where the foundations for two bridges and the canal prism excavated to grade were viewed. The third and longest stop was made at lock one near the lake. This structure is nearly complete and proved of great interest to the members. Considerable time was spent in examining the many features of this gigantic concrete structure and in hearing the explanations of the hydraulic, mechanical and structural problems involved in its design and construction. The train was again boarded and the party taken out on one of the great new earth piers that form the new Lake Ontario harbour. From here the harbour and dredging equipment were inspected along with the piles of sand for use in making concrete.

The party returned to Thorold by the sight-seeing train and all were unanimous in their thanks to the canal engineers for a profitable and instructive afternoon and for providing very effective and enjoyable means of transportation over the work.

* * *

Toronto Branch

W. S. Harvey, A.M.E.I.C., Sec'y.-Treas.

Under date of October 15th a circular was sent to the members of the Toronto Branch asking for nominations under Section 1, clause five of the By-Laws of the Branch, for the offices of Chairman, Secretary-Treasurer and three committee men for the coming year, nominations to be in the hands of the Secretary-Treasurer on or before the first day of November. All nominations to be entertained must be made in writing and signed by the least five corporate members. The retiring members of the Executive Committee, all of whom may be re-elected for the year, are:— J. R. W. Ambrose, Professor H. E. T. Haultain and R. O. Wynne-Roberts.

The initial meeting of the session was held at the Engineers' Club on October 16th, with the Chairman of the branch, A. H. Harkness, M.E.I.C., in the Chair. After the reading of the minutes of the previous meeting, which were approved, George T. Clark, M.E.I.C., Chairman of the Salaries Committee presented the report and salary schedules. This report dealt with the classifications, qualifications and proposed salaries for engineers employed in the following organizations, viz;— Railways, Municipal, Industrial, Public Utilities and Public Work, which were discussed in the order mentioned. A few amendments to the Committee's report were made and the report as ammended adopted.

The interest which was shown at the first meeting of the branch is a hopeful augury for the coming series of meetings which the branch proposes to hold. It is noted with pleasure that the younger members of the branch are taking a more active part than ever before in its affairs and they are making their influence felt in many ways in connection with the Branch's activities.

Toronto Branch Committees

The Committees of the Toronto Branch, together with the object of these Committees and the date of their appointment is as follows:—

Object of Committee	When Appointed 1919	Members of Committee
To review and discuss the Toronto Branch By-laws.	Feb. 1st.	A. H. Harkness (Chairman) Professor Gillespie Geo. Hogarth R. O. Wynne-Roberts W. S. Harvey.
To review the City of Toronto Building By-laws.	Feb. 1st.	A. H. Harkness (Chairman) Professor Gillespie Geo. T. Clark.
Finance Committee.	Feb. 1st.	A. H. Harkness W. S. Harvey.
To collect back dues.	Feb. 28th.	E. M. Proctor (Chairman) F. B. Goedike G. R. T. Jack.
Toronto Branch Representative on the Joint Committee of Technical Organizations.	Mar. 5th.	H. G. Acres.
Salaries Committee.	Mar. 5th.	Geo. T. Clark (Chairman) H. A. Goldman (Secretary) A. F. Stewart Professor Arkley E. G. Hewson

		F. B. Goedike G. G. Powell Thos. Taylor N. Leroi Crosby Jas. Milne Col. H. J. Lamb T. H. Hogg Ex-Officio A. H. Harkness W. S. Harvey
Fees Committee.	Mar. 5th.	Frank Barber (Chairman) J. G. G. Kerry E. A. James Geo. Power P. H. Mitchell A. L. Mudge A. H. Harkness W. S. Harvey
Employment Bureau.	Mar. 5th.	E. T. Wilkie (Chairman) Wm. Cross (Secretary) T. H. Hogg A. L. Mudge R. T. G. Jack R. O. Wynne-Roberts
Toronto Branch Representative on Legislation Committee at Montreal.	Mar. 5th.	Willis Chipman.
Toronto Branch Representative on J.C.T.O. sub-committee regarding "status of the engineer."	June 2nd.	Willis Chipman.
To consider the draft Bill concerning Legislation for Engineers.	June 12th.	J. C. Krumm (Chairman) E. T. Wilkie (Secretary) Willis Chipman Professor Haultain H. A. Goldman L. I. Stone Chester B. Hamilton.

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Ottawa Branch

M. F. Cochrane, A.M.E.I.C., Sec'y-Treasurer

The luncheon on October 18th, given by the Canadian Club of Ottawa to General C. H. Mitchell, C.B., C.M.G., D.S.O., was attended by many local members of *The Institute* who have followed the General's career at the front with much interest and were anxious to greet him on his return to civil life.

The subject of General Mitchell's address was "Reconstruction and Civic Development," and this luncheon formed part of the program of the Conference on "Town Planning," held in Ottawa on the 17th and 18th of last month.

Another item on the program which was largely attended by branch members was Noulan Cauchon's paper on the "Planning of Ottawa," a subject very near to all our members.

The program for the winter months is now being arranged; the first luncheon meeting being held on November 4th, when J. Grove Smith will address the members on "Fire Prevention."

G. J. Desbarats, C.M.G., Deputy Minister of the Department of Naval Service has authorized the publication of information prepared by Wm. J. Stewart, M.E.I.C., Chief Hydrographer of the Department of Naval Service in connection with the service of hydrographic officers of the Dominion Government with the Admiralty during 1918-1919.

In February, 1918, the Department of Naval Service learned that the Hydrographic Office of the British Admiralty was rather short of surveyors and advised the Hydrographer, Admiral Parry, that if necessary the Department could spare some of its staff from the Hydrographic Survey, for service in connection with the war.

This offer the Admiralty gladly accepted and granted commissions in the R.N.V.R. to Messrs. Robert J. Fraser, John L. Foreman, Lloyd C. Prittie, Murdock A. MacKinnon, Clifford G. Smith and Walter K. Willis, in 1918.

O. R. Parker, who was a Royal Naval Reservist before the war was put in general service and later appointed to H.M.S. "Endeavour" in the Mediterranean. After considerable service there he was transferred to home waters and served in the Straits of Dover on the Surveying Trawler "Esther," and after the armistice to service mine clearing off the Yorkshire coast. He returned to Canada in August 1919.

C. G. Smith originally with the Canadian Expeditionary Force and after transfer to the Surveying Service of the Admiralty was employed at various points off the English and Scottish coasts in connection with harbour improvement and aids to navigation demanded by the war. He also saw service on surveying ships mine laying.

L. C. Prittie was appointed to the H. M. S. "Endeavour" in the Mediterranean, operating in the vicinity of Malta. After the collapse of the Turks they were ordered to the Aegean and later to the Dardanelles where they prepared an anchorage and laid moorings for the Allied fleets off Constantinople. Just previous to this service the Commanding Officer of the "Endeavour" was killed on some special duty. Mr. Prittie also saw service on the Egyptian and Palestine coasts and returned to Canada in the early summer of 1919.

J. L. Foreman was appointed to the H. M. S. "Hearty" engaged in the lengthy and difficult re-survey work in the waters of The Wash on the east coast of England. Later the ship and party were transferred to the Scottish coast working out of Inverness and Aberdeen. He returned to Canada in the spring of 1919.

M. A. MacKinnin went originally overseas with the Canadian Expeditionary Force and was transferred early in 1918 to the Admiralty surveying service employed in the Firth of Forth.

R. J. Fraser was at first attached to the H. M. S. "Osea" Coastal Motor Boat Base on the Essex coast, as Assistant Surveying Officer to Lieut. Commander Maxwell, R. N. During the summer of 1918 he was appointed to the Submarine Boom Defence at Brigthlingsea and put in charge of surveying in the Thames Estuary until the Armistice was signed. In November 1918 he and Mr. MacKinnin were appointed to the newly commissioned surveying ship "Melisande" and worked throughout the winter and spring at Folkestone in the Straits and the Medway river surveying channels and mooring berths for the laying up of the Nore Reserve Fleet and sounding out the Thames Estuary. In June 1919 they were appointed to the H. M. S. "Kellett", the first of the new class of surveying ships designed to replace the ancient vessels still in service. They joined their ship on the Clyde and proceeded to Chatham where the ship was prepared as an exhibit for the visitation of the Inter-Allied Conference of Hydrographers on the 1st, July. They made a survey of the approaches to Chatham Dockyard in connection with the berthing of the " Queen Elizabeth " class of battle ships. They returned to Canada on the completion of this work.

W. K. Willis went overseas in November 1919, there still being a shortage of trained Admiralty surveyors. He was appointed to the H. M. S. "Hearty" and worked off the east coast of England and Scotland in connection with the mine clearance work in these waters, returning to Canada in July, 1919.

Much valuable experience was gained by all the Canadian surveyors whilst employed with those of the Royal Navy. Besides being surveyors they had at all times the many responsibilities of watch-keeping officers, both at sea and in harbour, and quite often were in sole command of their respective ships. The interchange of ideas and insight into the methods of working and the standards of accuracy adopted by the surveyors of the two countries will go far in the future towards a clearer understanding of each others work. Fundamentally the methods are the same, but in the matter of detail and the means employed to obtain the same desired result they naturally differ somewhat.

* * *

Montreal Branch

Frederick B. Brown, M.E.I.C., Sec'y.-Treas.

The Montreal Branch Executive has been working throughout the summer in order to prepare a programme for the present session, to help to increase the efficiency of the meetings and the comfort of the members.

It has had a number of meetings since September and has arranged committees for the ensuing year. These are as follows:— Chairman, Walter J. Francis, Vice-Chairman, Arthur Surveyer, Secretary-Treasurer, Frederick B. Brown; Executive Committee, H. G. Hunter, K. B. Thornton, F. P. Shearwood, J. Duchastel, W. C. Thomson, S. F. Rutherford; Papers and Meetings Committee, John T. Farmer, Chairman; Industrial Section, S. F. Rutherford, H. G. Hunter; Electrical Section, J. A. Burnett, E. T. Mug; Mechanical Section, Fred. Newell, J. W. McCammon; Civil Section, O. O. Lefebvre, G. R. Macleod; Reception Committee, J. L. Busfield, Chairman, P. A. Beique, Jos. Labelle, J. C. Kemp, H. L. Mahaffy; Special Service Committee, F. P. Shearwood, Chairman, G. K. McDougall, V. I. Smart, R. M. Hannaford; Publicity Committee, K. B. Thornton, Chairman, H. G. Hunter, E. S. M. Lovelace with the Chairman and Secretary of the Branch.

The programme for the first part of the session, October to December has been published. The following are the arrangements contemplated:— October 16th, Malleable Iron, by W. G. Dauncey, C. E., (Chairman, Mr. Francis); October 23rd, Grain Dust Explosions; Their Cause and Prevention, by J. A. Jamieson, M.E.I.C., (Chairman, Mr. Surveyer); October 30th, Centrifugal Process of Casting Pipe, by D. deLavaud, (Chairman, Mr. Newell); November 6th, Visit to St. Lawrence Sugar Refinery with Explanatory Talk, by J. J. York, A.E.I.C.; November 13th, Recent Progress in Wireless Telegraphy, by J. O. G. Cann, (Chairman, Mr. Burnett); November 20th, Automatic Fire Sprinkler Systems for Low Temperature Buildings, by Major Percy Sims, (Chairman, Mr. Rutherford); November 27th, Railway Track, Design and Manufacture, by W. E. L. Dyer, A.M.E.I.C., (Chairman, Mr. McCammon); December 3rd, Mechanical Stokers, Illustrated Lecture, by Combustion Engineering Corporation, (Chairman, Mr. Hunter); December 10th, Paint for the Protection of Steel Work, by John Grieve, A.M.E.I.C., (Chairman, Mr. Lefebvre); December 17th, The Modern Tramway Car, by D. E. Blair, A.M.E.I.C., (Chairman, Mr. Mug.)

It is hoped that motion pictures of industrial subjects and of natural resources will be shown at special meetings and arrangements are being made to obtain from the Canadian and United States Governments and industrial firms a number of suitable films.

The Secretary of the Montreal Branch has sent copies of the programme to the Secretary of every other branch and the Branch Executive will be glad to be of any assistance possible in connection with arranging branch meetings elsewhere.

The opening meeting was held on the evening of Thursday, October 16th, at which there were one hundred and ten present. W. G. Dauncey lectured on Malléable Iron and Walter J. Francis, Chairman of the Branch, presided.

In his preliminary remarks, Mr. Francis welcomed the members and the students of McGill University, the latter, he hoped, would become members in due course. The last season of the Branch was very successful and he looked forward to similar success for the current season. He introduced Mr. Dauncey as an eminent English metallurgist, who had done much, in a professional way, to win the war.

Mr. Dauncey in the opening part of his talk, sketched very briefly the history of the iron industry, from the making of the rough implements from meteoric iron, to the building of small forges, and to the construction of blast furnaces. He incidentally mentioned that the manufacture of cast iron was due to a change. Following a description of a modern blast furnace, Mr. Dauncey spoke of the manufacture of pig iron, and the malleable and puddling processes, open hearth, and electric furnaces.

There were, he said, four methods of manufacturing white iron into malleable castings — crucible, cupola, air furnace, and open hearth furnace. The advantages and disadvantages of each were enumerated, together with the precautions necessary to make good castings. The air furnace process was splendid, but was expensive as to upkeep. The iron was very satisfactory, but there was a drawback in this respect, the metal on the top might be hot in the middle comparatively cold. He advocated the use of three tap holes, so that three charges could be tested and drawn off. The open hearth method was admirable for large quantities, but must be in continuous operation.

The annealling process changed completely the chemical form of the iron. The best period of duration of time for the process was sixty hours, while the taking up and down of the temperature were the most important and critical stages of the process.

Mr. Dauncey then contrasted the European and American systems of manufacture, and went to say that the true position of malleable iron was between cast iron and steel. In some respects, notably in standing strains, it was better than steel. If American metallurgists had devoted as much attention to malleable iron as they had to steel, the former would now be in much more extensive use. Wrought iron, cast iron, malleable iron and steel had each the particular field, and these should not be confused. Let men who understood malleable iron design malleable iron for malleable iron purposes.

A discussion followed, in which Messrs. Dyer, R. A. Ross, F. B. Brown, J. Farmer, Mr. Groves and Mr. Fisher took part.

At this meeting the following resolution was passed:—moved by S. F. Rutherford, seconded by Major McKergow and carried: That this meeting of the Montreal Branch of *The Engineering Institute of Canada* record with much pleasure the honor conferred to-day upon our fellow member, Past President G. H. Duggan, of the honorary degree of Doctor of Laws by Queen's University, and that we extend to him our heartiest congratulations upon this signal mark of the high place he has achieved in learned circles in Canada.

* * *

At the meeting held on the 23rd instant there were one hundred and twenty-five present. J. A. Jamieson, M.E.I.C., presented a paper on Grain Dust Explosions, Their Cause and Prevention, dealing with the technical side of dust explosions with its bearing on the Port Colborne disaster which occurred on August 9th, Mr. Jamieson having made an investigation the following day. He gave a detailed description of the Port Colborne elevator, which he himself had designed and also gave the result of his investigations after the explosion.

Mr. Jamieson's paper occupied the entire evening and in view of its excellence it was decided to make a change in the regular programme to allow of a discussion. The meeting on the 30th instant will therefore be a discussion on Mr. Jamieson's paper instead of Centrifugal process of Casting Pipe, by D. deLavaud, which had been scheduled for that day.

REPORT OF COUNCIL MEETING

Owing to the lateness of the Council meeting this month it was impossible to have a full report published.

His Royal Highness, The Prince of Wales was elected to Honorary Membership.

The establishment of a branch of *The Institute* at Peterborough was approved and it was noted that the local engineers desired officers of *The Institute* to be present to make the inauguration on November 6th a notable event. A number signified their intention of attending the opening meeting at Peterborough.

A large number of items of general interest and importance were considered. The membership ballot was canvassed and the following elections and transfers effected:—

Members: four; Associate Members: thirty-three; Juniors: six; Transferred from the class of Associate Member to Member: eight; Transferred from the class of Junior to Associate Member: eleven; Transferred from the class of Student to Associate Member: four; Transferred from the class of Student to Junior: eight.

The list will be published in the next issue of the Journal.

Inasmuch as it was impossible to deal with classifications, the meeting was adjourned to the early call of the Secretary.

A. G. Dalzell, M.E.I.C., who received a hearty vote of thanks from the Vancouver Branch for his excellent work as Sec'y-Treas. on the occasion of his resignation recently.

Personals

Warren C. Miller, S.E.I.C., formerly Assistant Engineer of St. Thomas, Ont., has recently been appointed City Engineer.

*

J. T. Johnston, A.M.E.I.C., Assistant Director of Water Power, attended the National Exposition of Chemical Industries on behalf of the Dominion Government.

*

B. F. Haanel, M.E.I.C., acted as representative of the Dominion Government at the recent dedication of the Engineering Building at Pittsburg, which has been erected by the U.S. Bureau of Mines for research work in Metallurgy and Fuel problems.

*

J. O. Twinberrow, S.E.I.C., who has been serving overseas since May 1915 as Captain and workshop officer of the Mechanical Transport Dept., Royal Army Service corps, has returned to Montreal and is finishing his course at McGill University.

*

J. Blizard, A.M.E.I.C., of the Department of Mines, has for the past two months been conducting an investigation on Powdered Fuel, and has visited the principal sources of information in Canada and United States. His report on this subject will be published by the Department of Mines.

*

Major Cecil Ewart, A.M.E.I.C., has been engaged by the Department of Railways, British Columbia and is at present locating a line from the Pacific Great Eastern Railway at Clinton, B.C. to Ashcroft, B.C. Major Ewart was formerly with the 8th Batt., Canadian Railway Troops.

*

George B. Mitchell, M.E.I.C. who is well known in Montreal where he resided a number of years, and who for the past year and a half has been construction engineer with the Foundation Company at Port Huron, expects to leave for Peru on the sixth of November, in the interests of the Foundation Company.

*

Paul E. Mercier, M.E.I.C., who tendered his resignation as consulting engineer, Public Works of Montreal, will continue in the service of the City, in which capacity, however, it is proposed that he spend only part of his time, as he has accepted professorship in engineering on the staff of l'Ecole Polytechnique.

M. B. Weeks, M.E.I.C., formerly Director of Surveys of the province of Saskatchewan, has been appointed Director of Town Planning, and, W. A. Begg, A.M.E.I.C., formerly town site engineer for the Department of Highways of the province, has been appointed Town Planning Engineer by the Dominion Government.

*

D. Walter Munn, M.Sc., A.M.E.I.C., who for a number of years has been plant engineer for Armstrong Whitworth, Limited, has been appointed Professor of Civil Engineering in the Royal Military College. Professor Munn was for a number of years a member of the faculty of the University of British Columbia.

*

Morris Knowles, M.E.I.C., of Pittsburgh, visited Montreal recently en route to New York to attend a meeting of the Committee of Engineering Council dealing with the proposed Department of Public Works in the United States of which he is Chairman. Mr. Knowles is also President of the Pittsburgh Section of the American Society of Civil Engineers.

*

Lieut.-Col. G. H. Kirkpatrick has been appointed President and Major A. R. McKenzie one of the Board of the Vancouver Board of Harbour Commissioners. It is interesting to note that most of the members of the Board are engineers and returned soldiers with excellent records and that the previous Board of Harbour Commissioners contained no engineers. It is a further sign of the times.

*

Captain E. A. Earl, R.E., A.M.E.I.C. writes from the British Military Mission, Vladivostok, Siberia, expressing himself in favor of legislation for the engineer. Captain Earl is engaged in connection with the work of the Allied Mission in Siberia, and on his arrival at Vladivostok, was appointed D.O.R.E. for the Vladivostok district. He expects, however, that the work will be of a temporary nature.

*

Dr. G. H. Duggan, M.E.I.C., Past President of *The Institute*, has been elected Chairman of the newly appointed Quebec Division of the Canadian Manufacturers' Association. The formation of this Division is in keeping with the recently adopted policy of the Manufacturers' Association to establish branches in the various provinces to more efficiently co-ordinate the work of the Association.

*

J. T. Johnston, B.A.Sc., M.E.I.C., and A. M. Beale, B.Sc., A.M.E.I.C., of the Dominion Water Power Branch, Ottawa, spent the latter part of September in Chicago in attendance at the Fifth National Convention of Chemical Industries, where they demonstrated Canada's possibilities and resources particularly in relation to the enormous possible development of water power in this country.

The former partnership existing between James, Loudon & Hertzberg, Consulting Engineers, Toronto, has been dissolved. Messrs. T. R. Loudon, M.E.I.C., and C. S. L. Hertzberg, M.E.I.C., continuing the partnership of Consulting Engineers, with offices at 402 Excelsior Life Building, 36 Toronto Street, Toronto, where they will continue the practice of their profession in a consulting capacity. E. A. James, M.E.I.C. will also continue to act as Consulting Engineer.

*

H. U. Hart, M.E.I.C., who was Chief Engineer of the Canadian Westinghouse Company of Hamilton, has been appointed General Manager of the Company. Mr. Hart's elevation to this important executive position is evidence of the success of an engineer when given executive responsibility and illustrates further that the engineering profession contains men who from their training, experience and ability are the most logical directors of our industrial affairs.

*

H. L. Bunting, B.Sc., M.C., J.E.I.C., has been appointed Instructor in engineering drafting in the Department of Soldiers' Civil Re-Establishment Retraining School at Winnipeg. Mr. Bunting enlisted in March 1916 with the 200th Batt., C.E.F. and was transferred to the Canadian Engineers in June 1916. He served in France with the 5th Army Troops Co., Canadian Engineers from November 1917 to March 1919 and for his distinguished services was awarded the Military Cross. He was discharged August 23rd, 1919.

*

W. G. H. Cam, A.M.E.I.C., has been appointed to the position of Electrical and Power Engineer for the Canada Cement Company by A. C. Tagge, M.E.I.C., Assistant General Manager and General Superintendent of the Company. Mr. Cam is a graduate of the City and Guilds of London and the Central Technical Institute in Electrical Engineering. Mr. Cam had considerable continental experience before arriving in Montreal in 1909, since which time he has engaged in operation, construction and consulting in connection with a number of the power and lighting systems in Montreal and vicinity.

*

A. M. Robertson, Jr., S.E.I.C., returned from service in France, on September 30th last and is resuming his studies at McGill University. Mr. Robertson enlisted in February 1915 with the 21st Battery, 6th Brigade. In August of the same year he was commissioned in the Canadian Engineers and served in France with the 1st Divisional Engineers from January 1916 to January 1919, during which time he was twice wounded and was decorated with the Military Cross. When the armistice was signed Mr. Robertson was promoted to Captain and transferred to Divisional Pontoon, Bridging Unit and was stationed in London, England until his return to Canada.

*

William F. Drysdale, M.Sc., M.E.I.C., was married at noon, on Saturday, October 4th, at Albany, N.Y. to Miss Louise Adele Miller of that City.

Mr. and Mrs. Drysdale left on a motor trip to Montreal and a short time after sailed by the " Empress of France " from Quebec for Liverpool. They are to reside in Paris, France. Mr. Drysdale whose home was formerly in Montreal, is one of our younger Canadian engineers who have achieved single success in other countries. The high position he holds as European representative of the American Locomotive Works, is an evidence of his ability and gives promise of even greater achievement.

*

Brig.-Gen. C. H. Mitchell, M.E.I.C., Dean of the Faculty of Applied Science of the University of Toronto, gave his inaugural address, at Convention Hall, on October the 8th. General Mitchell stated that a broadening out of the general education of scientifically training a man to include more of the humanities, the bringing into closer relationship of theory and practice and the development of a curriculum suited to the needs of the nation were required. The future of applied science rested with all Canadians not only in the actual process of development but also in the education of the young men who would participate in that development. General Mitchell shows in his inaugural address a clear insight and a keen appreciation of the requirements of technical training.

*

Lieut.-Col. J. A. Hesketh, C.M.G., D.S.O., M.E.I.C., has returned to Winnipeg as assistant to the chief engineer of the Canadian Pacific Railway for the Western Division. Col. Hesketh was formerly Chairman of the Manitoba Branch.

In 1879 Col. Hesketh entered the R.M.C. and obtained his first commission with the Canadian Field Artillery in September 1882. Since then in various times he received promotion to the rank of Lieutenant-Colonel. He served in the North West Rebellion with the 7th Fusiliers. During the late war his services are as follows: From August 6th, 1914 to July 12th, 1919 in France. From May 1915 to December 1918, Major and Lieut.-Col. For these services he was awarded the honours of C.M.G., D.S.O.; mentioned in dispatches and was wounded, which is in all a very enviable record.

*

An Engineer in Parliament

Members will be interested to know that while for the next four years the Province of Ontario will be run very largely by the members elected by the farming interests, there will be at least one engineer sitting in the House. This honor belongs to Major Andrew W. Gray, B.Sc. (Queen's), A.M.E.I.C. of Westport, and will represent North Leeds. Major Gray was born at Morton, Leeds County, Ontario, and was graduated from Queen's University in 1912. He has had twelve years in municipal engineering and highway construction in addition to being overseas two years on active service with the C.R.T. where he was engaged in bridge construction and track laying with the rank of Major. Major Gray deserves all honor from his fellow members in the profession who will watch with interest his career in the House where it is expected he will soon make a name for himself.

Major D. A. White, D.S.O., J.E.I.C., has returned to Ottawa, having gone overseas in September 1914 as Captain of the 2nd Battery, C.F.A., 1st Canadian Division. On August 28th, 1915, he was promoted to Major and commanded the battery until December 1916. He served as Brigade Major of the 1st Canadian Divisional Artillery until December 1917. Later he served as Staff Officer, Royal Artillery, Canadian Corps Headquarters until demobilized in June, 1919. He was awarded the D.S.O., and three time mentioned in dispatches.

*

Colonel A. W. R. Wilby, C.B.E., A.M.E.I.C., has returned to Canada and resumed his work as District Engineer for the Department of Marine, Victoria, B.C. Col. Wilby left Canada in March 1916 with the 62nd Batt., C.E.F. This Battalion was broken up in England and in July 1916, Col. Wilby transferred to the 48th Batt., otherwise known as the 3rd Canadian Pioneers, which was then in France and with which he served with the rank of Major until the Battalion was broken up in France in May 1917. At this time the Canadian Corps were desirous of securing a Deputy Assistant Director for the Corps in connection with the then newly formed Labour Directorate and Col. Wilby was selected for this position. Upon the reorganization of the Labour Directorate in the early part of 1918 Col. Wilby was promoted to Colonel with the title of Labour Commandant, Canadian Corps Headquarters. He was twice mentioned in dispatches and for his services at the front was awarded the Order of Commander of the British Empire.

*

Gore, Nasmith & Storrie is the name of the newly formed partnership of consulting civil engineers and public health specialists, with offices in the Confederation Life Building, Toronto. William Gore, M.E.I.C. has been for some years consulting engineer of the John verMehr Engineering Co., Limited, Toronto, where he has resided for some years being intimately associated with the production of the Ransome drifting sand filter of which he is the inventor an account of which by himself and Mr. Storrie appears in the current issue of *The Journal*. Dr. George G. Nasmith, C.M.G., was formerly director of laboratories, Toronto, and for his services as Sanitary Advisor of the First Canadian Expeditionary Force was awarded the Companionship of St. Michael and St. George. William Storrie, M.E.I.C. was chief engineer and Director of the John verMehr Engineering Co. and has resided in Toronto since coming from Scotland in 1909 with the exception of the period when he was in charge of the Water Works of the City of Ottawa and for the past year until recently when in England taking charge of the construction of re-inforced concrete ships for the Admiralty.

*

Newly appointed Assistant Secretary

At the recent meeting of the Council it was decided that the work of the organization and of the detail at Headquarters had grown to such proportions as to require an addition to the staff of an assistant secretary. It was felt that the Secretary should have more time than was possible under present conditions to devote to the welfare of the branches and to the general executive work of *The Institute* and this decision resulted in the appointment by the Secretary of A. W. Swan, B.A.Sc. (University of Toronto), Jr.E.I.C. to the position of assistant secretary of *The Institute*. Mr. Swan was born in Glasgow on April 4th, 1893, and was educated at George Watson's, Edinburgh and took the engineering course in the University of Toronto where he graduated in mechanical engineering in 1917 with the degree B.A.Sc. Since his graduation Mr. Swan has been with The Canadian Ingersoll-Rand Co. Limited at Sherbrooke. During his first year there he was in the production department on time-study and kindred work and during the past year and a half was in the publicity department in charge of trade-journal section of publicity. Mr. Swan's training, experience and qualifications indicate that he is well fitted for this work.

A. W. Swan, B. A. Sc. Jr. E. I. C.

As is the case with the secretary and the accountant he will be bonded. As general executive assistant he will have charge of the production of *The Journal* and be responsible fot the printing of the Year Book, transactions and other publications of *The Institute* and as office manager he will be responsible for the efficient handling of the routine business of the office.

Mr. Swan's picture is reproduced herewith in order that he may be suitably introduced to the Members.

Lieut. J. M. Gilchrist, R.N.V.R., A.M.E.I.C., whose home is in St. John, N.B., arrived in Montreal early in October on the S. S. Tunisian from England. Lieut. Gilchrist left Canada early in 1916 taking a course in Greenwich Naval College and from there went to Southampton, where he was commissioned to Motor Launch 288, Sheerness, being second in command and engaged in patrolling, mine-sweeping and mine-laying. One year later he was made lieutenant in command of M.L. 525. Shortly after taking command he was sent to Dover for a course in the Zeebrugee blockade. Lieut. Gilchrist had the thrilling experience of taking a hand in one of the most daring exploits of the whole war, if not in the history of all wars, and there acquitted himself in a most creditable manner. As the records show, almost one half of the men who volunteered to engage in this exploit did not return. On volunteering they were warned by their Admiral that possibly ninety-five per cent would be total casualties. The success of this exploit is well known and those who engaged in it have a record of which they may well be proud. Following the blockade, he was sent back to Sheerness, was transferred to M. L. 244 and placed in command at Port Said where he remained until recently, taking part in the policing of the Suez Canal and participating on behalf of the British Forces during the strike last summer in Egypt.

*

Major W. H. Munro, A.M.E.I.C., whose home is in Peterborough, Ont., is now in the wilds of Northern Nigeria as hydro-electric engineer for Vickers, Ltd. of England. Major Munro has been employed making an inspection in detail of the design and progress of a hydro-electric scheme which Vickers, Limited, are installing for the Northern Nigeria Tin Mines, Limited. Writing to a friend in Canada of his experience in that remote country Major Munro writes in part:—

"This is a very interesting trip in the way of seeing new parts of the world. In my tender youth a favorite pastime on Sunday afternoons was to look at the pictures in a huge illustrated volume at home called "Darkest Africa." This is recalled by the actual scenes one sees on every hand here. The country is thickly populated with natives but the only white men are traders, agents, miners, officials, soldiers, missionaries, etc. The country is not open to colonization like Canada, Australia and other temporate countries. By the way, there is a *Canadian* mission station about eight miles from our camp. I met one of them, a chap named Kirke, whose home was on a farm somewhere near Morrisburg He said he knew people in Winchester, but not you, I asked him.

The real natives here are the Pagans, a numerous race of physically big fine looking people whose only clothes are " earrings and bracelets, and a very independent lot — they only work for us when they feel like it, or when they want a little money to pay taxes. Union wages are nine pence a day. Other tribes are emigrants here and are Mohammedans (they wear flowing cotton clothes as a rule) The Pagans are Ju Ju worshippers and late cannibals. The Hausas and Filanis are traders and cattle people and they are our laborers.

Enclosed are a couple of grass arm bracelets much worn by Pagan women. The Pagans are quite polite, they say good-day to you in their own language when you meet them on the native paths, but it is said that if the white men were not here they would clean up the Hausas and Filanis and other strangers in short order: they carry weapons all the time."

OBITUARIES

Robert Weddell, A.E.I.C.

Late. R Weddell, A.E.I.C.

Robert Weddell, A.E.I.C., died at his home in Trenton, Tuesday, September 19th. For nearly half a century, the late Mr. Weddell has occupied the position of an enterprising citizen of Trenton whose activities took him to various parts of Canada in connection with the contracting business in which he was so successful. The late Mr. Weddell was born in Edinburgh in June, 1850 and before leaving the land of his birth, served his apprenticeship in mechanical engineering. As a contractor he had numerous Government and municipal and other contracts, which won for him a wide reputation, in addition to his work in connection with building bridges, constructing railways and dredging waterways. For many years his foundry and machine shops at Trenton has been one of the most important establishments of the town. He was formerly President of the St. Andrew's Society of Trenton and was a Past Master of the A. F. and A. M. In religion he was a Presbyterian. Mr. Weddell is deeply mourned in his adopted city where he has been a leader in all that made for the betterment of the community, for many decades. He is survived by his son, R. G. Weddell, A.M.E.I.C., who has recently assumed full control of his business, and by one daughter.

Henry Gillmor Smith, B.Sc., A.M.E.I.C.

A shocking accident on the Canadian National Railways near Parry Sound, Ont., resulted in the death of H. G. Smith, A.M.E.I.C., popularly known as Harry Smith, while engaged in his duties superintending construction work for the Canadian National Railways in connection with the contract of the Dominion Construction Company. A collision occurred between a freight train and the construction train, the collision resulting in the destruction of the conductor's van in which the late Mr. Smith was riding at the time. The engine of the freight train struck the van which took fire and was soon destroyed with its single occupant who was imprisoned therein.

Henry Gillmor Smith was born at St. Martins, N.B., on May 4th, 1884, graduating in civil engineering from the University of New Brunswick, with the degree of B.Sc., in 1908. Upon graduation he entered the employ of the Canadian Northern Railway where he served in various capacities with increasing responsibility until the time of his death, transferring to the Canadian National Railways when the Canadian Northern Railway was taken over. The late Mr. Smith entered *The Institute* as a Junior on Jan. 13th, 1912 and was transferred to Associate Membership September 19th, 1916. His death occurred on October 10th, 1919.

Flight Lt. Franklin Sharp Rankin, R.M.C., S.E.I.C.

Word has just been received at headquarters of the death of Flight Lieut. F. S. Rankin, S.E.I.C., who was killed in action above Bapaume, on October 26th, 1916. Lieut. Rankin was a graduate of the 1914 class of the Royal Military College and enlisted in the early days of the war at the age of nineteen. He is typical of the huge class of Canadians who engaged with the Royal Air Forces and did so much to make the British Air Forces live in all history. Lieut. Rankin was born in Woodstock, N.B., on July 31st, 1894. In reply to a letter addressed to his father concerning his son's record, he writes that the facts are all summed up by saying " he went and stayed."

The following letter was sent by Colonel G. J. Carmichael, 18th Squadron Royal Flying Corps, to Dr. Rankin: He was one of the pluckiest fellows I have ever had in my Squadron, and I am sure he met the death he would have chosen. He was doing escort to a photographic plane well over the German lines. First they attacked three hostile machines and drove them off. They then attacked three more, sending one down in flames, and the second glided down emitting smoke, evidently having been hit in the engine. He was standing up firing over the top plane, firing at the third machine, when a bullet hit him in the head. It was a grand fight against long odds, and it was a splendid death. I am most awfully sorry to lose him; he had done a long spell of good work and had taken part in a good many scraps. Only two days before he was in a big melee, and shared honours over a machine that fell in our lines. He was always out for a fight, my only apprehension was that he would overstep the mark. His pilot and he together took an awful lot of straffing. He is a great loss." A Flying Corps' communique gives the following account of Lieut. Rankin's last engagement:—" On the 23rd October, 1916, Sec. Lieut. F. L. Barnard, with Lieut. F. S. Rankin, No. 18 Squadron, engaged seven hostile machines near Bapaume. Two of the enemy were hit and one of them went down out of control. During the engagement Lieut. Rankin was killed, and the machine being badly damaged Sec. Lieut. Barnard had some difficulty in returning to our side of the lines." Colonel W. W. Melville, under whose command Lieut. Rankin, went to Europe, wrote as follows:—" Your son was with me eighteen months and I became very much attached to him. Individually he was the soul of honour, absolutely without fear. . . . In all my communications with him he treated me very courteously and with respect, and had he been my own son he could not have given me better support. His work was splendid, and having a splendid physique he was able to do the work of two men, and I regret very much that he has not been permitted to live." Lieut. F. L. Barnard, his pilot, writes to his mother;— "Rankin, was by the far the most daring and reckless man in the R.F.C. that every one without exception was frightened to go with him, his one aim and object was to get German blood and whether he ever returned or not was a mere trifle. He had been shot down three other times, and was truly on the war path. One day we were out together and flew over a German air cadet school, that are so strongly guarded that no one would have a ghost of chance if they were ever attacked, and Rankin was determined to fly low and drop bombs on it, but I would not go, and after that I was even more unwilling to go with him, but the day the Germans attacked with seven planes, though I had hated to go up, yet my first thought when the Germans appeared was, thank Heaven, it is Rankin and no one else, and had anybody else been at the guns neither of us could have lived a minute, as it was, Rankin was as cool as though we were toasting our toes by the fire, and would not leave at all, but kept the place guarding the photographing plane until it got safely away."

EMPLOYMENT BUREAU

Outlook for Positions.

Conditions in the field of civil engineering show a slight improvement but more in relation to proposals for next year's activity than for work in progress. Reports from various parts of the country indicate that municipal activity will see a very material increase over any year for the past five or six. In one province alone it is estimated that over six million dollars of municipal improvements in the rural districts is anticipated, apart from highways. The highway situation in Canada from coast to coast bears evidence of a stimulation in engineering activity along this line. In fact it is to the development of highways that a large number of civil engineers must look for employment during the coming years, as it is anticipated that railway construction will be limited.

It is in the industrial field, however, that the greatest and most hopeful prospects for engineering employment are promised. Already there is a demand from large companies and many of the smaller concerns, particularly in the metal working lines, for draftsmen and junior engineers, preference being given to men who have had electrical and mechanical technical training. It is evident that the supply in this direction is going to fall far short of the demand during the coming season.

Within the past month the engineering faculties of the various universities have made a number of notable appointments from among the engineering profession to their professorships and it is found that the unusually large and unexpected enrolment of students in these faculties requires greater professorial assistance than is available at the moment. The head of one technical school spent some time in Montreal endeavouring to locate a sufficient number of men for his faculty and at the time of going to press, positions have not all been filled.

There is also noticeable a slight and well defined stiffening of salaries being offered. Next year is bound to see a decided improvement in this connection.

Situation Vacant.

Mechanical Draftsman:

Steel corporation desires draftsman who is capable of designing. Box 59.

Technical Instructor:

Instructor in civil engineering in a technical college in Eastern Canada desired. Salary $1800 per annumn. Box 62.

Mechanical Draftsman:

Temporary position for technical graduate who has had some experience in mechanical drafting in an industrial concern. Box 57.

Professor in Mechanical Engineering:

An eastern technical college requires a professor in mechanical engineering. Duties to commence immediately. Salary $2400 per annumn. Box 61.

Municipal Engineer:

Graduate engineer having had experience in the construction of sewers and water works wanted for municipality where considerable work is being undertaken at the present time. Box 58.

Instructor in Physics;

1. An Instructor in Physics, at an initial salary of $1,800 per annum, to assist in the Royal Military College, Kingston, Ont., in teaching and instructing in physics. Candidates should be not more than 25 years of age, and should be graduates in civil, mechanical or electrical engineering, or in honour physics with mathematics as a minor subject from a university of recognized standing. Applications must be filed in the office of the Civil Service Commission not later than November 3. This position was advertised August 14, and is now re-advertised.

Electrical Draftsman:

A power company in Montreal requires the services of an electrical draftsman who has had experience in this work. Box No. 63.

Mechanical Draftsman;

Ten or twelve mechanical draftsmen, experienced in foundation or structural steel or machine design, foundry work, and especially in rolling mill design. Positions open for the above number of mechanical draftsmen who are thoroughly competent and well experienced. Address Box 64.

Ten Ways to Kill a Branch.

An enthusiastic member of one of the branches has sent in the following under the heading of 'Ten Ways to Kill a Branch.'

I Don't come to the meetings.
II. If you do come, come late.
III. If the weather doesn't suit you, don't think of coming.
IV. If you do attend a meeting, find fault with the work of the officers and other members.
V. Never accept office, as it is easier to criticise than to do things.
VI. Nevertheless, get sore if you are not appointed on a committee, but if you are, do not attend the committee meetings.
VII. If asked by the chairman to give your opinion on some matter, tell him you have nothing to say. After the meeting tell everyone how things ought to be done.
VIII. Do nothing more than is absolutely necessary, but when other members roll up their sleeves and willingly, unselfishly use their ability to help matters along, howl that the branch is run by a clique.
IX. Hold back your dues as long as possible, or don't pay at all.
X. Don't bother about getting new members. " Let George do it!"

From " The Popular Engineer."

Automatic Control for Motor-Started Converters.

To synchronise the rotary converter with the line, the motor is cut off when the speed is approximately synchronous, and a reactance is switched on until the machine is in step, whereupon the reactance is short-circuited and the transformer connected directly to the converter rings. The means by which these operations are carried out are described in detail, together with methods for safeguarding the sub-station apparatus against A.C. and D.C. overloads, overspeed, and overheating of the bearings.

Causes of Sharp Wheel-Flanges.

The chief cause of wear on tyres and flanges are: difference of diameter of wheels on the same axle; uneven shoe and wheel wear, when the pivotal point on the brake-beam is slightly out of centre; tendency of a flange to crowd the rail when one wheel has worn smaller than the other; sanding one rail only; running cars always in the one direction; trucks out of square; flanged brake shoes; release springs, and sharp rail curves.

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And a member from each branch.

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District No. 2—ALEX. FRASER
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T. H. WHITE	"

Preliminary Notice

of Applications for Admission and for Transfer

20th October, 1919.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in November, 1919.

FRASER S. KEITH, Secretary.

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*The professional requirement are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits, scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ALLISON—PHILIP LIVINGSTON, of Peterboro, Ont. Born at Jersey City, N.J., Nov. 20th, 1872. Educ., M.E., Stevens Inst. of Tech., 1898. 1 yr. student in Gen. Elec. Co., testing dept., Lynn, Mass. 1899-1902, asst. foreman, Gen. Elec., Lynn; 1902-03, elec. engr., DeLaval Steam Turbine Co., Trenton, N.J.; 1903-04, constrn. foreman, Edison Elec. Co., Los Angeles, Cal.; 1904-09, supt., testing dept. Can. Gen. Elec. Co., and 1909 to date, industrial control engr., works eng. dept.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

BARNS—BIRD LEE (Capt.), of Peterboro. Born at Smyrna, Mich., Aug. 13th, 1881. Educ., B.Sc., Univ. of Mich., 1906. 6 mos., instructor, elec. eng. dept., Univ. of Mich.; 2½ yrs., sales and estimating engr., Allis-Chalmers Co., elec. and hydraulic power mach'y.; 5 yrs., designer, alternating current mach'y., Can. Gen. Elec. Co.; 20 mos., military service, U. S. Army, rank of capt. of engr., in chg. of distribution of eng. supplies in France; at present, designer, alternators and synchronous motors, Can. Gen. Elec. Co.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

BOOKHOUT-ALDEN FERRIS, of Peterboro, Ont. Born at Walton, N.Y., Feb. 5th, 1871. Educ., B.E., Union Univ., 1898. 1898-1900, in testing and drafting dept., Gen. Elec. Co., Schenectady, N.Y.; 1900-02, ch. engr., Middleburg & Schoharie Elec. Lt. Ht. & Pr. Co., superintended installation, hydraulic and electrical, etc.; 1902-09, ch. draftsman, Can. Gen. Elec. Co.; 1909-19, in eng. dept., Can. Gen. Elec.; at present, elec. engr., switchboard section.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

BUCHAN—PERCY HALCRO (Lieut.), of Vancouver, B.C. Born at Toronto, Ont., Oct. 8th, 1886. Educ., B.A.Sc., Toronto Univ., 1909. 1909-10, progress charts, costing, etc., constrn. dept., B.C. Elec. Ry. Co.; 1911-12, asst. to constn. engr., responsible for estimates, materials, cost, etc., on ry. constrn.; 1913-15, asst. engr., Way Dept., B.C. Elec. Ry.; 1916-18, lieut., Can. Infantry; 16 mos. on ry. constrn. with C.R.T., lieut., 5th Batt., C.R.T., at present asst. engr., Way Dept., B.C. Elec. Ry. Co.

References:—C. Brakenridge, C. R. Crysdale, A. C. Eddy, R. F. Hayward, A. E. Hill, J. H. Kennedy, W. G. Swan.

FYFE—ROBERT JOHN, of Regina, Sask. Born at Kincardine, Ont., Jan. 18th, 1891. Educ., 3 yrs., civil eng., Univ. of Sask., 2 summers, land surveying with Reilly, Dawson & Reilly, Regina; 2 summers, Govt. of Sask.; one summer, gen. eng. work, city of Regina; enlisted in final year and 3 yrs. overseas as an officer.

References: H. S. Carpenter, A. R. Greig, A. J. McPherson, L. A. Thornton, D. A. R. McCannel, W. R. W. Parsons.

GATES—ARCHIBALD BLAND, of Peterboro. Born at Kingston, Ont., Feb. 9th, 1888. Educ., B.Sc., Queen's Univ., 1911. 1908 (6 mos.), mining, Cobalt; 1911-12, elec. testing course, Can. Gen. Elec.; 1913-15, asst. transformer designer, Can. Gen. Elec.; 1915-16, asst. engr., constrn. and operation, Seven Falls, Hydro-Elec. plant and transmission line, Laurentian Power Co., Beaupre, Que.; 1916-17, sales engr., plant and factory apparatus, C.G.E.Co., Toronto; 1917, to date, asst. induction motor designer, C.G.E.

References: R. L. Robbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

GILCHRIST—THOMAS ERNEST, of Peterboro. Born at Ottawa, Aug. 30th, 1888. Educ., B.Sc. (E.E.), McGill, 1910. 1910-12, testing dept., Can. Gen. Elec. Co.; 1912, to date, works engr's dept., Can. Gen. Elec., on switchboard estimates.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

GRANT—ALEXANDER MacDONALD, of Ottawa. Born at West Merigomish, N.S., Dec. 10th, 1882. Educ., B.Sc., Queen's Univ., 1908. D.L.S. 2 yrs. on constrn. work, Can. Gen. Elec. Co.; 1 yr. Aluminum Co. of America; 1908-11, examiner of survey returns, Topog. Surveys Branch; 1911, in chg. of observing party and inst'man on base line party, Geodetic Survey; 1912-16, in full chg. of primary triangulation, western Ontario, Geodet. Survey; 1916-19, gauge inspector, Imperial Ministry of Munitions; Mar. 1919, to date, geodetic engr., at present in full chg. of triangulation, Montreal and district, Geodetic Survey of Canada.

References: J. D. Craig, R. J. Durley, G. R. MacLeod, J. J. McArthur, N. J. Ogilvie, F. B. Reid, W. M. Tobey.

HANCOX—FREDERICK JAMES, of Toronto, Ont. Born at Gloucester, Eng., Feb. 15th, 1885. Educ., Sir Thos. Rich's School (high school); 6 yrs. mech'l and milling eng. courses, Tech. School, Gloucester. 1902-06, articled to J. Reynolds & Co. Ltd., Gloucester, Eng.; 1906-08, asst. to supt. of plant, same firm; 1908-12, supt. of mill plant and repair shops, J. Reynolds & Co., millers and millwrights; 1913-15, designer, sewer section, Toronto; 1916-19, on active service; June 1919, to date, designer, sewer section, Toronto, storm overflow sewers, sewerage disposal.

References: W. S. Harvey, G. R. Jack, R. R. Knight, G. Phelps, W. R. Worthington.

HINTON—ROBERT EDWARD, of Peterboro. Born at Gananoque, Ont., Oct. 28th, 1888. Educ., B.Sc., Queen's Univ., 1913. 1905-09, operating in power plants, line constrn., wiring, etc.; 1913-17, power plant constrn.; 1917-19, testing dept., at present asst. engr. in eng. office, Can. Gen. Elec. Co.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

HOLMGREN—ERIC LAURENTIUS, of Peterboro. Born at Ostersund, Sweden, March 20th, 1893. Educ., B.E.E., Man. Univ., 1916. 4 mos., rodman, Sask. R. hydrographic survey; 6 mos. elec. constrn. work, Wpg. Light & Power Dept.; 2 yrs. in test dept., Can. Gen.Elec. Co.,Aug. 1919, to date, transformer design, C.G.E.Co.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

JAMES—HAROLD CHESTER, of Vancouver, B.C. Born at Bridgewater,Ont., Dec. 14th, 1878. Educ., Hooton Lawn Grammar School; course in underground mine surveying and mapping; apprentice with British Mercantile Marine Ass'n. 1897-1901, private business; 1901-04, in Kimberley, S. Africa; 1905-07, transitman and asst. engr. in mine survey dept., DeBeers Consolidated Mines Ltd., Kimberley; in chg. of tunnel survey and various other work in connection with underground mining; 1907-08, transitman on maintenance and asst. to res. engr., C.P.R., Revelstoke, B.C.; 1908-13, in chg. of eng. and estimating dept., Pacific Coast Pipe Co. Ltd., Vancouver; 1913-18, mgr., same firm; 1918, to date, vice-pres. and mgr.

References: H. G. Acres, C. E. Cartwright, E. A. Cleveland, J. P. Forde, R. F. Hayward, T. H. Hogg, J. B. Holdcroft, T. H. Tracy.

JONES—FREDERICK SIMEON (Capt., M.C.), of Cambridge, N.B. Born at St. John, N.B., Jan. 11th, 1889. Educ., B.Sc. (C.E., Univ. of N.B., 1913 (medallist). June-Aug. 1912, with geological survey, Topog. Branch, as junior asst. on topography; 1913-16, with Dept. of Marine, River St.-Lawrence Ship Channel Branch, asst. engr., constrn. and maintenance of deep water channel between Montreal and Lower St. Lawrence, layout of work, placing of dredges, etc.; Mar. 1916-Mar. 1919, on active service, Can. Engrs., as a lieut. in chg. of section of field coy., May 1918, Capt., in chg. of a coy.; May 1919, to date, asst. engr., River St. Lawrence Ship Channel, Sorel, P.Q.

References: V. W. Forneret, N. B. McLean, C. McN. Steeves, J. A. Stiles, F. A. Wise.

JUPP—ERNEST HODGSON (Lieut.), of Orillia, Ont. Born at Orillia, Nov. 22nd, 1891. Educ., B.A.Sc., Toronto Univ., 1915. 1914, town eng., Orillia, in chg. of sewer and waterworks constrn.; 1915, survey work and drafting, Trent Canal; Lieut., 1st Can. Ry. Troops, on ry. work; 1919, asst. engr., McIntyre Gold Mines.

References: P. Gillespie, E. G. Hewson, F. S. Lazier, T. R. Loudon, W. Monds, F. S. Rutherford.

LANCASTER—Henry Pettit, of St. Catharines, Ont. Born at Grimsby, Ont., May 30th, 1894. Educ., junior matric.; I.C.S. 1914 (6 mos.), rodman and levelman, Welland Ship Canal; 1915-16, draftsman; 1916-17, transitman, Welland Canal; Aug. 1918, to date, draftsman, Hydro-Elec. Power Comm., Niagara Development.

References: A. C. D. Blanchard, G. H. Lowry, F. N. Rutherford, W. H. Sullivan, J. L. Weller.

LANGLEY—GORDON RUSSELL, of Peterboro. Born at Toronto, Ont., Aug. 9th, 1885. Educ., B.E. (E.E.), Union Univ., 1907. Member, A.I.E.E. 1907-09, in testing dept., Can. Gen. Elec., testing all varieties of elec. apparatus; short periods as: analytical chemist, Allegheny Steel & Iron Co., Tarentum, Pa ; asst. in research laboratory, Gen. Elec. Co., Schenectady, N.Y.; 1909-11, eng. work in switchboard eng. dept.; 1911-13 in same dept., at Peterboro; 1913 to date, engr in chg switchboard, eng. dept., Can. Gen. Elec Co.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

LUMSDEN—JAMES FREEMAN, of Halifax, N.S. Born at Trinity, Nfld., June 8th, 1890. Educ., B.Sc. (E.E.), N.S. Tech. Coll., 1911. 2 yrs. apprentice course, Can. Gen. Elec. Co., Peterboro, Ont.; 6 mos., asst. designing engr., transformer section of eng. dept., Can. Gen. Elec.; 6 mos., requisition engr.; 2 yrs., 10 mos., constrn. engr., same firm; 8 mos., operating power house, Wpg. Elec. Ry. Co.; 3 yrs., military service, 1½ yrs as officer in France; 6 mos. ch. elec. instructor in vocation training, N.S. Tech. Coll.; at present, prof. of elec. eng., N.S. Tech. Coll.

References: F. R. Faulkner, P. A. Freeman, I. P. Macnab, G. S. Stairs, K. E. Whitman, C. H. Wright.

MacAFEE—RALPH EVANS (Capt.), of Montreal. Born at Newtown,N.B.,April. 15th, 1887. Educ., B.Sc., McGill, 1910. 1910-13, Can. Westinghouse Co., Hamilton, shop practice, including assembly and testing of A. C. and D. C. generators and motors, later in sales dept.; 1913-15, MacMullen, Riley & Durley, conslt. engrs., in chg. of design and installation of lighting and power systems for large bldgs., etc.; 1915-19, Lieut., with Can. Engrs., since 1916 in France and Belgium, May 1918, captain; July 1919, to date. sales engr., Babcock & Wilson Ltd.

References: C. V. Christie, F. A. Combe, R. J. Durley, S. J. Fisher, C. A. Robb.

MAXWELL—MARVIN WILBUR (Major, M.C.), of Montreal. Born at St. David, N.B., Aug. 24th, 1888. Educ., B.Sc. (C.E.), Univ. of N.B., 1912. 1912, draftsman, Mt. Royal Tunnel & Terminal, C.N.R.; 1913. inspector of underground work, Apr. 1913. asst. to the tunnel engr., in chg. of office, all plans. reports, etc.; May 1915, Forest Products Laboratories, McGill Univ., asst. to ch. of div. of Timber Tests; Nov. 1915, Lieut , Can. Engrs., 1st Tunnelling Coy., promoted to Capt., Aug. 1916; awarded M.C., Oct. 1917; May 1918, major; at present, resumed with Forest Products Lab., as engr. in ch. of timber tests.

References: J. S. Bates, F. B. Brown, S. P. Brown, J. L. Busfield, W. G. Hardy, D. F. Maxwell, C. N. Mitchell, J. C. K. Stuart.

MAXWELL—REGINALD JAMES, of St. Stephen, N.B. Born at St. Stephen, N.B., Jan. 28th, 1892. Educ., 2½ yrs., Univ. of N.B. 1912-13, draftsman, plotting prelim. and location plans on 32 mile survey, F. & G. L. Coal & Ry. Co.; 1913 (5 mos.), rodman, draftsman, etc., on maintenance survey, 60 miles, N.B. Coal & Ry. Co.; 5 mos., inst'man and draftsman on constrn., F. & G. L. Coal & Ry. Co.: 1913-14, draftsman, right of way dept., C.P.R., St. John, N.B.; 1914-15, inst'man and draftsman, making right of ways and land surveys, Atlantic div., C.P.R.; summer 1915, Infantry School, Halifax. Lieut., 104th Batt.; at present convalescing from gas wounds.

References: H. W. D. Armstrong, A. A. Colter, B. M. Hill, D. F. Maxwell, J. A. MacKenzie, J. K. Scammell, S. B. Wass, G. L. Wetmore.

McDOUGAL—CHARLES HERBERT, of Niagara Falls, Ont. Born at Owen Sound, Ont., Sept. 4th, 1882. Educ., public and high school. 1907-08, Dutton & McArthur, railroad contractors, Kenora, Ont.; 1908-10, office work, rodman, inst'work, etc., N.T.C.Ry.; 1910'11, div. draftsman, in chg. of div. office; 1911-12, inst'man on residency, N.T.C.; 1912-14, with C.N.R., res. engr., Sudbury-Port Arthur line, in chg. 8 miles of work; Sept. 1914, enlisted; 1916-17, 2nd Can. Tunnelling Coy., 1917-Apr. 1919, Can. Ry. Troops; at present, res. engr., Niagara power development, Hydro-Elec. Power Comm.

References: E. T. Agate, A. C. D. Blanchard, H. L. Bucke, A. M. Macgillivray, A. F. Stewart.

McLAREN—DUNCAN LENNOX, of Peterboro. Born at Perth, Ont., Jan. 1st, 1892. Educ., B.A.Sc., Toronto Univ., 1914. 1914, to date, with Can. Gen. Elec. Co., as follows: 1914-16, students test course; 1916-19, asst. engr. on design of alternating current generators, synchronous motors and condensers.

References: R. L. Dobbin, J. A. G. Goulet, J. Macintosh G. R. Munro, R. H. Parsons, R. B. Rogers.

MERRY—FRANK STUART, of Toronto. Born at London,Eng.,Aug.6th,1893. Educ., 4th yr. student, S.P.S. 5 mos. with National Tube Works, Pittsburgh; 4¼ yrs. in C.E.F., 2 yrs. with commissioned rank in Can. Engrs.

References: L. M. Arkley, P. Gillespie, H. E. T. Haultain, C. H. Mitchell, W. J. Smither, C. R. Young.

MOLESWORTH—JOHN BROOKE, Lord Congleton, of Montreal. Born at Clonmel, Tipperary, Ireland, May 16th, 1892. Educ., Royal Naval Colleges, Osborne and Dartmouth, England; 1909-19, in Royal Navy; qualified gunnery lieut.; at present in 3rd year, mech'l eng., McGill Univ.

References: E. Brown, E. G. Burr, H. M. MacKay, C. M. McKergow, A. R. Roberts.

MORGAN—NEIL LYMAN, of Montreal. Born at Montreal, March 8th, 1892. Educ., B.Sc., McGill Univ., 1914. 1913 (5 mos.), with Can Allis Chalmers Ltd., Montreal, testing A.C. and D.C. motors, generators, etc.; 1914-17, Marconi Wireless Telegraph Co.:—1 yr. at Glace Bay transatlantic transmitting station as shift engr., in chg. of complete plant; 7 mos. at Louisburg, N.S., transatlantic receiving station as asst. res. engr.; 7 mos., at Montreal factory, designing steel towers and transmitting relays; Jan. 1917, to date, with Northern Elec. Co., as research engr., in chg. research laboratory.

References: E. G. Burr, J. S. Cameron, C. V. Christie, T. Eardley-Wilmot, L. A. Herdt.

MORTON—JAMES MARSHALL, of Winnipeg, Man. Born at Motherwell, Scotland, Sept. 6th, 1889. Educ., B.Sc., Glasgow Univ., 1912. Post grad. classes in roads and rys., Royal Tech. Coll, 1904-09, draftsman and estimator, Motherwell Bridge Co.; summers 1910, Appleby Crane & Transporter Co., Glasgow; 1911, Sir Wm. Arrol & Co.; 1912-15, estimator, Man. Bridge & Iron Works; 1915, inspector, Greater Wpg. Water Dist.; 1915-19, checker and estimator, Dom. Bridge Co.; at present, engr., J. & J. J. Allen, on new theatres in western Canada.

References: W. G. Chace, T. R. Deacon, G. H. Duggan, J. G. Glassco, J. G. Legrand, H. A. MacKay.

NOURSE—HUGH CAMPBELL BOYD, of Sherbrooke, Que. Born at Sherbrooke, Oct. 13th, 1892. Educ., B.Sc. (Mech. eng.), Queen's Univ., 1914. Summers, 1911-12-13, in machine shop, bench and vise work, running lathe, etc., erection air compressors; Aug.-Nov. 1914, with 5th Field Coy. C.E., Valcartier and Kingston; Feb. 1915, to date, with Can. Ingersoll-Rand Co., in various capacitices; 5 mos. in shrapnel shop on band lathe, etc.; 11 mos., tool drafting office, on design of lathes and tools, etc., transferred to eng. dept.; layouts of shop, machines and equipment for mfr. of shells, assisted in supervision of extension to shell shops; supervised extensions of drainage and sewerage system, also constrn. of 2 small brick bldgs., fire protection system and sprinklers, etc.; at present, engr. in chg. on Leyner Drill Sharpener and Little Tugger Hoist also on air compressor design.

References: N. E. Brooks, L. McD. Cairnie, G. D. MacKinnon, S. R. Newton, A. E. Nourse, S. R. Turner.

PERKS—WILLIAM GEORGE (Lieut.), of Peterboro. Born at Peterboro, Sept. 27th, 1884. 1907, rodman and inst'man, G. N. Ry., Spokane, Wash.; 1909, inst'man, Trent Valley Canal; 1910-11, res. engr., C.N.O.Ry.; 1912-14, in chg. of a section on constrn.; Oct. 1914-Sept. 1918, sapper and lieut., 6th Field Coy., Can. Engrs.; 1918, Sept. 1919, res. engr., C.N.R., in chg. of a section, maintenance of way; at present, asst. engr., city of Peterboro.

References: R. L. Dobbin, A. L. Killaly, G. P. MacLaren, G. R. Munro, R. H. Parsons, R. B. Rogers, A. F. Stewart.

PERRY—LEWIS ALAN (Cpl. M.M.), of Firdale, Man. Born at Fort William, Ont., Nov. 20th, 1893. Educ., 3 yrs. high school; I.C.S. 1909 (6 mos.), terminal party, G.T.P.; 1909-10, elec. apprentice, Federal Eng. Supply Co.; 1911, with G.T.P.; 1911-12, rodman, constrn., A.C.Ry.; 1912, rodman and inst'man., constrn., C.N.O.Ry.; 1912-13, acting res. engr., C.N.O.; 1913-14, rodman, maintenance of way, G.T.P.; Dec. 1914, enlisted, C.E.F., 1916-18, Royal Engrs. survey coys., as inst'man and draftsman, discharged Jan. 1919; 1919 (3 mos.), draftsman, dist. engr's office, P.W.D.,Fort William. Apr. 1919, to date, inst'man, G.T.P.

References: G. C. Dunn, C. H. Ellison, R. P. Graves, J. A. Heaman, G. Murray, J. G. Legrand.

REID—JOHN HERBERT, of Peterboro, Ont. Born at Seattle, Wash., Sept. 27th, 1890. Educ., B.Sc., McGill Univ., 1916. 1912-13, elec. maintenance. Granby Mining, Smelting & Power Co., Grand Forks, B.C.; 2 yrs., elec. constrn., city of Grand Forks; at present, students eng. course, test dept., Can. Gen. Elec. Co.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

ROBERTSON—CHARLES, of Peterboro. Born at Brantford, Ont., Sept. 17th, 1890. Educ., B.Sc., McGill. 1912. 1907-08, under city engr., Brantford; summer 1909, maintenance of way dept., C.P.R., Quebec; 1910, in chg. resurvey, Laurentian Mt. Div., C.P.R.; 1912, to date, asst. engr. on staff of ch. engr., Dept. Rys. and Canals, in chg. Trent River watershed hydrometric survey, etc.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

ROCHESTER—GORDON HAMILTON (Capt.), of Montreal. Born at Ottawa. Ont., Jan. 4th, 1894. Educ., grad., Ottawa Coll. Inst., 1913; at present 3rd year chem. eng., McGill Univ., 1912, C.N.R. constrn.; 1913, precision survey, Geodetic Dept.; 1914, I.C.Ry. constrn.; 1915-16, in chg. planetable party, International Boundary survey; Lieut., 1st Can. Tunnelling Coy., France; Captain, 6th Batt., Can. Engrs., mentioned in despatches; at present, attending McGill Univ.

References: M. B. Atkinson, R. E. Chambers, H. M. MacKay, M. H. MacLeod, N. J. Ogilvie, J. B. Porter.

SEATON—NORMAN DUNDAS, of Peterboro, Ont. Born at Alameda, Sask., July 17th, 1885. Educ., B.A.Sc., Toronto Univ. 1912. 2 yrs. in test dept., Can. Gen. Elec., one yr. on inventory of sub-stations, Toronto hydro-elec. system and one yr. as operator in hydro-generating station, Northern Canada Power Co.; Sept. 1916, to date, in switchboard section, eng. dept., Can. Gen. Elec. Co., making estimates and working on requisition for switchboard equipment.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

SHIRLEY—ERNEST ROXFORD, of Peterboro, Ont. Born at Canterbury Stn., N.B., Aug. 31st, 1882. Educ., B.A. (hons.), Univ. of N.B., 1903. B.Sc. (hons.), Queen's Univ. 1913. 1903-11, with Can. Gen. Elec. Co., as follows: 1903-04, factory and cost work; 1905-09, asst. mgr., production dept., Peterboro; summer, 1911, supt., erecting and operation of heavy elec. mach'y., transformers, etc., at Fort William and Kakabeka Falls, Ont.; 1912-13, asst. supt., British Can. Power Co. Ltd., and Northern Ontario Light & Power Co., Cobalt, complete chg. of entire power systems; 1913-15, elec. engr., Can. Exploration Co. Ltd., Naughton, Ont.; 1915-17, supt., Laurentian Power Co., Beaupre, Que.; 1917 to date, elec. engr., on eng. staff, Can. Gen. Elec. Co., specializing in design of switchboards and switching apparatus and power plant layout.

References: R. L. Dobbin, L. W. Gill, J. A. Goulet, A. R. Henry, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers, J. Ruddick, E. A. Wallberg.

SISSON—CHARLES EVERETT, of Peterboro. Born at Cavan, Ont., Oct. 25th, 1879. Educ., grad., S.P.S., Toronto, 1905. 20 mos. in testing dept., Can. Gen. Elec. Co.; 1905 to date, with same firm as follows:—1905-08, design and eng supervision of mfr. of induction motors and small transformers; 1908-10, head designer of small and medium sized transformers, etc.; 1910 to date, chg. of estimates, designing and supervision of constrn. and testing of all transformers.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

SMITH—JOSEPH WARREN, of Toronto, Ont. Born at Philadelphia, Pa., April 21st 1885. Educ., Franklin Inst., Phila.; Y.M.C.A. night classes; private night schools. 1900-10, with American Bridge Co., 8 yrs. in offices and shops and 2 yrs. in drawing room at Ambridge, Pa', as detailer, checker and asst. squad boss; 1910-12, in chg. bridge and complicated bldg. work in drawing room of Can. Foundry, Toronto; Nov. 1912, to date, ch. draftsman in chg. of drawing room, Dom. Bridge Co., Toronto, also mgr., Robb. Eng. Works, Toronto Office.

References: R. S. Buck, G. H. Duggan, G. E. Evans, E. S. Mattice, J. W. Moffat, D. W. Robb, F. P. Shearwood, H. H. Vaughan.

STAVERT—REUBEN EWART, of Peterboro. Born at Kingston, Jamaica, Oct. 3rd, 1893. Educ., B.Sc., McGill, 1914. 1912 (2½ mos.) in transformer dept. and motor assembly, Can. Gen. Elec.; 1913 (3 mos.), test and motor assembly, Westinghouse Mfg. Co., Hamilton; 5 mos., students test course, Can. Gen. Elec ; 1914. March 1919, with C.E.F., in France and England; one yr. as an officer in Can. Engrs.; at present, rest course, C.G.E.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

SUTHERLAND—ANGUS LYNN, of Peterboro, Ont. Born at Chippewa Falls, Wis., Aug. 21st, 1885. Educ., B.A.Sc. (mech. eng.), Toronto Univ., 1911. 1911-16, with Can. Gen. Elec. Co., as follows:—1911-13, elec. test; 1913 (5 mos.), asst. to transformer engr. on design; 1913-14, asst. to data engr.; 1915-16, production dept., following up mfr. of induction motors and repair parts; 1916, with Ross Rifle Co., Quebec, in chg. of production of miscellaneous rifle parts; 1916-18, eng. and drafting on air compressors and air tools, 9 mos. in chg. of drafting and detailing marine engines; June 1918, to date, transformer drafting and mech'l design, Can. Gen. Elec. Co.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

WATSON—JAMES MORRISON, of Toronto, Ont. Born at Woodstock, Ont., May 18th, 1895. Educ., 4th year student, school of science, Toronto. 17 mos. in machine shop work during vacations; served in Army.

References: L. M. Arkley, P. Gillespie, H. E. T. Haultain, C. H. Mitchell, W. J. Smithers, C. R. Young.

WESTBYE—PEDER PEDERSON, of Peterboro, Ont. Born at Hedrum, Larvik, Norway, Jan. 31st, 1878. Educ., M. and E.E., Mittwida & Dresden, Saxony, 1900; grad. as M.E., Porsgrund Tech. School, 1897. One yr. machine shop experience, Larvik, Norway; 1900-02, asst. to ch. engr. and 1902-05, ch. engr., Jensen & Olsen, machine shops and foundries, Esbjerg, Denmark; 1905-06, on eng. work in Europe; 1906, designer, Wm. Sellers & Co., Philadelphia; 1906-10, designer and then ch. engr., Dayton Globe Iron Works, hydraulic turbines and pulp mill mach'y.; 1910-11, asst. to ch. engr., Platt Iron Works, Dayton, Ohio; invented and patented 3 styles of centrifugal pulp and screening machines; 1911, came to Peterboro to introduce these on the market; 1913-19, conslt. engr., Wm. Hamilton Co., Ltd., Jan. 1919, to date, vice-pres. and gen. mgr., same firm.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

WHYTE—GEORGE HERBERT (Major), of Calgary, Alta. Born at New Westminster, B.C., Feb. 19th, 1890. Educ., high school. 1908-10, drafting office, Forestry branch, Dept. Interior; 1910 (5 mos.), rodman and recorder, Hydrographic Survey; 1910-11, hydrographer, Milk & St. Mary Rivers investigation; 1911-13, dist. hydrographer, Irrigation branch; 1913-16, senior asst. to ch. hydrographer; 1916 (4 mos.), div'n hydrometric engr.; 1916-Apr. 1919, lieut., capt. and major, 10th Field Coy. and 10th Batt., Can. Engrs., B.E.F.; at present, div. hydrometric engr., Reclamation Service.

Reference: R. J. Burley, A. L. Ford, F. H. Peters, P. M. Sauder, J. S. Tempest, W. P. Wilgar.

WILKINS—HAROLD OSWALD DAY, of Norwood, Ont. Born at Norwood, June 7th, 1892. Educ., R.M.C., 1914. Aug. 1914-Oct. 1919, officer in Imperial regiment; at present in 3rd year mech'l eng., McGill Univ.

References: E. Brown, E. G. Burr, H. M. MacKay, C. M. McKergow, A. R. Roberts.

WILSON—JOHN SAMUEL (Lieut., M.C.), of Toronto, Ont. Born at Green River, Ont., Mar. 6th, 1892. Educ., 4th year student mech'l eng., Toronto, Univ., 1910-11, asst. millwright, log saw mill; 1912, head millwright; 1913, in chg. planing mill; 1914, engr. in chg. steam plant, engines, boilers, elec. lighting; Mar. 1915, enlisted, 26th Battery, C.F.A., 4 yrs. with C.E.F., demobilized, Mar. 1919, as Lieut. (M.C.); Mar.-Oct., 1919, engr. in chg. 300 h.p. steam plant; at present, attending Toronto Univ.

References: L. M. Arkley, P. Gillespie, H. E. T. Haultain, T. R. Loudon, C. H. Mitchell, C. R. Young.

YOUNG—WILLIAM BRAND, of Vancouver, B.C. Born at Glasgow, Scotland, Nov. 7th, 1881. Educ., private tuition, technical training, mechanics, constrn., Royal Tech. Coll., architectural eng., Glasgow School of Art. 1898-99, architectural eng., office of late W. J. Anderson, Glasgow; 1900-05, structural eng., Brand & Lithgow, conslt. engr. and surveyors; 1905-08, ch. draftsman, Brand & Lithgow, preparing designs and details for eng. works; 1908-09, private practice, Glasgow; 1911, to date, in city engr's office, Vancouver, ch. draftsman in chg. of drawing office, responsible for designs for roadways dept., etc.; military appointments during war:—Lieut., Can. Engrs.; Works Officer, Engrs. Training Depot, St.Johns, P.Q.; Officer in chg. of Engineers Relief Party; Halifax Disaster; camp engr., Sussex Camp, N.B.; asst. engr. to director of engr. services, Q.M.G. Branch, staff headquarters, London, Eng.

References: C. Brakenridge, C. E. Cooper, A. G. Dalzell, P. Phillip, W. H. Powell, R. Rome.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

DICKENSON—JOHN GOODALL, of Cobalt, Ont. Born at Tor. Bay, N.S., March 17th, 1883. Educ., Loyola Coll., Montreal, 1895-99. B.A., 1904, B.Sc. (mining), 1907, McGill Univ., 1904 (6 mos.), electrolytic refinery, Can. Smelting Works, Trail, B.C., clerk of works; 1905 (6 mos.), ch. of party, prelim. and location, various surveys, G.T.R., Midland, Ont.; 1905-06, one of 4 supts. in chg. of constrn. subaqueous work, McAdoo Tunnels, New York to Jersey City; Sept. 1906, taught surveying, McGill field school; Oct. 1907, foreman on subway and other constrn., with N.Y. and N.J. Telephone Co.; 1909-14, div'n. commercial engr., Hodson Div., N.Y. Telephone Co., Albany, N.Y.; May 1916 to date, mgr., O'Brien Mine; mgr., The Cobalt Foundry; president, The Northern Lumber Mills Ltd.; mgr., The Miller Lake O'Brien Mine; mgr., Gowganda Power Co., Ltd., etc.

References: DeG. Beaubien, C. E. W. Dodwell, T. M. Fyshe, F. S. Keith, J. G. G, Kerry, W. S. Lea, D. W. McLachlan.

HERTZBERG—HALFDAN FENTON HARBO (Col., C.M.G., D.S.O., M.C.), of Halifax, N.S. Born at Toronto, Ont., Sept. 3rd, 1884. Educ., St. Andrews Coll., grad., S.P.S., 1907, 3 mos. course, mil. eng., R.M.C. 1901-03, rodman, etc., C.P.R., Toronto; summers, 1906, rodman and leveller, constrn., Magog, Que.; 1907, transitman, maintenance, Montreal; 1908, rodman and asst. transitman, C.P.R., London, Ont.; 1909, topog'r and leveller, C.N.R., location in Minnesota; 1909-10, leveller, C.P.R., Vancouver; 1910 (8 mos.), asst. branch mgr., Trussed Concrete Steel Co. of Can. Ltd., Winnipeg; 1910-11, mgr., Wpg. office, same firm, in chg. of designing and supervision of constrn. of reinforced concrete bldgs., bridges, etc.; 1911-14, ch. engr., Trussed Concrete Steel Co., at Walkerville, Ont., in chg. eng. dept., design, supervision of constrn. etc.; 1916-18, commanding Royal Engrs. in Field Co'y, 1st Can. Div., France; 1918-19, commanding 3rd Can. Div. Engineers, in chg. of all fortifications and defence work held by 1st and 3rd Can. Div.; at present, C.R.C.E., Mill. Dist. No. 6, Halifax.

References: C. J. Armstrong, C. E. W. Dodwell, J. M. R. Fairbairn, E. P. Fetherstonhaugh, G. Kahn, H. J. Lamb, A. Macphail, J. M. Rolston.

HILL—EDGAR MURRAY MacCHEYNE (Capt.), of Winnipeg, Man. Born at Guelph, Ont., Oct. 13th, 1882. Educ., grad., S.P.S., Toronto, 1904. Summer, 1902, on Dom. Govt. surveys, Kamloops, B.C.; 1903-16, with C.N.R., as follows:—1903, rodman, etc., constrn. Roblin, Man.; 1904-05, res. engr., constrn., main line; 1906, transitman on location party; 1907-08, in chg. location party; 1909-11, on various lines in Alberta; 1911-14, reconnaisance exploration and surveys; div. engr. in chg. constrn., Calgary-MacLeod branch; 1914-16 ,location, various lines in Alta.; Aug. 1916, joined Can. Engrs., transferred to Royal Engrs. (B.E.F.); had chg. of surveys, Conchil-Conteville Ry., France; later, transferred to No. 7 ry. reconnaisance and survey section, B.E.F., and attached to O i/c ry. maintenance and works, Arras, France, as officer in chg. of surveys; at present, exploration and reconnaisance engr. C.N.R., Winnipeg.

References: W. Burns, H. A. Dixon, M. H. MacLeod, A. J. Sill, T. Turnbull.

MUNRO—GEORGE REID, of Peterboro, Ont. Born at Peterboro, Mar. 13th, 1887. Educ., grad., S.P.S., 1905; B.A.Sc., Toronto U iv., 1906. Summers, 1903-04, in foundry, 1905-06, in machine shops, Wm. Hamilton Mfg. Co., Peterboro; 1906-07, draftsman, eng. dept., same firm; 1907-08, demonstrator in mech. drawing, Faculty of Applied Science, Toronto Univ.; 1908-09, inst'man, reconnaisance surveys, H.B. Ry.; 1909-10, asst. engr., Smith, Kerry & Chace, Toronto; 1910-11, asst. engr., R. S. Lea, Montreal; 1911, to date, ch. engr., Wm. Hamilton Co. Ltd., mfrs. hydraulic turbines, pulp and saw mill mach'y., at present, 2nd vice-pres. and ch. engr.

References: F. B. Brown, R. L. Dobbin, W. J. Francis, N. R. Gibson, P. Gillespie J. G. G. Kerry, R. S. Lea, J. B. McRae, R. H. Parsons, R. B. Rogers.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

LEGER—ALCIBIADE, of Montreal. Born at Montreal, Oct. 14th, 1887. Educ., classical course (B.L.), St. Mary Coll., Jesuites; 1 yr. Laval Univ. 1 yr. with Federal Govt., Yamaska River public works; 3 yrs., in office, Malcolm Barclay; 1 yr., Beique & Charton (C.N.R. contracts); 1 yr., Hurtubise & Hurtubise, sewers at Pointe aux Trembles; 4 yrs., with Quebec Govt. (cadastral office); 1917, enlisted in Forestry Corps and was overseas 1 yr.; re-enlisted in Can. Engrs., 1918, served in France and England 18 mos.; while in France had chg. of different surveys and mapping for areas covering all north part of France; in England had chg. of a class in eng'g. at Khaki Univ. for 6 mos.; at present, dept. Colonisation, Mines & Fisheries, Quebec Govt.

References: M. D. Barclay, U. Chopin, G. Hurtubise, L. Hurtubise, T. Kirk, R. Lesage, S. Ouimet.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

MACDONALD—CHARLES BEVERLEY ROBINSON (Capt.), of London, Eng. Born at Halifax, N.S., Dec. 8th, 1893. Educ., diploma with honors, R.M.C., 1914. 1910-11 (8 mos.), rodman, etc., irrigation dept., C.P.R.; July-Nov. 1914, asst. surveyor, Hydrographic Survey of Canada in Hudson Bay & Straight; Jan. 1915, gazetted 2nd lieut., Royal Engrs.; July 1916, Lieut.; Mar. 1918, capt.; was engaged in regular field eng. works, defences, water supply, etc., and in chg. of location and constrn. of important light rys. in Salonica; as adjutant of engrs., 10th Div., in complete control of all engr. supplies for div., etc.; at present, on Hydro Elec. Power Comm. Canal, Niagara Falls, Ont., with various gangs, at present as runner of submarine drill on land carriage.

References: H. L. Bucke, R. P. Johnson, H. J. Lamb, R. W. Leonard, A. C. Macdonald.

McPHAIL—DONALD STUART (Capt.), of Montreal. Born at Tulloch, Jamaica, May 23rd, 1893. Educ., Oundle School, England; 3 yrs. applied science (civil), McGill; School of Mil. Eng., Chatham, Eng.; summers, 1913, transitman, Jamaica Govt. Ry.; 1914, asst., topog. section, Canada Geological Surveys; Mar. 1915—June 1919, overseas, capt., R.E., design and constrn. of military works; at present student 4th year civil eng., McGill Univ.

References: E. Brown, H. M. Lamb, H. M. MacKay, C. M. McKergow, J. B. Porter.

RYAN—CHARLES WILBERT, of Lisben Falls, Me. Born at Mount Forest, Ont. Aug. 10th, 1892. Educ., B.Sc., McGill Univ., 1916. Summers, 1906-07-15, with Prov. of B.C.; 1914, rodman, Dept. of Mines survey in N.S.; 1916, to date, with Turner Constrn. Co., as follows:—1916-17, engr. on constrn. bldgs.; 1917-19, asst. supt.; Aug. 1919, to date, supt., on Worumbo Mfg. Co., new addition, Lisben Falls, Maine.

References: E. Brown, F. B. Brown, H. M. MacKay, W. McNab. J. B. Porter.

SEABOURNE—ROLFE LESTER, of Quebec, P.Q. Born at Thorndale, Ont., Sept. 25th, 1889. Educ., B.A.Sc. (hons.), Toronto, S.P.S. 1916. 1909 (9 mos.), rodman, exploration and mapping (compass), Laurentide Co., Grand Mere; 1910 (3 mos.), exploration, Q.M.S.Ry.; exploration, cruising, base-line and river trav., topog. survey, Brown Co., LaTuque; pole transmission line, Windsor Mills, Sherbrooke; quarry survey, profile, section, etc., Stanbridge, P.Q.; survey, St. Narcisse, P.Q.; 1916-17, Shaw. Water & Power Co.; May 1917, to date, mgr., Laurentian Forest Protective Ass'n, Quebec.

References: A. C. Fellows, P. Gillespie, H. E. T. Haultain.

WEEKS—ROWLAND EDGAR (Lieut.), of Souris, Man. Born at Winnipeg, Man., May 12th, 1893. Educ., B.C.E., Univ. of Man., 1916. 10 mos., rodman, etc., on C.P.R. constrn. surveys, at Wardner, B.C., and Lauder, Man.; 1913 (5 mos.), levelman, Dom. hydrographic survey on North Sask. River; 1914 (5 mos.), levelman, prelim. surveys in St. Andrews Munic., Man., under Man. Good Roads Dept.; 1916 (6 mos.), Man. Prov. Highway dept., as asst. engr., Wallace Munic., making prelim. surveys, staking out and supt'g. constrn. of good roads; 1916, valuation survey on part of southern lines, C.N.R.; 1917, res. engr. with Wpg. Aqueduct Constrn. Co. supervising excavation of trench, placing of grand foundation, etc.; 1917-18, lieut., Can. Engrs.; 1919 (3 mos.), engr. in chg. of prelim. road surveys in Munic. of Rockwood; July 1919, to date, municipal engr., Munic. of Glenwood, Man., in chg. of all eng. work, bldg. of highways, etc.

References: E. E. Brydone-Jack, F. E. Emery, M. A. Lyons, A. McGillivray, C. N. Mitchell, A. H. O'Rielly, G. L. Shanks.

Monthly Engineering Index

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AERONAUTICS

AEROPLANE PARTS

FITTINGS. The Design of Aeroplane Fittings, E. S. Bradfield. Aerial Age, vol. 9, no. 26, Sept. 8, 1919, pp. 1175-1176, 4 figs. Charts for determining dimensions and design of metal fitting.

AIRCRAFT

APPLICATIONS. Future of Airships. (La question du plus léger que l'air et son avenir. J. Sabatier. Aéronautique, vol. 1, no. 1, June 1919, pp. 15-24, 6 figs. Comparison, from commercial viewpoint, with aeroplane.

BALLOONS, OBSERVATION. Observation Baloons. (L'Aérostation d'observation) M. Georges. Aéronautique, vol. 1, no. 3, Aug. 1919, pp. 105-111, 11 figs Their origin and development, notably during the war.

CEILING. Application of Theory of Airships to an Example. Variations of Ceiling and Essential Speed with Characteristic Coefficients. (Application de la théorie des avions à un exemple. Variations du plafond et de la vitesse ascensionnelle avec les coefficients caractéristiques), A. Rateau. Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 4, July 28, 1919, pp. 156-162, 1 fig. In case of airship weighing 1700 kg. fitted with 300-hp. motor.

ELECTROSTATIC EFFECTS. Electrostatic Effects on Airships, Gordon S. Fulcher. Aviation, vol. 7, no. 4, Sept. 15, 1919, pp. 174-176. Results of experiments conducted at Princeton University and in wind tunnel at Navy Yard, Washington, to determine safety precaution in design, construction and operation of airships necessary because of electrostatic effects.

FLIGHT FORMULAE. Calculating the Maximum Continuous Flight of an Airship (La distance maxima de vol d'un avion), E. Dorand. Aéronautique, vol. 1, no. 1, June 1919, pp. 4-10. Formula in terms of quantities usually determine in experimental testing of machine.

LANDING GEAR. Landing and Mooring Gear for Airships. Aeronautics, vol. 17, no. 301, July 24, 1919, pp. 90-92, 3 figs. Vicker's patent masts and their operation.

LIFT. The Available Lift of Rigid Airships, E. H. Lewitt. Aeronautics, vol. 17. no. 306, Aug. 28, 1919, pp. 214, 2 figs. Graphs and formulæ.

LOAD. Calculation of the reduced Useful Load of an Airship. (Berechnung der reduzeirten Nutzlast eines Luftschiffes), C. Eberhardt. Motorwagen, vol. 22, no. 13, May 10, 1919, pp. 221-223. Important from commercial point of view.

MOORING GEAR. *See Landing Gear.*

NAVAL AIRSHIPS. Navail Airships (L'Aérostation Maritime). Génie Civil, vol. 75, no. 7, Aug. 16, 1919, pp. 141-147, 7 figs. Types of the French and Italian navies.

UNITED STATES. Airship Engineering Progress in the United States, J. C. Hunsacker. Aviation, vol. 7, no. 3, Sept. 1, 1919, pp. 123-128, 9 figs. Suspension systems and valve construction; features of C class. (Concluded).

UNITED STATES NAVY. The U. S. Navy B.-Class Dirigible. Aerial Age, vol. 10, no. 1, Sept. 15, 1919, p. 19, 3 figs. Sketch showing arrangement of parts.

VICKERS. " Milestones" (Airships), Vickers. Flight, vol. 11, no. 34, Aug. 21, 1919, pp. 1121-1130, 20 figs. British Admirality types developed from 1913 to 1918.

WIRING, STRESSES. Tensions in Transverse Wiring of a Rigid Airship due to deflated Gas Bag, E. H. Lewitt. Aeronautics, vol. 17, no. 302, July 31, 1919, pp. 121-123, 3 figs. Deflation diagram of circular shape having axial wire passing through center.

APPLICATIONS

COMMERCIAL FLYING. Commercial and Pleasure Flying, Claude Graham-White. Aeronautical Jl., vol. 23, no. 101, May 1919, pp. 231-256, 13 figs. Considerations in regard to safety, reliability and commercial value of flying together with illustrations of various models developed for carrying passengers.

PHOTOGRAPHY, AERIAL. Recent Progress in Aerial Photography, L. P. Clerc. Sci. Am. Supp., vol. 88, nos. 2278 and 2280, Aug. 30 and Sept. 13, 1919, pp. 136-138 and p. 170, 14 figs. Discussion of application of war inventions to peace-time needs. (*Translated from La Science et la Vie.*)

SURVEYING AND MAPPING. Surveying and Mapping from Airplanes, E. Lester Jones. Eng. & Contracting, vol. 52, no. 12, Sept. 17, 1919, pp. 325-326. Application of methods which were used during the war for photographing enemies' lines to mapping of extensive area. Address delivered before Second Pan-American Aeronautic Convention.

AUXILIARY SERVICE

PARACHUTES. Aviation Parachutes (Les parachutes d'Aviation), L. P. Frantzen. Aerophile, vol. 27, nos. 13-14, July 1-15, 1919, pp. 211-217, 8 figs. Particulars of various types developed in U. S., England and France. (To be continued.)

DESIGN

DESIGN. Some Points in Aeroplane Design, F. S. Barnwell. Aeronautical Jl., vol. 23, no. 102, June 1919, pp. 301-325, 10 figs. Concerning form of aerofoil section, optimum position for main spars of aerofoil and question of economic position of points of support.

CEILING. Formulae for practical Calculation of Ceiling of Aircraft (Nährungsformeln aur praktischen Berechnung der Höhenleistung von Flugzeugen), p. Jaray. Zeitschr. f. Flugtechnik und Motorluftschiffahrt, vol. 10, nos. 7-8, Apr. 26, 1919, pp. 73-82, 8 figs. Tables and curves showing altitude and velocity calculations.

LINEAR FLIGHT. Notes on Flying (Indications sur le problème de l'avion), M. Devillers. Aéronautique, vol. 1, no. 2, July 1919, pp. 22-28, 3 figs. Technical study of linear flight; experiments to determine efficiencies of various problems differing in ratio of pitch to diameter. (To be continued.)

PERFORMANCE FORMULAE. Predicting the Performance of an Airplane, V. E. Clark. Aviation, vol. 7, no. 4, Sept. 15, 1919, pp. 168-174, 16 figs. Curves for estimating absolute ceiling, climb and maximum and minimum horizontal speeds at any working altitude.

STRESSES. The Loads and Stresses on Aeroplanes, John Case. Aeronautics, vol. 17, nos. 301, 302, 303, 304 and 305, July 24, 31, Aug. 7, 14 and 21, 1919, pp. 98-101, 115-118, 141-143, 167-169 and 192-193, 34 figs. July 24: Effect of stagger and gap chord ratio on center of pressure movement. July 31: Examples of applications of formulae derived in preceding installments. Aug. 7: Loads on machine turning in horizontal circle. Aug. 14: Spar design; load curves for spars. Aug. 21: Bending moments and shearing forces on freely supported beams.

WAR DEVELOPMENTS. Some Developments in Aircraft Design and Application during the War, Lord Weir. Trans. North-East Coast Instn. Engrs. & Shipbuilders, vol. 35, no. 6, Aug. 1919, pp. 268-333 and (discussion), pp. 333-347, 57 figs. Aerodynamical and applicational aspect of salient features of progress and design.

DYNAMICS

HIGH-SPEED AERODYNAMIC PHENOMENA. Studies in High-Speed Aerodynamic Phenomena, F. W. Caldwell and E. N. Fales. Automotive Industries, vol. 41, no. 9, Aug. 28, 1919, pp. 422-426, 13 figs. Comment on workings of army high speed wind tunnel at McCook field, Dayton, Ohio.

ENGINES

HISPANO-SUIZA. The Hispano-Suiza Airplane Engine—V, H. O. C. Isenberg. Am. Mach., vol. 51, no. 11, Sept. 11, 1919, pp. 515-519, 16 figs. Making of pistons; porosity test of large parts that must be air-or liquid-tight are subjected; inspection gages for rough castings.

NAPIER LION. Napier 450-Hp. "Lion" Engine. Aeronautics, vol. 17, no. 303, Aug. 7, 1919, pp. 138-139, 2 figs. Twelve-cylinder 850-lb. engine.

ROTARY ENGINES. German Type of Double Rotary Aircraft Engine. Automotive Industries, vol. 41, no. 11, Sept. 11, 1919, pp. 514-515, 1 fig. Siemens & Halske power plant which appeared in single seater scout plane near end of war. Cylinders and crankshaft rotate in opposite directions.

SUPERCHARGING. How to Get Maximum Efficiency of Supercharged Motors giving Constant Power at all Altitudes (Emploi des moteurs suralimentés à puissance constante à toutes les altitudes.) Aéronautique, vol. 1, no 2, July 1919, pp. 17-22. Calculation of speed to give propeller at various altitudes.

CONSTANT PRESSURE. Maintaining Constant Pressure Before the Carburetors of Aero Engines Regardless of the Altitude, Leslie V. Spencer. Flight, vol. 11, no. 36, Sept. 4, 1919, pp. 1191-1194, 8 figs. Mechanical details of Moss turbo-supercharger. (Concluded.)

VIBRATION. Airplane Engine Vibration, Glenn D. Angle. Aviation, vol. 7, no. 3, Sept. 1, 1919, pp. 118-122, 6 figs. Technical study of its causes and manner of preventing it.

HISTORY

War Period. Historical Account of Aviation during the War from 1914-1918 (Historique de l'emploi de l'aviation), M. Orthlieb. Aéronautique, vol. 1, nos. 1 and 3, June and Aug. 1919, pp. 9-13 and 112-117, 6 figs. June: Strategic operations. Aug.: Work of aviation corps in battle of Verdun. (Concluded.)

MATERIALS OF CONSTRUCTION

Dope. *See Fabric and Dope.*

Fabric and Dope. Fabric and Dope, with Special Reference to Deterioration of Strength and Tautness, F. W. Aston. Aeronautical Jl., vol. 23, no. 101, May 1919, pp. 213-230, 10 rigs. Sunlight is claimed to be only serious deteriorating agent; a curve is given showing change in rate of strength throughout year, effect being very great in summer and practically negligible in winter.

Plywood. Tests on Thin Plywood as a Substitute for Linen in Aeroplane Construction, Armin Elmendorf. Aerial Age, vol. 9, no. 24, Sept. 1, 1919, pp. 1135-1136, and p. 1147, 4 figs. At Forest Products Laboratories of U. S. Forest Service, Madison, Wisc.

Wood. Selecting Wood for Airplanes, Arthur Koehler. Sci. Am. Supp., vol. 88, no. 2279, Sept. 6, 1919, pp. 148-149, 5 figs. Discussion of considerations necessary in selecting materials and the effects of some hidden defects.

See also Plywood.

Splintering. Splintering of Airplane Woods, G. E. Heck. Sci. Am. Supp., vol. 88, no. 2274, Aug. 2, 1919, pp. 68-69, 4 figs. Tests of different airplane woods to determine relative splintering under rifle fire, conducted at U. S. Forest Products Laboratory, Madison, Wisc.

Spruce, Treatment. Treatment, Seasoning and Working of Spruce for Airplanes (Manutention, Magasinage et entretien des bois de sapin pour aéroplanes). Génie Civil, vol. 75, no. 11, Sept. 13, 1919, pp. 251-253, 2 figs. Account of processes followed and of experiments performed to determine physical properties of various samples.

METEOROLOGY

Atmospheric Sounding. Sounding of Very High Regions of Atmosphere with Long Range Artillery (Sondage de la très haute atmosphère par l'Artillerie à longue portée), A. de la Baume-Pluvinel. Aérophile, vol. 27, nos. 13-14, July 1-15, 1919, pp. 209-210. Concerning requirements which must be possessed by shells capable of being sent to height in neighborhood of 50 miles.

Barometric Variation, Forecast. Utilization of Temperatures in Forecasting Barometric Variations (Sur l'utilisation des températures pour la prévision des variations barométriques), G. Reboul and L. Dunoyer. Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 4, July 28, 1919, pp. 191-193. Following rules are formulated: (1) Rise in temperature precedes barometric depression; (2) falling temperature precedes barometric rise.

Clouds, Measurement of Water. Measurement of Water in Clouds, L. F. Richardson. Proc. Roy. Soc., vol. 96, no. A674, Aug. 1, 1919, pp. 19-31, 3 figs. How to measure diminution by clouds of difference of brightness at edge of sun's disc by special photometer.

Electrical Physics of Atmosphere. The Electrical Physics of the Atmosphere, J. E. Taylor. Instn. Post Office Elec. Engrs., no. 74, Nov. 19, 1917, 60 pp., 7 figs. Compilation of technical information in regard to electrical effects in atmosphere considered as of useful value to telephone and telegraph engineers, with special reference to general character and causes of natural disturbances on telephone and telegraph circuits apart from direct lightning discharges.

Magnetic Storms. Magnetic Storms of March 7-8 and August 15-16 and their Discussion, C. Chree. Proc. Roy. Soc., vol. 96, no. A674, Aug. 1, 1919, pp. 32-35, 1 fig. From records obtained at Kew and Eskdalemuir observatories.

Stirring, Atmospheric Measurement. Atmospheric Stirring Measured by Precipitation, Lewis F. Richardson. Proc. Roy. Soc., vol. 96, no. A674, Aug. 1, 1919, pp. 9-18. Equation for diffusion is investigated in general case in which atmospheric distance and degree of turbulence must both be regarded as varying with height.

United States Army. Some Scientific Aspects of the Meteorological Work of the United States Army, Robert A. Millikan. *Proc. Am. Philosophical Soc., vol. 58, no. 2, 1919, pp. 133-149, 8 figs. Scientific interest seem to center about (1) extension of knowledge of law of motion of pilot balloons, (2) procurement of data and development of methods for preparation of artillery range tables, (3) development of long range propaganda for preparation of artillery range (3) development of long range propaganda balloons, and (4) charting of upper air in United States and overseas, in aid of aviation.

Wind. Diurnal Variation of the Velocity of the Wind (La variation diurne de la vitesse du vent dans l'atmosphère), J. Rouch. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 6, Aug. 11, 1919, pp. 293-295. Observations made at top of Eifel Tower (altitude about 1000 ft.)

Wind Velocity in High Atmosphere in Clear Weather (Sur la vitesse du vent dans la haute atmosphère par temps clair), Cu. Maurain. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 2, July 15, 1919, pp. 79-82, 1 fig. Based on balloon sondages at altitudes exceeding 32, 800 ft.

PRODUCTION

Aviation Repair Depot. "New Planes for Old"—The Work of the Aviation Repair Depots, William Menkel. Aerial Age, vol. 9, no. 24, Sept. 1, 1919, pp. 1129-1133, and p. 114, 11 figs. Organization system of depot at Indianapolis.

Inspection. Inspection of Airplanes at Romorantin, France, Earl E. Ives. Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 819-820. DeHaviland-4s American built were shipped to Romorantin in semi-assembled condition and there were uncrated, set up, tested and flown to the battle line. Work of inspectors involved in these operations is taken up.

Standardization. Standardization in Aircraft Construction (Normung in Luftfahrzeugbau). Zeitschr. f. Flugtechnik und Motorluftschiffahrt, vol. 10, nos. 5-6, Mar. 29, 1919, pp. 45-61. Standards for bolts, screws, cables, sheets, tubes, etc.

MILITARY AIRCRAFT

War Period. Historical Account of Aviation during the War of 1914-1918 (Historique de l'emploi de l'Aviation pendant la guerre 1914-1918), M. Orthlieb. Aéronautique, vol. 1, no. 2, July 1919, pp. 49-52, 3 figs. Reconnaissance work by means of airplanes. (Continuation of serial.)

See also History (War Period).

MODELS

Model Tests. From Model to Full Scale in Aeronautics, H. Levy. Aeronautical Jl., vol. 23, no. 102, June 1919, pp. 326-345, 12 figs. Question discussed from theoretical standpoint.

PLANES

B.A.T. The B.A.T. Four-Seater Biplane. Aerial Age, vol. 9, no. 26, Sept. 8, 1919, pp. 1172-1174, 7 figs. Biplane designed either for passenger work or for carrying mail. *From Flight.*

German Giant Aircraft. Development of Giant Aircraft Construction in Germany during the War (Die Entwicklung des deutschen Riesenflugzeugbaues während des Krieges), A. Baumann. Zeitschr. des Vereines deutscher Ingenieure, vol. 63, no. 22, May 31, 1919, pp. 497-504, 10 figs. Description of C, G, R and Lenz types.

See also Hydroaeroplanes, German.

Graham-White. The Graham-White "Aero-Limousine." Aeronautics, vol. 17, no. 305, Aug. 21, 1919, pp. 190-191, 3 figs. Flight, vol. 11, no. 37, Sept. 11, 1919, pp. 1214-1218, 19 figs. Power unit consists of two Rolls-Royce Eagle Mark V engines of 320 hp., one on each side of fuselage, between top and bottom planes; span is 60 ft.; overall length 39 ft. and overall height 11 ft.

Hydroaeroplanes, German. Development of German Hydroaeroplane Construction (Die Entwicklung des deutschen Seeflugzeuges), Werner v. Langsdorff. Schiffabu, vol. 20, no. 16, May 28, 1919, pp. 423-427, 10 figs. Description of Aeg, Ago, Albatross, Friedrichshafen and other types.

Lawson. The "Lawson" Aerial Transport. Flight, vol. 11, no. 37, Sept. 11, 1919, pp. 1220-1222, 6 figs. Power is supplied by two Liberty engines of 400 hp. each. Overall length is 47 ft. 7 in., overall height 14 ft.; speed is 100 m.p.h.

NC. Design and Construction of the NC Flying Boats, G. C. Westervelt. U. S. Naval Inst. Proc., vol. 45, no. 199, Sept. 1919, pp. 1529-1581, 47 figs. Historical and descriptive account.

Nieuport. British Nieuport Aeroplanes. Aeronautics, vol. 17, no. 301, July 24, 1919, pp. 94-95, 6 figs. Economy claimed in manufacture by use of rectangular section struts, streamlining being effected by means of fabric fairing.

The Nieuport "Hight Hawk" Single-Seater Scout—II. Engineer, vol. 128, no. 3320, Aug. 15, 1919, pp. 151-153, 5 figs. Arrangement of controls in cockpit.

Siemens-Schuckert. Enemy Airships (L'Aviation Ennemie), René Bréval. Aérophile, vol. 27, nos. 13-14, July 1-15, 1919, pp. 198-199, 7 figs. Characteristics of Siemens-Schuckert chasing biplane.

Siemens-Schuckert 1800-hp. Giant Airship (L'avion Géant Siemens-Schuckert 1800 hp.), René Bréval. Aérophile, vol. 27, nos. 13-14, July 1-15, 1919, pp. 199-200, 2 figs. Length 71 ft.; height 24 ft.

Westland. The Westland Limousine. Aeronautics, vol. 17, no. 303, Aug. 7, 1919, p. 133, 1 fig. Flight, vol. 11, no. 35, Aug. 28, 1919, pp. 1145-1148, 6 figs. Four-seater commercial biplane; length 28 ft. 6 in., wing span 38 ft. 2 in.; speed at 10,000 ft. 91 miles, fitted with 275-hp. Rolls-Royce Falcon engine.

RESEARCH

Stanford University. The Stanford University Aerodynamic Laboratory, E. J. Baughman. Aviation, vol. 7, no. 4, Sept. 15, 1919, pp. 183-184, 4 figs. With reference particularly to wind tunnel.

TRANSATLANTIC FLIGHT

Airship, Trans-Atlantic Flying. Notes on Long Aerial Flights (En marge des raids aériens), M. Thebault. Aéronautique, vol. 1, no. 1, June 1919, pp. 11-15, 5 figs. Technical study of problem of trans-Atlantic crossing in airship.

VARIA

Air Navigation Regulations. Convention relating to International Air Navigation. Aeronautics, vol. 17, nos. 302, 303, 304 and 305, July 31, Aug. 7, 14 and 21, 1919, pp. 124-127, 145-147, 170-173 and 197-198, 4 figs. July 31: International Convention for Regulation of Air Navigation agreed by representatives of allied and associated powers serving on International Commission dealing with aerial navigation. Aug. 7: Rules as to lights and signals; rules of the air. Aug. 14: International aeronautical maps and ground markings; collection and dissemination of meteorological information. Aug. 21: Customs regulations applicable to aircraft and goods. (Concluded.)

Regulation of Air Navigation in United Kingdom. Automotive Industries. vol. 41, no. 10, Sept. 4, 1919, pp. 453-456. Illustrating to what extent English Government is aiding aircraft industry to get foothold in civil life.

Aircraft Ministry, British. How Britain Has Originated Its Aircraft Ministry. Allen Sinsheimer. Automotive Industries, vol. 41, no. 9, Aug. 28, 1919, pp, 399-401, 1 fig. British and American organizations contrasted.

Department of Aviation. Probable Duties of a Department of Aviation, Allen Sinsbeimer. Automotive Industries, vol. 41, no. 12, Sept. 18, 1919, pp. 553-555. Writer says that within a few years it will be necessary to develop for aircraft all tbat bas been developed in a century for ships.

See also Aircraft Ministry.

A Suggestion for a Federal Aviation Department, Allan Sinsheimer. Automotive Industries, vol. 41, no. 11, Sept. 11, 1919, pp. 503-506, 1 fig. Plan contemplates department under director and advisory board.

Licensing of Engineers. Tbe Licensing of Aeronautical Engineers and the Inspection of Aircraft, G. Edward Barnbart. Aviation, vol. 7, no. 3, Sept. 1, 1919, pp. 128-129. Suggestions in regard to licensing, making inspection reports and maintaining logbooks.

Stars, Identification. The Identification of Stars in Cloudy Weatber, Armistead Rust. U. S. Naval Inst. Proc., vol. 45, no. 199, Sept. 1919, pp. 1597-1606, 2 figs. How to obtain asimuth, without use of compass, from two observed altitudes.

CIVIL ENGINEERING

BRIDGES

Arch Testing. Description of a Machine to Test the Actual Horizontal Thrust of Model Arches, Edward Waller Stoney. Indian Eng., vol. 66, no. 3, July 19, 1919, pp. 38-39, 2 figs. Machine constructed to scale of one-twelfth for 10-ft. span, bricks being made of teakwood, two forms, plain and grooved, being used.

Approach Fill. Concrete Ties Hold Together Walls of Bridge-Approach Fill. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 522-523, 2 figs. Showing details of reinforced-concrete tie rods between retaining walls of bridge-approacb fill.

Construction. New Railroad Bridge at Schwanden, Switzerland (Neue Linthbrücke der S. B. B. in Schwanden.) Schweizerische Bauzeitung, vol. 74, no. 7, Aug. 16, 1919, pp. 80-84, 14 figs. Air temperature curves; details of construction.

Design. Economic Span Lengths for Simple-Truss Bridges, J. A. L. Waddell. Ry. Age, vol. 67, no. 13, Sept. 26, 1919, pp. 635-636. Showing fallacy of old criterion of equal superstructure and substructure costs.

Erection. Erecting Louisville Bridge Main Span. Contracting, vol. 9, no. 4, Aug. 15, 1919, pp. 97-99, 3 figs. Riveted trusses 644-ft. long assembled on falsework of towers and plate girders by 380-ton gantry traveler 149 ft. higb.

Floors. Highway Bridge Floor replaced after Corrosion. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 562-564, 2 figs. Noting special details adopted to protect new steel-conerete covering for tops of transverse floor beams, complete encasement of steel at abutments and over peirs.

Hydraulic Resistance of Bridge. A Problem on the Hydraulic Resistance of a Bridge over the Chemung River at Elmira, N.Y., S. C. George and E.W. Rettger. Cornell Civil Engr., vol. 27, no. 4, May 1919, pp. 119-126, 1 fig. Maximum flow in river near Lake Street bridge was found to be about 118,000 cu. ft. per sec.; special reference to Collingwood report on flood of 1889.

Rebuilding. Method of Rebuilding the Genesee River Bridge, Lehigh Valley R.R. Eng. & Contracting, vol. 52, no. 9, Aug. 27, 1919, pp. 249-251, 4 figs. Bridge originally built for 125-ton heavy grade engine was brought up to capacity of Cooper's E. 60 loading, which is present standard used on Lebigb Valley R.R. main line bridges.

See also Strengthening, Floors.

Rebuilding an Old Masonry Arch Bridge. Eng. & Contracting, vol. 52, no. 9, Aug. 27, 1919, p. 238, 3 figs. Strengthening by jacketing it in reinforced conerete.

Reconstruction and Reinforcement of Iron Bridges of the Gotthard Railroad between Erstfeld-Bellinzona (Ueber den Umbau und die Verstärkung der eisernen Brücken auf der Bergstrecke Erstfeld-Bellinzona der Gotthardlinie), A. Bubler. Schweizerische Bauzeitung, vol. 74, no. 6, Aug. 9, 1919, pp. 61-66, 11 figs. This reconstruction was necessary to enable bridges to carry load of new electric locomotives. (To be continued.)

Strengthening. War-Time Economies in Strengthening Old Bridges, E. E. Howard. Ry. Age, vol. 67, no. 11, Sept. 12, 1919, pp. 497-498, 3 figs. Two through spans of unusual type reinforced by doubling up of trusses.

See also Rebuilding.

Swing Bridge. Temporary Swing Bridge over the Suez Canal. Engineer, vol. 128, no. 3321, Aug. 22, 1919, pp. 174-176, 3 figs. There are six separate spans, all of different length, total length of structure being 537 ft.; four of spans are fixed and two are capable of being swung. Translated from Génie Civil.

BUILDING AND CONSTRUCTION

Air Pressure. Design of Structures Subjected to Passive Earth Pressure. (Etude de quelques Constructions sollicitées par la Pression passive des Terres), Keiichi Hayashi. Memoirs of the Coll. of Eng., Kyushu Imp. University, Fukuoka, Japan, vol. 1, no. 5, 1919, pp. 333-394, 41 figs. By passive thrust is understood resistance offered by bank of earth to lateral displacement of wall subjected to external horizontal forces. Tbeory of stresses is developed in sucb cases as a reinforced concrete repair-dock, members bridges, etc., where passive tbrust of earth occurs.

Arches. Reinforced Concrete Arches in Construction of Ships and Hangars for Dirigible Balloons (Les voûtes en béton armé dans la couverture des bâtiments. Le hangar de Montebourg pour ballon dirigeable.) Génie Civil, vol. 75, no. 10, Sept. 6, 1919, pp. 213-224, 32 figs. Design formulae and calculations.

Concrete Surfaces. The Artistic Treatment of Concrete Surfaces, H. Vandervoort Walsh. Architectural Rec., vol. 46, no. 3, Sept. 1919, pp. 237-242, 10 figs. Mecbanical means used to produce variety of texture, either by making pitted surface give valley shadows and peaks of high-ligbts, or by securing same effect with peppering of light and dark aggregates.

Churches. *See Roofs.*

Code, Building, Scotland. National Building Code Adopted in Scotland Uses Quantity Surveying Metbods. Contract Rec., vol. 33, no. 38, Sept. 17, 1919, pp. 878-883. Contracts are standardized by requiring all schedules for building works to adhere to same conditions.

Dams. Reinforced Concrete Dam at Gideabacka, Sweden (Le barrage en béton armé de Gideabacka, Suède). Génie Civil, vol. 75, no. 11, Sept. 13, 1919, pp. 249-251, 14 figs. Noting especially precautions to provide against pressure of ice masses and against contraction of masonry in excessively cold weather.

Construction Features of Grand River Roller Crest Dam. Eng. & Contracting, vol. 52, no. 11, Sept. 10, 1919, pp. 289-291, 10 figs. Dam is steel roller crest surmounting concrete weir with sluiceway and canal intake with capacity of 1425 cu. ft. per sec. at one end.

Erection. Limited Space Contributed to Difficulty of Erecting Massey-Harris Warehouse. Contract Rec., vol. 33, no. 38, Sept. 17, 1919, pp. 876-877, 5 figs. Scheme improvised to substitute ordinary stiff leg or guy derrick.

Foundations. A Concrete Foundation for a Wooden Water Tank. Ry. Age. vol. 67, no. 10, Sept. 5, 1919, p. 473, 2 figs. Design embodies use of concrete tower 10 ft. square inside with walls heavy enough to carry tank load.

Foundations in Quicksand and Watery Gravel. Contract Rec., vol. 33, no. 37, Sept. 10, 1919, pp. 861-862, 2 figs. Sinking wells for concrete cylinder piers built as foundations for Canal Street in Cbicago.

Foundation, Tremied. Finishing a Tremied Foundation Under Air Pressure. Contracting, vol. 9, no. 4, Aug. 15, 1919, pp. 91-92, 3 figs. Pneumatic chambers formed in mass concrete made leaky bottom of cofferdam accessible.

Housing. Government Housing at Home and Abroad, Wm. E. Shannon. Am. Industries, vol. 20, no. 2, Sept. 1919, pp. 25-27. American types of bouses considered as more practical, comfortable and more healthful to live in than European, although latter are said to have a higher architectural standard.

Workingmen's Houses in Italy, Alfredo Melani. Architectura Rec., vol. 46, no. 3, Spet. 1919, pp. 243-250, 12 figs. Plans developed by Institute for Popular Homes.

Selling Homes to Workmen at Cost. Iron Age, vol. 104, no. 11, Sept. 11, 1919, pp. 695-697. Amortization basis selling plan of Clark Equipment Co. of Buchanan, Mich.

Steel Corporation's Alabama Developments. Iron Age, vol. 104, no. 10 Sept. 4, 1919, pp. 627-631, 12 figs. Building of homes for employees.

Reservoirs. *See Roofs.*

Roofs. Calculation of Wind Pressure on Arched Roofs, F. Grau. Eng. & Contracting, vol. 52, no. 9, Aug. 27, 1919, pp. 253-254, 5 figs. Method of determining forces and moments produced in parabolic fixed arches. Translated from Le Génie Civil, May 31.

Tanks. Tank Construction—XXXI, Ernest G. Beck. Mech. World, vol. 66, no. 1703, Aug. 22, 1919, pp. 91-92, 5 figs. Design of supports, stays, and connections for side walls of rectangular tanks. (Continuation of serial.)

Standards. Establishing Standards in Construction, A. B. Segur. Eng. & Contracting, vol. 52, no. 9, Aug. 27, 1919, pp. 242-244, 2 figs. Associated Gen. Contractors of Am., vol. 1, no. 2, Aug. 1919, pp. 9-12, 2 figs. Diagrams showing possibility of shipping labor between local industries. From report prepared for Committee on Methods of Assoc. General Contractors of America. Also abstracted in Contract Rec., vol. 33, no. 37, Sept. 10, 1919, pp. 854-857, 2 figs.

Steel Construction. The Standard Unit System of Steel Construction, R. R. Reid. Contract Rec., vol. 33, no. 37, Sept. 10, 1919, pp. 862-863, 2 figs. Development in England.

Stucco Work. Making a Success of Stucco Work. Building Age, vol. 41, no. 9, Sept. 1919, pp. 284-285, 2 figs. Framing and methods of application that prevent cracks, as recommended in extracts from Committee Report of Am. Concrete Inst.

Reservoirs, Concrete. Groined Arches or Flat Roof for Concrete Reservoirs. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 566-568. Opinions of various engineers and builders as to relative economy and safety, based on experience with both types through a number of years.

Trusses, Steel Roof. Encasing Steel Roof Trusses in a Church Building, N. Serracino. Am. Architect, vol. 116, no. 2281, Sept. 10, 1919, pp. 357-360, 7 figs. In order to make steel trusses give appearance of timber trusses, steel trusses were encased with 1-in. quartered oak casing.

Silos. On the Design of Silos (Un problema sobre Silos), Fernando D. da Silva. Ingenieria, vol. 23, no. 9, May 1, 1919, pp. 579-584, 2 figs. Expressions for determining relation between cost per unit of volume and dimensions of structure.

Concrete Silo may be built without Contractor. Contract Rec., vol. 33, no. 39, Sept. 24, 1919, pp. 898-902, 7 figs. Suggestions of Portland Cement Association in regard to construction of silos witb home-made equipment.

Snowslide Protection. Viaduct Protected from Snowslides by Concrete Walls, E. E. Adams. Eng. News-Rec., vol. 83, no. 10, Sept. 4, 1919, pp. 470-471, 3 figs. Bases of shore bents incased in concrete to prevent recurrence of accidents due to snowslides.

Underpinning. Underpinning a 6-Storey Iron, Glass and Brick Wall. Contracting, vol. 9, no. 4, Aug. 15, 1919, pp. 107-108, 1 fig. Contract Rec., vol. 33, no. 37, Sept. 10, 1919, pp. 864, 865. Work done in strengthening and extending footings so as to increase their strength and reliability without disturbing them or impairing their stability during operation.

Construction, Essentials. Essentials of Important Construction—XXXV, J. B. Golds-Borough. Contracting, vol. 9, no. 5, Sept. 1, 1919, pp. 123-125. Underpinning old buildings; the Breuchaud method; use of piles.

Walls. Concrete Wall Construction is Continuous Process. Eng. News-Rec., vol. 83, no. 10, Sept. 4, 1919, pp. 454-456, 4 figs. Wall 25 ft. high and running nearly 5¼ cu. yd. per ft. is being completed at rate of 76 ft. per week.

Wind Pressure. *See Roofs.*

Wind Pressure on Cylindrical Structures in Practice, R. Fleming. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 499-502. Methods applicable to various problems of structural designer in dealing with chimneys, stacks and standpipes.

CEMENT AND CONCRETE

Beams and Slabs. Design of Reinforced Concrete Beams and Slabs—II, L. Goodman. Building Age, vol. 41, no. 9, Sept. 1919, pp. 292-293, 1 fig. Formulae and how to use them.

Bonding. Bonding New Cement Mortar and Concrete to Old in Tests, W. E. Rosengarten. Public Roads, vol. 2, no. 14, June 1919, pp. 26-34, 4 figs. Results of tests carried out in engineering research laboratory of Bureau of Public Roads.

Columns. European Design of Concrete Columns, William Wren Hay. Concrete, vol. 15, no. 3, Sept. 1919, pp. 104. Formulæ.

Concreting. Rapid Concreting a Feature of Big Portsmouth Dry Dock. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 494-496, 3 figs. Installation of duplicate mixer units of large size made possible placing of 16,000 cu. yd. in one month.

Cracks. The Significance of Cracks in Reinforced Concrete Construction, H. Stanley Harris. Surveyor, vol. 56, no. 1439, Aug. 15, 1919, pp. 103-104. Can. Engr., vol. 37, no. 13, Sept. 25, 1919, pp. 333-334. It is said that cracks are generally due to contraction of concrete in setting, to expansion and contraction caused by temperature changes in concrete; to too early removal of forms; to overloading of structure and to settlement of supports. From Proc. of Roy. Victorian Inst. Architects.

Diagrams, Reinforced Concrete. Calculating Diagrams for Reinforced Concrete, James Williamson. Engineer, vol. 128, no. 3320, Aug. 15, 1919, pp. 149-151, 6 figs. on supp. plates. Two types—one combination of logarithmic alignment chart with ordinary logarithmic graph and adaptable to slabs, beams, shear members, pillars, etc., and the other applicable to cases of doubly reinforced beams and rectangular sections under combined stresses, for which ordinary formulae do not admit of direct solution.

Mixers. Better Concrete—the Problem and Its Solution, Nathan C. Johnson. Jl. Engrs., Club Philadelphia, vol. 36, no. 178, Sept. 1919, pp. 333-341, 16 figs. With microscopic motion picture studies as basis, type of mixer is developed in which it is claimed reaction between cement and water is promoted with greater production of useful "glue."

Mixtures. Good Concrete—Right Materials and Mixtures, Russell Bohrek. Concrete, vol. 15. no. 3, Sept. 1919, pp. 98-100. Typical examples of what has been done with the use of local aggregates and cement on Pierce County paving work.

Reinforcements. Proof that Iron used in Reinforced Concrete is Rustproof (Ein Nachweis für die Rostsicherheit des Eisens bei Eisenbeton), E. Probst. Armierter Beton, vol. 12, no. 5, May 1919, pp 105-107, 3 figs. Cites as example slabs made 33 years ago by Dyckerhoff & Widman, and which were stored in the open most of the time; based on his examination of these slabs writer furthermore concludes that a depth of 1.5 cm. is sufficient to prevent iron from rusting.

Sands. Fine-Grained Concrete Sands, F. E. Giesecke. Can. Engr., vol. 37, no. 10, Sept. 4, 1919, pp. 279-280. Study of their value in concrete construction, made at University of Texas.

Stucco, Portland Cement. Standard Recommended Practice for Portland Cement Stucco. Eng. & Contracting, vol. 52, no. 9, Aug. 27, 1919, pp. 251-252. Recommendations by Committee on Treatment of Concrete Surfaces of Am. Concrete Inst.

See also Building and Construction, Stucco.

Vibration. Effect of Vibration, Jigging and Pressure on Concrete, Duff A. Abrams. Eng. & Contracting, vol. 52, no. 13, Sept. 24, 1919, pp. 352-354, 7 figs. Concrete, vol. 15, no. 3, Sept. 1919, pp 107-111, 7 figs. Effect of vibration produced by electric motor on strength of concrete; effect of consistency on strength of jigged concrete.

EARTHWORK, ROCK EXCAVATION, ETC.

Backfilling. Backfilling Tunnel with Concrete. Concrete, vol. 15, no. 3, [illegible] 1919, pp. 130-131, 2figs. Employed in connection with construction of Winnipeg aqueduct, which is 97 miles long.

Breakwater. Building Toronto's Western Breakwater. Contract Rec., vol. 33, no. 35, Aug. 27, 1919, pp. 807-809, 4 figs. Large concrete blocks and rock bill, keyed together with mass concrete, form structure. Dredge converted for handling blocks.

Breakwater and Piers at Victoria, B.C., C. C. Worsfold. Contract Rec., vol 33, no. 39 Sept. 24, 1919, pp. 891-894, 12 figs. Rock and concrete breakwater and two concrete crib piers built during past six years under direction of Public Works Dept.

Caissons. Reinforced Concrete Caissons built with Compressed Air (Fondazioni ad aria compresa con cassoni di cemento armato). Annali d'Ingegneria e d'Architettura, vol. 34, no. 13, July 1919, pp. 199-204, 5 figs. Details of structures designed for Italian Department of Labor.

Canals. Progress of Queenston-Chippawa Power Canal. Can. Engr., vol. 37, no. 9, Aug. 28, 1919, pp. 249-256, 33 figs. Loading 8500 cu. yd. on cars in 20 hours with one shovel.

Conduits. Winnipeg Circular Concrete Conduit. Contracting, vol. 9, no. 5, Sept. 1, 1919, pp. 127-128, 7 figs. Reinforced pipes 87 to 108 in. in diameter, built with steel forms set on invert in open trench.

Demolition. Safety Measures in Demolition of Buildings. Contract Rec., vol. 33, no. 39, Sept. 24, 1919, pp. 895-897, 1 fig. Suggested precautions to observe when tearing down old structures; protection of eyes; securing of beams before cutting; removal of material.

Excavation. Labor. Piece Work Versus Day Labor in Hand Excavation, Everett N. Bryan. Eng. & Contracting, vol. 52, no. 12, Sept. 17, 1919, pp. 319-320. Instance illustrating advantage of piece work over day rate.

Excavator Work Measurement. Scottish Mode of Measurement for Preparation of Schedules of Quantities. Contract Rec., vol. 33, no. 39, Sept. 24, 1919, pp. 903-907. Standardized methods which are applied to measurement of excavator and mason work in Scottish Nat. Building Code.

Packing. Concrete Packing Stops Settlement over Tunnel, E. E. Adams. Ry. Age, vol. 67, no. 11, Sept. 12, 1919, pp. 509-511, 3 figs. Change in sub-surface drainage conditions said to cause decay of timber lagging, requiring its replacement.

Shovels, Steam. Methods of Moving Steam Shovels, J. R. Sherman. Eng. & Contracting, vol. 52, no. 12, Sept. 17, 1919, p. 318, 4 figs. Methods employed in connection with excavation of material for large earth dam for Braden Copper Co., Cjile, S. A.

Subways. Completion of the Boston Subway. Ry. Rev., vol. 65, no. 8, Aug. 23, 1919, pp. 257-261, 10 figs. Data of Broadway surface and Andrew Terminal stations. From final report of Boston Transit Commission.

HARBORS

Peru. Plans for Harbor Improvements in Peru (Plannen voor verbetering van Peruaansche havens), G. J. van den Broek. Ingenieur, vol. 34, no. 35, Aug. 30, 1919, pp. 638-646, 12 figs. Mollendo, Callao, Camana and Matarani. Paper read before department of Building and Waterways, Holland.

HYDRAULIC ENGINEERING

Flood Hazard. Widened Channel Reduces Flood Hazard at Columbus. Eng. News Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 512-513, 2 figs. Fixtures of spillway levee.

Percolation Water. Stream Flow and Percolation water, Samuel Hall. Can. Engr., vol. 37, no. 12, Sept. 18, 1919, pp. 313-314, 1 fig. Illustrating low and basic curves. (Concluded.)

Rhone. Harnessing of the Rhône by Means of Successive Dams (L'Aménagement du Rhone à l'aide de barrages successifs), L. Mähl. Génie Civil, vol. 75, no. 8, Aug. 23, 1919, pp. 175-180, 5 figs. Details of project presented to the Congrès de la Houille blanche.

River Control Work. Some River Control Work of the C.B. & Q. Ry. Rev., vol. 65, no. 11, Sept. 13, 1919, pp. 365-368, 12 figs. Bundled brush mattresses, revetments of riprap and log rafts, successfully used.

Rochester. Hydro Electric Development at Rochester, N.Y. Southwestern Elecn., vol. 15, no. 3, May 1919, pp. 18-19, 7 figs. Station of 25,000 k.v.a. of Rochester Ry. & Light Co., located in gorge of Genesee.

Scowing of Drainage Channels. Board Mattress for Preventing Scour in Drainage Channel, B. F. Burns. Eng. & Contracting, vol. 52, no. 11, Sept. 10, 1919, p. 299, 4 figs. Plan, section and details.

Siphon Spillway. Dam and Tunnel Construction by the Marin Water District. Eng. & Contracting, vol. 52, no. 11, Sept. 10, 1919, p. 302, 2 figs. For providing daily draft of 15,000,000 gals. Siphon spillway of dam is designed to discharge 4,000 cu. ft. per sec.

Spillway of Dam. Australian Dam Said to be World's Largest. Contract Rec., vol. 33, no. 36, Sept. 3, 1919, pp. 832-833. Spillway operation of dam which is to hold 272,250,000,000 gallons of water.

MATERIALS OF CONSTRUCTION

Wood. "Compression" Wood and Failure of Factory Roof-Beam, G. E. Heck. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 508-509, 4 figs. Instance in which cause of sagging in roof was found to be yellow-pine beam with wood of peculiar, abnormal growth and wide annual rings.

MUNICIPAL ENGINEERING

City Planning. City Planning for Portland. Mun. Jl. & Public Works, vol. 47, no. 9, Aug. 30, 1919, pp. 133-134. Arguments for narrower roadways in minor streets. (Concluded.)

Street Cleaning. Street Cleaning and Refuse Collection in Newark. Mun. Jl. & Public Works, vol. 47, no. 12, Sept. 20, 1919, pp. 180-182, 3 figs. Appliances, methods and organization in a large manufacturing and commercial city. (To be concluded.)

RECLAMATION AND IRRIGATION

LINDSAY-STRATHMORE IRRIGATION DISTRICT. Operation Methods and Results on the Lindsay-Strathmore Irrigation District, E. Court Eaton.Eng. News-Rec., vol. 83, no. 10, Sept. 4, 1919, ii. 474-478. Well tests and reconstruction; operation results of well and main pumping plants; water-hammer in wood pipe lines; repairs to steel pipes; gravity and pressure consummers' meters.

PUBLIC CONTROL. State and Federal Control of Land Drainage Needed, Arthur M. Shaw. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 523-524. Cause, writer claims, controlled by districts does not meet larger problems.

RIO GRANDE IRRIGATION PROJECT. Drainage Works of the Rio Grande Irrigation Project, J. L. Burkholder. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 543-549, 4 figs. Elements of design, methods of ditch construction with dragline excavators on caterpillar tractors and details of cost.

ROADS AND PAVEMENTS

BITUMINOUS PAVEMENTS. Some Practical Points to observe in the Construction of Bituminous Pavements, R. Keith Compton. Mun. & County Eng., vol. 57, no. 3, Sept. 1919, pp. 105-107. Specifications; inspection of hot material; brick gutters; rate of rolling.

BITUMINOUS ROAD MATERIALS. Ultra-Microscopic Examination of Disperse Colloids Present in Bituminous Road Materials. E.C.E. Lord. Jl. Agricultural Research, vol. 17, no. 4, July 15, 1919, pp. 167-176, 3 figs. partly on supplement plates. Investigation undertaken principally to develop method for counting colloidal particles in bituminous solutions.

CANTONMENT ROAD BUILDING. Cantonment Road Building at Camp Lewis—I, U. S. Marshall. Good Roads, vol. 18, nos. 10 and 11, Sept. 3 and 10, 1919, pp. 115-119 and p. 124 and pp. 127-130, 16 figs. Methods and costs of building about 22 miles of gravel road and over 150,000 sq. yd. Warrenite-Bithulithic, with local gravel aggregate, on bituminous concrete foundation.

CLASSIFICATION. Street Classification as an Air to Pavement Design, James W. Routh. Mun. Jl. & Public Works, vol. 47, no. 10, Sept. 6, 1919, pp. 148-149. Relation between character and density of traffic and thickness of foundation. Opinions of several prominent municipal engineers.

The Classification of Highways, Henry G. Shirley. Good Roads, vol. 18, no. 13, Sept. 24, 1919, pp. 149-151, 2 figs. Advantages of improved roads; description of several classes and estimates of costs of improvement.

CRACKING. Does Rich Concrete in Roads Crack More Than Lean? Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 518-520. Replies received from various engineers to questionaire sent out to them by Eng. News-Rec. Answers show that there is no well developed foundation for statement that there is greater tendencies to crack in richer mixes of concrete.

FRESH CONCRETE PAVEMENT PROTECTION. Methods of Protecting Concrete Pavements Laid in Warm Weather. Eng. & Contracting, vol. 52, no. 10, Sept. 3, 1919, pp. 266-267, 2 figs. Suggested design for light frame to hold canvas over newly placed concrete pavement.

GOOD ROADS MOVEMENT. Good Roads, Chas. F. Puff. Jl. Engrs. Club Philadelphia, vol. 36, no. 178, Sept. 1919, pp. 353-360, 3 figs. Discussion of location, construction and maintenance.

GRANITE BLOCK PAVEMENT. Quick Work in Laying Granite Block Pavement, Clarence D. Pollock. Mun. Jl. & Public Works, vol. 47. no. 9, Aug. 30, 1919, pp. 128-130, 3 figs. Composition of working gangs and methods employed in paving half mile of Seventh Avenue, New York. Paving was done in 40 working days; street crossing were closed to traffic three days only.

Experience with Granite Block Pavements in New Orleans, La., John C. Bartley. Mun. & County Eng., vol. 57, no. 3, Sept. 1919, pp. 112-115. Old Belgian block pavements; salvaging old granite blocks.

MACADAM ROADS. Construction of Twelve-Mile Macadam Road is Largely a Haylage Problem. Contract Rec., vol. 33, no. 37, Sept. 10, 1919, pp. 849-850, 3 figs. Caledonia-Jarvis highway in Haldimand County, Ontario, built in two sections; wagons used on one, motor trucks on the other.

Recommended Procedure in the Construction of New Macadam Roads, M. D. Ross. Mun. & County Eng., vol. 57, no. 3, Sept. 1919. pp. 116-118. Characteristics of properly constructed road; equipment used on construction; preparing sub-grade.

MAINTENANCE. Highway Maintenance in Wisconsin—IV, V and VI. Good Roads, vol. 18, nos. 10, 11 and 12, Sept. 3, 10 and 17, 1919, pp. 120 and 124, 136-137 and 139-141, 4 figs. Sept. 3: Methods employed for highways of shale, pit run gravel or crushed and screened gravel. Sept. 10: Practice of building surface-streeted macadam roads; cold patching methods. Sept. 17: Gang maintenance; heavy grading work; equipment and methods; resurfacing stone and gravel roads; bonding.

MISSISSIPPI VALLEY STATE HIGHWAY DEPARTMENT. Recommended Practice of Mississippi Valley State Highway Departments for Concrete Road Construction. Can. Engr., vol. 37, no. 9, Aug. 28, 1919, pp. 260-262. As adopted at conference of Miss. Valley Assn. of State Highway Depts.

NEW YORK STATE. What Has New York State Received for Its $100,000,000 Highway Expenditures, H. Eltinge Breed. Eng. News-Rec., vol. 83, no. 10, Sept. 4, 1919, pp. 450-454. Analysis of work done during 21-year, 1898-1915, study to show economic fallacy of increasing mileage with nondurable types of construction involving high maintenance cost.

OVERHAUL COMPUTATION. Simple Method of Computing Overhaul. Eng. & Contracting, vol. 52, no. 10, Sept. 3, 1919, p. 273, 1 fig. Employed by Minnesota State Highway Commission.

Suggestions for Contractors on Concrete Road Construction, Clyde E. Learned. Public Roads, vol. 2, no. 14, June 1919, pp. 15-17. Concerning overhauling, proportion of subgrade, hauling materials and laying pipe line.

ROAD BEDS. Sizes of Blocks and Construction of Road Beds (Abmessungen der Pflastersteine und Herstellung der Pflasterbahn), Utsch. Zeitschrift für Transportwesen und Strassenbau, vol. 36, no. 13, May 1, 1919, pp. 147-148, 3 figs. Construction of roads designed for heaviest kind of traffic and cold climate.

ROAD MACHINERY. Road Machinery, A. H. Blanchard. Better Roads & Streets, vol. 9, no. 5, June 1919, pp. 187-189 and 214. Factors determining selection of equipment for construction and maintenance of highways.

Pneumatic Tools for Breaking up Pavement, Walter P. Burn. Elec. Ry. Jl., vol. 54, no. 12, Sept. 20, 1919, pp. 583-584, 7 figs. How by using special points a tie-tamping machine was used for cutting asphalt, toothing out paving blocks and breaking up pavement.

RESURFACING. Resurfacing Old Macadam and Gravel Roadways with Special Reference to Adaptability of Old Roadbeds as Foundation for Hotmix Bituminous Surfaces, Hugh W. Skidmore. Mun. & County Eng., vol. 57, no. 3, Sept. 1919, pp. 99-105, 12 figs. General requirements of pavement foundations; suitability of broken stone, stone and gravel macadam pavements as foundations for permanent types of surface; thickness of base; edging for highway pavements.

STANDARD DETAILS. Standard Details of Pennsylvania State Highway Department for Minor Features of State Roads. Eng. & Contracting, vol. 52, no. 10, Sept. 3, 1919, p. 264, 8 figs. Underdrains, plain and grouted rubble gutter, plain cement concrete gutter, concrete curbing, stone curbing.

SURVEY INSTRUCTIONS. Instructions of Arizona State Highway Department for Guidance of its Engineers. Eng. & Contracting, vol. 52, no. 10, Sept. 3, 1919, pp. 271-273. Instructions to engineers on reconnaissance surveys.

SANITARY ENGINEERING

GARBAGE UTILIZATION. Profit in Garbage-Fed Hogs, E. C. W. Schubel. Am. City, City Edition, vol. 21, no. 3, Sept. 1919, pp. 217-220, 3 figs. Experience of Lansing, Mich.

REFUSE COLLECTION. The Trend in Municipal Refuse Collection and Disposal—Estimating Costs, Rudolph Hering. Mun. & County Eng., vol. 57, no. 3, Sept. 1919, pp. 107-109. The Cobwell system; garbage disposal by feeding; incineration.

SEWAGE DISPOSAL. Town Sewage Problems Often Intricate, Edward B. Savage. Contract Rec., vol 33, no. 36, Sept. 3, 1919, pp. 836-840. Sources of trouble and defects and remedial measures. Methods of flushing. Storm water separation.

The Utilization of Sewage Sludge in Birmingham, England. Am. City, City Edition, vol. 21, no 3, Sept. 1919, pp. 213-215, 4 figs. Shallow tanks and thorough furnish sludge without odor with possibility of organic fertilizer.

Sewage-Disposal Difficulties at Madison, Wisconsin. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 510-511, 1 fig. Improving sludge handling by hoppers and new pipe connections for flat-bottom tanks.

Sewerage Works of Stratford, Conn., Clyde Potts. Mun. Jl. & Public Works, vol. 47, no. 11, Sept. 13, 1919, pp. 160-161, 2 figs. Invert of sewer at plant is three feet below high tide and three feet above low tide; effluent held in tidal chamber during flood tide; Imhoff tanks and chlorination.

SEWAGE TREATMENT. Electrolytic Sewage Treatment. Mun. Jl. & Public Works, vol. 47, nos. 9 and 10, Aug. 30 and Sept. 6, 1919, pp. 131-132 and 151-152. Investigation of Easton plant by committee of Franklin Inst. Chemical and bacterial effect of treatment. Cost of treatment.

Tests of Lime-Electrolytic-Agitation Sewage-Treatment Process at Easton, Pennsylvania. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 569-573, 1 fig. Laundreth "direct-oxidation" system studied by engineering division of Pennsylvania State Department of Health and for Committee of Franklin Institute.

SURVEYING

RECONNAISSANCE MAPPING. Quick Method of Reconnaissance Mapping, M. L. Fuller. Economic Geology, vol. 14, no. 5, Aug. 1919, pp. 411-423. Method involves among other features taking of compass bearings to nearest five degrees and direct plotting of courses by standard coordinates while in motion.

REGIONAL SURVEY. The Regional Survey as the Basis for the Regional Plan, and the Regional Plan as the Basis for the Town Plan, Thomas Adams. Landscape Architecture, vol. 9, no. 4, July 1919, pp. 173-179. By regional survey is meant investigating and recording of existing physical, industrial, and residential features of a region which needs comprehensive and co-ordinated treatment without regard to arbitrary administrative boundaries; by regional plan is considered general planning of area included in regional survey.

RESURVEY, RAILWAY. Curve Chart for Railway Resurvey, J. G. Wetherell. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, p. 506, 1 fig. Chart shows degree of curve having given angle and external.

WATER SUPPLY

BACTERIA, IRON-DEPOSITING. Iron-Depositing Bacteria and Their Geologic Relations, Edmund Cecil Harder. Dept. of Interior, U. S. Geological Survey, Professional Paper 113, 1919, 89 pp., 37 figs., partly on four supplement plates. Based principally on investigations of crenothrix cultures obtained from city water of Madison, Wis.

BATON ROUGE. Baton Rouge Water Supply, L. R. Howson. Fire & Water Eng., vol. 66, no. 12, Sept. 17, 1919, pp. 104-105 and p. 616, 3 figs. Remarks on usual ground water conditions and apparent connection between river and sand strata.

CHLORINATION. Chlorination and Health of Communities. Fire & Water Eng., vol. 66, no. 10, Sept. 3, 1919, p. 502, 1 fig. Chart showing relation of chlorinated water supplies to typhoid death rate.

DROUGHTS. Method of Constructing a Diagram to show probable Droughts, V. V. Tchikoff. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, p.. 554, 1 fig. Illustrated by study of rainfall during ten-day periods, or decades of days, for 32 years, at Kherson, European Russia.

FILTERS. High-Capacity, Self-Cleaning Filters for Purifying Water. Contract Rec., vol. 33, no. 37, Sept. 10, 1919, p. 857. Arrangement used at waterworks on Desrumaux system, in France. Translated from Génie Civil.

Purification Effected in Toronto's Water Supply by Slow Sand Filtration, N. J. Howard. Contract Rec., vol. 33, no. 38, Sept. 17, 1919, pp. 871-875. Tests of 10,000 samples during 1918 said to show reductions of 99.7, 99.1 and 99.0 per cent b. coli, total bacteria and excremental bacteria respectively.

Operation of Slow Sand Filters at Toronto, Norman J. Howard. Can. Engr., vol. 37, no. 12, Sept. 18, 1919, pp. 317-319. Ten thousand samples tested during year 1918 said to have shown 99.7 per cent average in b. coli, 99.1 per cent in total bacteria, and 99 per cent in excremental bacteria.

FILTRATION PLANTS. New Water Filtration Plant of Whiting, Ind., Renville S. Rankin. Eng. & Contracting, vol. 52, no. 11, Sept. 10, 1919, pp. 292-294, 4 figs. Plant is to have capacity of 4,000,000 gallons.

Plant for Quick Filtering of Water, installed at Altona Water Works (Schnellfilteranlage des städtischen Wasserwerks Altona), Jürgensen. Zeitschrift für Bauwesen, vol. 69, nos. 4-6, 1919, pp. 294-307, 16 figs. Example of close co-operation between architect and engineer.

IPSWICH RIVER. The Ipswich River Water Supply for the City of Lynn, Mass., H. K. Barrows. Mun. & County Eng., vol. 57, no. 3, Sept. 1919, pp. 133-134, 2 figs. Diagram for determining economical size of Ipswich River pipe line.

KANSAS CITY, KANSAS. The Water-Works and Electric Plant of Kansas City, Kansas, H. C. Chapman. Am. City, City Edition, vol. 21, no. 3, Sept. 1919, pp. 199-201, 3 figs. Plant consists of ten Jewell filters, each having capacity of one-half million gallons daily, and nine concrete filters, each having capacity of one and one-quarter million gallons daily.

MUNICIPAL WATER WORKS. Management of Municipal Water-Works, W. M. Rich. Am. City, City Edition, vol. 21, no. 3, Sept. 1919, pp. 209-212. Introduction of budger system metering water waste surveys said to have increased economy of operation of Sault Ste. Marie water-works.

RECONSTRUCTION WATER WORKS. Reconstruction of Water Works at Cobourg, Ont., A. E. Davison. Can. Eng., vol. 37, no. 11, Sept. 11, 1919, pp. 287-288, 3 figs. Installation of four electrically-driven pumping units, each 750 gal. per min. capacity, on domestic service.

SAN FRANCISCO. San Francisco's Auxiliary System, Fred. M. Hyde. Fire & Water Eng., vol. 66, no. 10, Sept. 3, 1919, pp. 497-499 and p. 503, 6 figs. One-high-pressure hydrant claimed to give more water than three fire engines.

STORAGE OF WATER. Development and Storage of Water for Electrical Purposes, J. W. Mearles. Engineer, vol. 128, no. 3321, Aug. 22, 1919, pp. 186-189, 7 figs. Conditions requisite for water power; classification according to head. Paper read before Instn. Elec. Engrs.

WATER WORKS AND FIRE INSURANCE. Relation Between Water Works Improvements and Fire Insurance Rates, Kelsey L. Walling. Contract Rec., vol. 33, no. 36, Sept. 3, 1919, pp. 834-835. Suggestions in regard to reducing fire rates with improvements to water works.

WATERWAYS

INLAND WATER TRANSPORTATION. The Need of Inland Water Transportation, W. E. Joyce. Coal Age, vol. 16, no. 11, Sept. 11, 1919, pp. 437-439, 1 fig. Particularly as means of reducing cost of moving various products, especially bulk freight.

MEANDERS. *See River Beds.*

RIVER BEDS. River Beds and Meanders, Colonel Hoc. Sci. Am. Supp., vol. 88, no. 2278, Aug. 30, 1919, pp. 134-135, 8 figs. Mechanical analysis of forces at work suggests to writer that meanders result from "Buckling." Translated from Génie Civil, Paris.

VARIA

CONTRACT, COST-PLUS. How the Cost-Plus Contract Safeguards Both the Owner and Contractor, A. E. Wells. Am. Architect, vol. 116, no. 2280, Sept. 3, 1919, pp. 309-310. Because, it is said, it removes "gambling element" which is found in lump-sum contract.

RAISING A DREDGE. Raising a Sunken Dredge in Kowno (Hebung eines gesunkenen Baggers in Kowno). Zentralblatt der Bauverwaltung, vol. 39, no. 38, May 7, 1919, pp. 205-206, 5 figs. Cost of raising dredge amounted to 90,000 marks, while the value is 200,000 marks.

ELECTRICAL ENGINEERING

ELECTROCHEMISTRY

POLARIZATION. The Polarization of a Leclanché Cell, Felix E. Hackett and R. J. Feely. Scientific Proc. Roy. Dublin Soc., vol. 15, no. 26, March 1918, pp. 279-288, 4 figs. Recovery of cell from polarization divided into two sections; initial stage of rapid recovery in which about 90 per cent of polarization disappears; in about en minutes; followed by slow return extending over several hours to initial value of e.m.f.

POTENTIAL OF ALUMINUM. The Effect of Amalgamation upon the Single Potential of Aluminum, Louis Kahlenberg and John A. Montgomery. General Meeting of the Am. Electrochem. Soc., paper no. 7, Sept. 23-26, 1919, pp. 45-56, 5 figs. Measuring single potential of aluminum in 1/3 molar solution of aluminum chloride at room temperature, by means of calomel electrode, writers claimed to have obtained much higher values with amalgamated than with unamalgamated aluminum, due to removal of coat of resistant oxide by mercury.

ELECTRODEPOSITION

GOLD AND SILVER. Electrodeposition of Gold and Silver from Cyanide Solutions, S. B. Christy. Dept. Interior, Bur. Mines, Bul 150, 1919, 171 pp., 44 figs. Based on writer's experiments made in laboratories of University of Cal., extending over period of 20 years. Results are expressed in diagrammatic form by curves showing relation between simultaneous variables.

LEAD PLATING. Lead Plating from Fluoborate Solutions, W. Blum, F. J. Liscomb, Zalia Jencks and W. E. Bailey. General Meeting of the Am. Electrochem. Soc., paper no. 11, Sept. 23-26, 1919, pp. 101-122, 12 figs., partly on six supplement plates. From experiments it is concluded that by increasing concentration of lead it is possible to use higher current densities than those ordinarily used without causing treeing of deposits. A range of conditions is recommended as guide for commercial work.

PLATERS' SOLUTIONS. Standardization of Platers' Solutions in Individual Plants, Charles H. Proctor. Metal Industry, vol. 15, no. 7, Aug. 15, 1919, pp. 122-124. As means of increasing efficiency.

SILVER. *See Gold and Silver.*

STRUCTURE OF ELECTRO-DEPOSITED METALS. Factors Governing the Structure of Electro-Deposited Metals, William Blum. General Meeting of the Am. Electrochem. Soc., paper no. 8, Sept. 23-26, 1919, pp. 57-76, 19 figs., partly on ten supplement plates. Experiments said to have shown that Bancroft's "axioms of electroplating" are applicable over wide range of conditions and with variety of metals. It is, therefore, suggested that they may serve as valuable guide in plating research and in practical plating operations.

ELECTROPHYSICS

ARMATURE REACTIONS. Reactions of the Armature of an Alternator. (Sur la réaction d'induit des alternateurs), E. Brylinski. Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 4, July 28, 1919, pp. 174-177. As influenced by magnetic hysteresis.

ALTERNATING CURRENT CIRCUITS. Calculation of Values in A. C. Circuits, A. E. Tattersall. Ry. Engr., vol. 40, no. 476, Sept. 1919, pp. 193-196, 3 figs. Application of hyperbolic functions; method of determining values of equivalent circuit by circular trigonometry; study of Ferranti effect. (Continuation of serial.)

On the Diagrams of Lines of Force Around the Aerial Lines (In Japanese), K. Ogawa. Denki Gakkwai Zasshi, no. 373, Aug. 10, 1919.

The Solution of Circuit Problems. Mathematical Methods of Investigation Resulting from the Application of Fourier's Integral, Thornton C. Fry. Phys. Rev., vol. 14, no. 2, Aug. 1919, pp. 115-136, 6 figs. Expansion of fundamental integral for current in any network in circuit theory effected in Bessel's series and also by (1) using Heaviside(Carson expansion, and (2) using Taylor's series.

Calculation of Alternating Current Circuits, Terrell Croft. Nat. Engr., vol. 23, no. 9, Sept. 1919, pp. 442-446, 12 figs. Graphic method of determining wire sizes. Derivation of formula. (Concluded.)

CABLES. The Magnetic Field Round a Submerged Cable Carrying Alternating Current, H. R. Rivers-Moore. Elec. Rev., vol. 85, no. 2179, Aug. 29, 1919, pp. 259-260, 4 figs. Determined by considering propagation outwards of lines of force during rise of current in conductor.

Heating of Underground Cables, A. L. Freret. Assn. Iron & Steel Elec. Engrs., Aug. 1919, pp. 10-15 and discussion, pp. 15-17, 4 figs. Shows that, Current being intermittent, heating of cable depends upon mean effective current, which is square root of mean squares of current.

ELECTROMAGNETIC FIELD. Mechanical Theories of the Electromagnetic Field—XI. (Mechanische Theorien des elektromagnetischen Feldes), A. Korn. Physikalische Zeitschrift, vol. 20, no. 3, Feb. 1, 1919, pp. 58-61. Quickly changeable Fields.

Notes on Electric and Magnetic Field Constants and their Expression in terms of Bessel Functions and Elliptic Integrals, A. Gray. Lond., Edinburgh & Dublin Phil. Mag., vol. 38, no. 224, Aug. 1919. pp. 201-214, 4 figs. Four cases—(1) Potential produced at any point in a thin disk of matter of uniform surface density; (2) potential produced and component magnetic field intensities at any point in a circular doublet-disk of uniform strength per unit area; (3) potential and field intensities of uniform right circular cylinder; and (4) potential and field intensity of right cylindrical array of equal doublet-disks.

A Report on Electromagnetic Induction, S. J. Barnett. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 10, Oct. 1919, pp. 1151-1169. Historical sketch of fundamental results obtained from days of Faraday to present time in studying electromotive forces ordinarily referred to domain of electromagnetic induction, together with treatment of unipolar induction in both open and closed circuits.

INDUCTION AND CAPACITY. Induction and Capacity of Electric Lines (Induction et capacité des lignes), J. Fisher-Hinnen. Revue générale de l'Electricité, vol. 6, nos. 7 and 8, Aug. 16 and 23, 1919, pp. 203-213 and 233-244, 24 figs. Aug. 16: Computation formulae. From Bulletin de l'Association suisse des Electriciens, Décembre 1917, tome VIII, p. 333. Aug. 23: Formulae giving capacity of lines developed by means of analogy existing between capacity and conductance; with reference to single-phase lines, writer points out that an unconnected conductor may show dangerous difference of potential with respect to the earth.

Additions to the Formulas for the Calculation of Mutual and Self-Inductance, Frederick W. Grover. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 537-570. Supplementing collection of formula a given in Scientific Paper no. 169.

INTERFERENCE. Interference of Power Circuits with Telephone Circuits, E. Parry. New Zealand Jl. Sci. & Technology, vol. 11, nos. 4-5, July 1919, pp. 308-314, 4 figs. Attempt to co-ordinate result of experience for calculating beforehand effects resulting from any given relative disposition of circuits and from any given method of work.

LEAKAGE. Studies on doubly interlinked Leakage (Beitrag zur doppeltverketteten Streuung), F. Punga. Archiv f. Elektrotechnik, vol. 7, nos. 11-12, May 5, 1919, pp. 337-379, 53 figs. Vectorial derivation of differential leakage for any desired number of groves and any desired position of rotor. Cases where zig-zag leakage and double interlinked leakage are synonymous, as in motors with squirrel cage rotor and motors with an uneven number of groves in the stator and rotor and in those with slip-ring rotor.

MAGNETIC FIELD, MOLECULAR. The Molecular Magnetic Field (El campo magnético molecular), Richard Gans. Contribucion al estudio de las ciencias fisicas y Matematicas, Universidad Nacional de la Plata, vol. 11, no. 36, July 1918, pp. 209-222, 2 figs. Technical derivation of following theorem: At absolute zero all directions of molecular magnetic field may be considered, with respect to determination of magnetism curve, as equally probable.

MAGNETISM. Magnetism and the Theory of Quanta (Teoria de los Quanta y Magnetismo), Richard Gans. Contribucion al estudio de las ciencias fisicas y Matematicas, Universidad Nacional de la Plata, vol. 11, no. 36, July 1918, pp. 195-205, 5 figs. Formulæ expressing Pô magnetism in terms of temperature in order to test whether first or second of Planck's hypothesis is exact. Application of these formulæ to sulphate of anhydrous manganese led to conclusion *how that* energy of magneton could not have any value and consequently second hypothesis of Planck was pronounced inexact.

OSCILLATION DISCHARGE. Oscillation during the Discharge of an Induction Coil, E. Taylor Jones. Elecn., vol. 83, nos. 2152 and 2153, Aug. 13, and 22, 1919, pp. 167-169 and 201-202, 20 figs. Aug. 15: Photographs of spark discharges with secondary condenser. Aug. 22: Photographs illustrating effect of invoice current at break. (Concluded.)

PERMEABILITY, REVERSIBLE. Reversible Permeability in the Ideal Curve of Magnetization (La Permeabilidad reversible en la Curva ideal de imanacion), Richard Gans. Contribucion al estudio de las ciencias fisicas y Matematicas, Universidad Nacional de la Plata, vol. 11, no. 36, July 1918, pp. 147-172, 13 figs. By ideal curve of magnetization is meant, following Steinhaus and Gumlich conception, the curve of maximum irregularity compatible with the existing magnetic field. Apparatus and method of producing this irregularity and measurements taken with tempered and annealed steel soft iron and nickel are described and equations are derived for computing reversible permeability for any degree of magnetization.

REACTANCE COILS. Some New Formulas for Reactance Coils, H. B. Dwight. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 9, Sept. 1919, pp. 1039-1060, 7 figs. Formulæ are derived for mutual inductance of coils with parallel axes, repulsion of coils with parallel axes and self-inductance of long cylindrical coils.

RECTIFIERS. Rectifying High-Tension Alternating Currents, Samuel Cohen. Elec. World, vol. 74, no. 11, Sept. 13, 1919, pp. 573-575, 5 figs. Experiment with high-tension rectifier, consisting of gap between point and plate, for the purpose of determining most favorable gas, gas pressure and electrode construction.

See also Thermionic Rectifiers.

SPARK DISCHARGE. Time-Lag in the Spark Discharge, Norman Campbell. Lond., Edinburgh & Dublin Phil. Mag., vol. 38, no. 224, Aug. 1919, pp. 214-230, 1 fig. Each of two theories of time-lag—that formation of corona must precede spark and that presence of casual ions is necessary—considered as explaining part of facts.

THERMIONIC RECTIFIERS. The Current-Voltage Characteristics of High-Voltage Thermionic Rectifiers, C. L. Fortescue. Phys. Soc. of London, vol. 31, no. 5, Aug. 15, 1919, pp. 319-337, 12 figs. Reference to use of high-voltage of thermionic types for production of high-voltage steady current from an alternating current supply. Curves and approximate methods of calculating them are given for determining best combination of electron current and alternating supply voltage for any prescribed conditions.

THERMOELECTRICITY. Thermoelectric Power and Resistance of Bismuth in a Magnetic Field (Potere Thermoelettrico e resistenza del bismuto nel campo magnetico), M. La Rosa. Il Nuovo Cimento, vol. 18, no. 7, July 1919, pp. 26-38, 1 fig. Experimental. Effect of producing Peltier, Thomson, and Hall phenomena in magnetic field.

TRANSFORMATION LIMITATION. Inherent Limitations on Transformations possible by stationary Apparatus, Joseph Slepian. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 9, Sept. 1919, pp. 1061-1075, 1 fig. Expressions for electro-static and electromagnetic energies, Joulian heat dissipation and power are given in complex quantities.

VACUUM TUBE. The Vacuum Tube as a Generator of Alternating Current Power, John H. Morecroft and H. Trap Friis. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 10, Oct. 1919, pp. 1193-1221, 35 figs. Deals with operation of tube when separately excited and efficiency of tube as generator. Analysis of forms and phases of voltages and currents in different parts of circuit as well as oscillograms showing action of tube under various conditions are given.

VIBRATIONS, DAMPED. A Simple Derivation of the Formulae for the Resonance Curves of a Damped Vibration and Some Properties Thereof, Balth Van Der Pol, Elecn., vol. 83, nos. 2154 and 2155, Aug. 29 and Sept. 5, 1919, pp. 225-228 and 251-252, 4 figs. Aug. 29: Method based principally on assumptons that (1) coupling coefficient of two circuits is small, and (2) spacing of separate discharges, and damping factors are such that each damped oscillation falls off nearly completely before next one sets in. Sept. 5: Bjerknes formula. (Concluded.)

FURNACES

The Electric Furnace—I, II, I. F. Rowlinson. Sci. Am. Supp., vol. 88, nos. 2278 and 2281, Aug. 30 and Sept. 20, 1919, pp. 132-133 and 180-181 and 191, 8 figs. Survey of its development, its scope and its future.

BOOTH-HALL FURNACE. The Electric Furnace in Practice, Carl H. Booth. Jl. Electricity, vol. 43, no. 5, Sept. 1, 1919, pp. 223-224, 1 fig. Mechanical details in operation of Booth-Hall furnace.

DESIGN. The Design of Electric Furnaces, R. C. Gosrow. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp. 235-241. Consideration of the elements of size and other details in relation to operation and recovery of metal, with special reference to production of ferromanganese.

GREAT BRITAIN. Electric Furnace Operation in United Kingdom, 1918, R. G. Mercer. Elec. News, vol. 28, no. 18, Sept. 15, 1919, pp. 25-26. With reference to general efficiency of electric furnace in steel making.

GREAVES-ETCHELLS FURNACE. Greaves-Etchells Electric Furnace (El horno electrico Greaves-Etchells). Madrid Cientifico, vol. 26, no. 998, Aug. 5, 1919, pp. 342-344, 3 figs. Details of 3-ton Greaves-Etchells electric furnace.

OPERATION. A Square Deal for the Electric Furnace, H. G. Weidenthal. General Meeting of the Am. Electrochem. Soc., paper no. 10, Sept. 23-26, 1919, pp. 95-100. User of electric furnace is urged to acquaint himself thoroughly with electric furnace practice in order that he may "do justice to himself and his business, and at the same time give the electric furnace a square deal."

SAHLIN FURNACE. A New Type of Electric Furnace, Axel Sahlin. Elecn., vol 83, no. 2152, Aug. 28, 1919, pp. 164-165, 1 fig. Designed with a view to embodying advantages of both direct-arc and free-burning arc types. From paper read before Instn. Elec. Engrs.

GENERATING STATIONS

COST OF ELECTRIC SUPPLY. The Cost of Electric Supply, William Woodhouse. Elec. Times, vol. 56, no. 1454, Aug. 28, 1919, pp. 159-160, 1 fig. Relationship between cost, load factor and demand.

HIGH-TENSION SERVICE. Delivery of High-Tension Service to Large Consumers, Rawson Collier. Elec. Rev., vol. 75, no. 10, Sept. 6, 1919, pp. 392-396, 3 figs. General considerations involved; relation of cost to station capacity and revenue; choice of equipment metering.

HIGH-TENSION STATIONS. Large High-Tension Alternating-Current Electric Stations. (Les grands postes électriques à courant alternatif haute tension), A. Hayet. Revue Générale de l'Electricité, vol. 6, no. 9, Aug. 30, 1919, pp. 261-277, 13 figs. Technical study of design and characteristics of central power stations. (To be continued.)

GATUN HYDRO-ELECTRIC STATION. Development of Gatun Hydro-electric Station. Jl. Electricity, vol. 43, no. 5, Sept. 1, 1919, pp. 198-201. 5 figs. Details of recent improvements in power plant which furnishes power for operation of canal.

PARALLELING ALTERNATORS. Paralleling Alternators—II, F. Ashton. Mech. World, vol. 66, no. 1705, Sept. 5, 1919, pp. 112-113, 4 figs. According to writer accuracy of synchronizing connections can be tested by opening neutral point of three-phase generator and closing main-switch,

RATES. Central-Station Rates in Theory and Practice, H. E. Eisenmenger. Elec. Rev., vol. 75, nos. 9, 10, 11 and 12, Aug. 30, Sept. 6, 13 and 20, 1919, pp. 352-355, 388-391, 434-437 and 473-476, 6 figs. Aug. 30: Discussion of principles governing selection of rate system, particularly policies underlying questions of what amount of profit shall be desired and in what proportion shall different classes of customers contribute to that profit. Sept. 6: Comparison of cost-of-service and value-of-service principles of rate making. Sept. 13: Conditions under which reductions are desirable as regards earnings. Sept. 20: Conclusions of mathematical and analysis of conditions in which price splitting or reduction is advantageous as regards earnings of Central Station.

RECTIFICATION. Advantages and Disadvantages of the Various Systems of Rectifying High-Tension Alternating Current. (Advantages et inconvénients des divers systèmes de transformation de courant alternatif à haute tension en courant continu), F. Sarrat. Association des Ingénieurs Electriciens Sortis de l'Institut Electrotechnique Montefiore, vol. 1, nos. 3, 4, 5, 6, 7, Mar., Apr., May, June, July, 1919, pp. 161-236, 29 figs. Figures complied from various power stations in reference to efficiency, cost, maintenance expense, power factor, etc., of various systems, for presentation to Congrès International de Tramways et de Chemin de Fer d'intérêt local, which was to be held at Buda-Pest in Sept., 1914.

UNIT ANALYSIS. Unit Analyses of Industrial Power Business. Elec. World, vol. 74, no. 12, Sept. 20, 1919, pp. 627-629. Records of Massachusetts central stations quoted as proof that desirable revenue is consistent with moderate average yield per kw.-hr.

GENERATORS AND MOTORS

BALANCING ROTORS. Balancing and Alignment of the Alternator Rotor, C. Sylvester. Elec. Rev., vol. 85, no. 2179, Aug. 29, 1919, pp. 260-261, 3 figs. Illustrating method for adjusting balance weights on turbo-alternator rotor.

CONTROL GEAR FOR D.-C. MOTORS. Control Gear for Direct-Current Motors, C. W. Stubbings. Electricity, vol. 31, no. 1504, Sept. 5, 1919, pp. 553-554. Recently constructed switch of the liquid type was so arranged that closing short-circuiting switch for starting resistance automatically opened valve which caused tank immediately to empty.

DYNAMO, D.-C. Direct-Current Dynamo for Constant Current at Variable Speed (Gelijkstroomdynamo voor constanten stroom bij veranderlijk aantal omwentelingen), J. Botermans. Ingenieur, vol. 34, no. 33, Aug. 16, 1919, pp. 603-605, 2 figs. This dyanmo differs from other constructions in that field of dynamo is influenced by currents which circulate in a number of short-circuited bars.

See also Motors, D.-C., Large.

MOTORS, D.-C., LARGE. The Operation of Large Direct-Current Motors Without Starting Resistances, W. Linke. Elecn., vol. 83, no. 2152, Aug. 28, 1919, pp. 170-171. Account of Trettin's conclusions arrived at from mathematical investigations and of tests performed by writer. From Elektrotechnische Zeitschrift.

See also Control Gear.

SYNCHRONIZING. Methods of Synchronizing Alternating-Current Machines, Frank Gillooly. Power, vol. 50, no. 12, Sept. 16, 1919, pp. 456-459, 8 figs. Construction and principles of operation of different types of synchronoscopes are described and various methods of synchronizing alternating-current machines discussed.

IGNITION APPARATUS

SPARK-PLUG TERMINALS. Deterioration of Nickel Spark-Plug Terminals in Service, Henry S. Rawdon and A. I. Krynitzky. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152. Aug. 1919, pp. 1323-1350, 21 figs. Investigation at Bureau of Standards represented as having shown that service deterioration of nickel spark-plug terminals is due to embrittlement of wire by formation of system of intercrystalline network and definite transverse cracks.

TWO-SPARK IGNITION. A Two-Spark Generator Battery Type Ignition. Automotive Industries, vol. 41, no. 11, Sept. 11, 1919, pp. 511-512, 7 figs. Equipment consists of double ignition distributor, two ignition coils and combination lighting and ignition switch.

LIGHTING AND LAMP MANUFACTURE

AERIAL LIGHTING DEVICES. Illuminating Devices in the Great War—II, H. M. Brayton. Sci. Am. Supp., vol. 88, no. 2279, Sept. 6, 1919, pp. 146-147, 155 and 159. Account of aerial lighting devices and their development from 1914 to the armistice.

ARC, LUMINOUS VAPORS. Luminous Vapors Produced in the Arc, with Applications to the Study of Spectral Series and Their Origin (Vapeurs lumineurses distillées de l'arc, avec applications à l'étude des séries spectrales, leur origine), R. J. Strutt. Radium, vol. 11, no. 7, May 1919, pp. 200-204, 4 figs. Brilliant effects similar to those obtained with mercury arc reported to have been produced with other metals.

PHOTOMETRY. Regarding the Photometric Measuring of Searchlights (Ueber das Photometrieren von Scheinwerfern), Gehlhoff. Zeitschrift f. Beleuchtungswesen, Heizungs-und Lüftungstechnik, vol. 25, nos. 7-8, Apr. 1919, pp. 35-41, 12 figs. Claims that in order to eliminate absorption it is necessary to photometer two sufficiently different distances.

SEARCHLIGHTS. Metal Mirrors for Searchlights, R. B. Hussey. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 652-655, 6 figs. Processes used in production of 60-in. mirrors.

See also Photometry.

Adaptation of the High Intensity Arc to the Open-type 60-inch Army Searchlight, John T. Beechlyn. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 655-659, 4 figs. After pointing out characteristics essential to production of high-intensity arc and describing how these are obtained in practice, writer deals successively with mounting and connections, ventilation system, mechanical construction, and feeding mechanism.

Searchlight Air Defence Operations, William F. Tompkins. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 663-667, 7 figs. Method of defence described as requiring placing anti-aircraft guns in bands along entire front especially guarding prominent routes to important objectives in rear. Technique and effect of this method against night raids by enemy aircraft are discussed.

Searchlight Testing, F. A. Benford. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 668-675, 15 figs. Description of instruments employed for testing intensity of lamps, flux values obtained with certain groups of electrodes and effect on efficiency of distribution of light within a searchlight beam.

Distant Control of Projectors for Sea Coast Defence, J. L. Hall. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 676-679, 3 figs. Manner in which remote control is effected and equipment for its performance.

Thirty-inch Open Type Searchlight with Tripod Mount, E. J. Murphy. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 680-682, 5 figs. Deisgn and construction.

Searchlight Production, Langdon Gibson. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 683-684, 1 fig. Notes on production of searchlight on war basis.

Searchlight Electrodes, W. H. Hardman. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 685-688, 8 figs. Special requirements and processes of manufacture.

Searchlight Tower Units, R. S. Hood, Jr. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 689-693, 6 figs. Data concerning telescopic, Bascule bridge and counterbalanced types.

Mobile Searchlight Power Units for U. S. Army, Henry S. Baldwin. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 694-699, 11 figs. Particulars of 6-kw. and 50-kw. units.

Searchlight Developments of the U. S. Army, Chester Lichtenberg. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 700-703, 3 figs. How weight and number of parts have been reduced, power and efficiency increased and mobility vastly improved.

The Lynn 60-inch Open Type Army Searchlight Development, Cromwell A. B. Halvorson, Jr. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 704-713, 17 figs. Impressive features of development are said to be radical departure from conventional design and rapidity of carrying out experimental work, object of which was to produce a powerful light-weight searchlight that would be so mobile and yet so rugged that it would withstand severe conditions of battle service at firing line.

Light Weight Barrel Searchlights, Preston R. Bassett. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 714-717, 5 figs. Problems that had to be met by engineers in adapting 60-in. searchlight to field conditions.

Distant Electrical Controls for Military Searchlights, Theodore Hall. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 718-721, 4 figs. Comparative study of various types.

The General Electric Company in the Great World War—III, John R. Hewett. Gen. Elec. Rev., vol. 22, no. 9, Sept. 1919, pp. 726-740, 20 figs. Ship propulsion, electric heating devises and searchlights.

STANDARDIZED INDUSTRIAL LIGHTING SYSTEM. Standardized Industrial Lighting Systems—II, H. L. Cornelison. Elec. World, vol. 74, no. 9, Aug. 30, 1919, pp. 459-461, 5 figs. Engineering plans of Austin Co., Chicago, for conduit, wiring, panel and fixture arrangements for providing layouts in standard buildings.

MEASUREMENTS AND TESTS

CONDUCTIVITY. Measurements of Electric Conductivity in Free Atmosphere at Altitudes up to 9,000 Meters (Mesures de conductibilité électrique dans l'atmosphère libre jusqu'à 9000 mètres d'altitude), A. Wigand. Radium, vol. 11, no. 7, May 1919, pp. 204-208, 1 fig. Made with Gerdien apparatus modified by replacing needle electrometer for a wulf bifilar electrometer.

Simple Method for Ascertaining the Conductivity Constant in Alternating Current Measurements (Einfache Verfahren sur Ermittlung der Leitungskonstanten aus Wechselstrommessungen), H. Jordan. Telegraphen-u. Fernsprech-Technik, vol. 8, no. 2, May 1919, pp. 17-22, 5 figs. Approximating formula for low and high values of B I.

ELECTROMETER. A Sensitive Modification of the Quadrant Electrometer; Its Theory and Use, A. H. Compton and K. T. Compton, Phys. Rev., vol. 14, no. 2, Aug. 1919, pp. 85-98, 3 figs. Introduction of tilted needle and movable quadrants in design. Advantages claimed are high sensitivity independent of deflection and quick adjustment of sensitivity through great range. It is claimed that by using a small needle 4.5 mm. in radius with a slight tilt, sensitivity as high as 60,000 mm. per volt were obtained.

ELECTROSCOPE, GOLD LEAF. A Method of Measuring the Capacity of Gold-Leaf Electroscopes, A. T. Mukerjee, Lond., Edinburgh. and Dublin. Phil. Mag., vol. 38, no. 224, Aug. 1919, pp. 245-256, 1 fig. Using standardized or (Gerdien) sliding condenser, absolute capacity of quadrant system, including specially designed connecter, is first determined by method of mixtures; gold-leaf system is then charged to known voltage, adjusted so that when charge is shared with quadrant system final potential is not far from one volt; as capacity of quadrant system can be varied by sliding condenser; capacity of electroscope can be measured at different voltages.

GALVANOMETERS. Needle Galvanometers with Recording Mechanism. (Galvanomètres inscripteurs à fer mobile), Henri Abraham and Eugène Bloch. Comtes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 4, July 28, 1919, pp. 171-174. Built for military radio-telegraphy and geographic service of French army.

METERS, CURRENT. Sensitive Alternating Current Meters (Appareils sensibles pour les mesures en courants alternatifs), H. Abraham, E. Bloch and L. Bloch. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 2, July 15, 1919, pp. 59-62. Amplifying direct reading voltmeter.

POTENTIOMETER, HIGH-FREQUENCY MEASUREMENTS. Alternating-Current Planevector Potentiometer Measurements at Telephonic Frequencies, A. E. Kennelly and Edy Velander, Proc. Am. Philosophical Soc., vol. 58, no. 2, 1919, pp. 97-132, 16 figs. Principle of potentiometer is the same as that described by Prof. Larson in 1910. (Elek. Zeitschrift, Oct. 13, 1910, vol. 31, pp. 1039-1041; also The Electrical World, vol. 56, Nov. 3, 1910, pp. 1085-1088), to present form worked out in Mas. Inst. Technology Laboratories through thesis studies of A. E. Hanson in "The Design and Construction of an Alternating-Current Potentiometer," Sept. 1918.

SUSCEPTIBILITIES. On the Measurement of Small Susceptibilities by a Portable Instrument, Ernest Wilson. Phys. Soc. of London, vol. 31, no. 5, Aug. 15, 1919, pp. 338-346, 2 figs. Horizontal beam is supported by phosphor-bronze strip attached to torsion head. Specimen, which is held in grip at one end of beam and is counterpoised by a sliding weight, hangs between pole pieces fixed to base of instrument. Magnet consists of two rings of tungsten steel, each of which is magnetized with north and south poles at opposite ends of diameter. By varying azimuths of rings, field between pole pieces can be varied. Method consists of turning torsion head until specimen just breaks away from field between poles.

TRACK CIRCUIT. The Alternating Current Track-Circuit, Douglas C. Gall, Elecn. vol. 83, no. 2155, Sept. 5, 1919, pp. 244-247, 8 figs. Methods used to determine behavior track circuit.

VOLTMETER, SYNCHRONIZING. An Improved Voltmeter for Synchronizing Purposes, G. Keinath. Elecn., vol. 83, no. 2153, Aug. 22, 1919, p. 198, 1 fig. Employing resistance, having high temperature coefficient in series with voltmeter. From Elektrotechnische Zeitschrift, No. 46, 1918.

MATERIALS OF CONSTRUCTION

CABLE WIRE MATERIAL. Aluminum versus Copper Cable Wire, A. J. Smout. Metal Industry, vol. 15, no. 8, Aug. 22, 1919, pp. 146-147, Showing (1) effects of impurities on electrical conductivity of aluminum, (2) physical properties of aluminum and copper wire, and (3) composition and tensile strength of aluminum wire.

CONTACT MATERIAL. Contacts and Contact Material, H. von Fleischbein. Elecn., vol. 83, no. 2154, Aug. 29, 1919, pp. 220-221, 3 figs. Results obtained with tungsten contacts on relays. Translated from Elektrotechnische Zeitschrift.

ERINOID. *See Insulators.*

FIBRE. The Absorption of Water by Vulcanized Fibre and Erinoid on Exposure to Moist Air, and the Consequent Change of Electrical Resistance, R. G. Allen. Scientific Proc. Roy. Dub. Soc., vol. 15, no. 32, Oct. 1918, pp. 405-414. Vulcanized fiber found to be much more hygroscopic than erinoid. After being thoroughly dried and then exposed to moist air, electrical resistance of both, specially fiber, observed to decrease rapidly as time of exposure continued.

INSULATORS. The Porosity of Porcelain, with Special References to High-pressure Insulators for Electric Transmission Lines, C. C. Farr. New Zealand Jl. Sci. & Technology, vol. 11, nos. 4 and 5, July 1919, pp. 302-307, 1 fig. Experiment claimed to have shown that density and porosity have little or no connection with each other.

Cracking of Pin Tupe Corner Porcelain Insulators, S. L. Foster. Jl. Electricity, vol. 43, no. 5, Sept. 1, 1919, pp. 213-215. How problem was solved by painting with shellack by United Railroads of San Francisco.

The Electrical Resistance of Porcelain at Different Temperatures, R. G. Allen. Scientific Proc. Roy. Dublin Soc. vol. 15, no. 27, June 1918, pp. 289-309, 6 figs. Tests of several samples in various forms at different temperatures ranging from 80 to 300 deg. cent. Relation of Rasch and Hinrichsen between insulation resistance and absolute temperature found to remain approximately true.

The Insulating Properties of Erinoid, R. G. Allen. Scientific Proc. Roy. Dublin Soc., vol. 15, no. 29, Aug. 1918, pp. 331-358, 6 figs. Experimental Erinoid found to be good insulator of fairly constant insulation resistance. Of various varieties of erinoid, red was found to be most absorbent of water and generally of lowest resistance.

See also Fibre.

PORCELAIN. *See Insulators.*

POWER APPLICATION

BAKING. Electric Baking Furnaces in Switzerland (Les fours de boulangers à chauffage électrique en Suisse). Industrie Electrique, vol. 28, no. 652, Aug. 25, 1919, pp. 314-316. Comparison of energy consumption in electrically-heated and coal-heated furnaces.

COOKING LOAD. The Use of Electrical Power in Industrial Works, G. W. Stubbings. Eng. & Indus. Management, vol. 2, no. 9, Aug. 28, 1919, pp. 264-265, 2 figs. Writer suggests types of electrical motors suitable for different classes of work. *See also Baking.*

HEATING. Industrial Applications of Electric Heating (Les applications du chauffage électrique dans l'industrie), F. Rutgers. Génie Civil, vol. 75, no. 9, Aug. 30, 1919, pp. 189-194. 18 figs. Illustrating electrically-heated boilers, air-heating apparatus, electric radiators and electric furnaces.

LIGHTERS. An Electrically Equipped Lighter, William H. Easton. Pac. Mar. Rev., vol. 16, no. 9, Sept. 1919, pp. 130-131, 6 figs. Penn. R.R. lighter equipped with electrically-operated winches.

MOTOR SELECTION. The Use of Electrical Power in Industrial Works, G. W. Stubbings. Eng. & Indus. Management, vol. 2, no. 9, Aug. 28, 1919, pp. 264-265, 2 figs. Writer suggests types of electrical motors suitable for different classes of work.

STANDARDS

FRENCH RULES, ELECTRICAL MATERIAL. French Rules for Standardizing Electric Material (Règles françaises d'unification du matériel électrique). Electricien, vol. 49, no. 1235, Aug. 31, 1919, pp. 73-75.Regulations for rating and classifying electric machines adopted by Commission Permanente de Standardisation.

STORAGE BATTERIES

DRY CELLS. Depreciation in Small Dry Cells with Age, A. J. Helfrecht. Gen. Meeting, Am. Electrochem. Soc., Paper no. 5, Sept. 23-26, 1919, pp. 33-40, 4 figs. Writer endeavors to show how closely method of judging cell deterioration, called "flesh test," approaches actual measurements of capacity through discharging cells. Comparative curves for different sizes of cells are given.

LEAD ACID BATTERIES. Factors Affecting the Life of Lead-Acid Storage Batteries, P. L. Rittenhouse. Automotive Industries, vol. 41, no. 10, Sept. 4, 1919, pp. 474-475, 2 figs. Two seemingly contradictory statements, one advanced by manufacturer of house-lighting plants and other by automobile engineer, are discussed. Writer endeavors to demonstrate that apparent difference is one of practice rather than of principle.

Theory of Lead Storage Battery (Sur la théorie de l'accumulateur au plomb), Paul Bary. Revue Générale de l'Electricité, vol. 6, no. 7, Aug. 16, 1919, pp. 195-199. Taking into account electrolysis of lead sulphate dissolved in electrolyte.

TELEGRAPHY AND TELEPHONY

The Scientific Problems of Electric Wave Telegraphy, J. A. Fleming, Jl. Roy. Soc. Arts, vol. 67, nos. 3282 and 3483, Aug. 15 and 22, 1919, pp. 612-616 and 625-631. Aug. 15: Transmission of long electric waves used in wireless telegraphy over surface of earth. Aug. 22: Detection of electric waves sent out from radio-transmitter station and manner in which these are controlled to create intelligible signals. (Cantor Lectures.)

AMPLIFIERS. Recording Amplifiers Used in Wireless Telegraphy. (Application des amplificateurs à l'inscription mécanique des signaux de télégraphie sans fil.), Henri Abraham and Eugène Bloch. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 6, Aug. 11, 1919, pp. 282-285. Essays and field work of French Military radiotelegraphy quoted as evidence that lamp amplifiers permit direct reception of signals without any mechanical relays being used.

ANTENNAE. *See Interference Elimination.*

The Natural Constants of Wireless Antennae, A. Meissner. Wireless Age, vol. 7, no. 78, Sept. 1919, pp. 320-323, 6 figs. Empirical formulæ for determining natural wavelength of various form of aerials. Translated from Physikalische Zeitschrift, March 15, 1919.

ARTOM RECEIVER. Artom's Visual Receiver for Directive Wireless Telegraphy. Wireless Age, vol. 6, no. 11, Aug. 1919, pp. 21-22, 3 figs. Built in form of d'Arsonval galvanometer. Movable coil is traversed by rectified high frequency currents fed by directive aerials.

AUTOMATIC SWITCHBOARD. The Operator versus the Automatic, H. C. Townsend. Telephone Engr., vol. 22, no. 3, Sept. 1919, pp. 98-100. Examples in which manual switchboard is said to cope better with traffic.

AUTOMATIC TELEPHONY. Meter and Coin Devices for Automatic, Arthur Bessey Smith. Telephone Engr., vol. 22, no. 3, Sept. 1919, pp. 101-105, 9 figs. Illustrating method of operation. Paper read before Automatic Tel. Engrs.' Conference.

CONDUITS, TELEPHONE. Conduit Construction in Telephone Cable Tunnels. Eng. World, vol. 15, no. 6, Sept. 15, 1919, pp. 33-35, 6 figs. Construction methods employed.

DAMPING OF SIGNALS. The Damping of Wireless Telegraph Signals, G. H. Wood. Wireless World, vol. 7, no. 77, Aug. 1919, pp. 274-277, 2 figs. Investigations in West Indies.

DIRECTION FINDING. Theory and Practical Attainments in the Deisgn and Use of Radio Direction Finding Apparatus Using Closed Coil Antennas, A. S. Blatterman. Jl. Franklin Inst., vol. 188, no. 3, Sept. 1919, pp. 289-362, 69 figs. Summary of investigation carried out in U. S. Signal Corps Radio Laboratories.

DUPLEX APPARATUS. Universal Duplex Apparatus. Telegraph & Telephone Age, no. 17, Sept. 1, 1919, pp. 422-426. Balancing circuit for automatic working at high speeds. (Concluded.)

FIELD WIRELESS SETS. "W-T. R.E.". B. F. J. Schonland. Wireless World, vol. 7, nos. 76, 77, July and Aug. 1919, pp. 174-178 and pp. 261-267, 4 figs. Account of work and development of field wireless sets with armies in France. (Continuation of serial.)

INFRA-RED RADIATION, RADIOTELEGRAPHY. Radiotelegraphy by Infra-red Radiations (Radiotélégraphie par rayonnement infra-rouge), J. Herbert-Stevens and A. Larigaldie. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 3, July 21, 1919, pp. 136-137. Experiments said to have given satisfactory results of distance up to 12 miles. Transmitter was arc projector, luminous rays of which were observed through suitable screen; receiver was thermo-electric ouple placed at focus of parabolic mirror.

INTERFERENCE ELIMINATION. The Weagant "X-Stopper," Wireless World, vol. 7, no. 77, Aug. 1919, pp. 271-273. 2 figs. Modified form of three-aerial arrangement. (Concluded.)

OSCILLATIONS. Electrical Oscillations in Antenna and Inductance Coils, John M. Miller. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 677-696, 8 figs. Application of antenna to theory of circuits having uniformly distributed electrical characteristics such as cables, telephone lines, and transmission lines.

PHOTOGRAPHS. The Electrical Transmission of Photographs, Marcus J. Martin. Model Engr. & Elecn., vol. 41 nos. 952, 953, 954, July 24, 31, and Aug. 7, 1919, pp. 83-86, 102-104, 130-131, 14 figs. July 24: Professor Korn's selenium machines. July 31: Professor Belin's telesteregraph. Aug. 7: Principle of operation of the teletrograph.

RADIO COMMERCIAL OPERATION. Radio Telegraphy in Competition with Wire Telegraphy in Overland Work, Robert Boyd Black. Telegraph & Telephone Age, no. 18, Sept. 16, 1919, pp. 459-464. Operation of radio stations. (Concluded.)

RADIO REMOTE CONTROL. Naval Radio Remote Control, P. H. Boucheron, Sci. Am., vol. 121, no. 10, Sept. 6, 1919, pp. 234 and 244, 1 fig. What the Navy is doing to minimize interference in radio operation.

RECEIVING SETS. Experimental Wireless Telegraphy and Telephony—V, Louis Gerard Pacent and Austin C. Lescarboura. Sci. Am. Supp., vol. 88, no. 2279, Sept. 6, 1919, pp. 152-153, 9 figs. Describing the more advanced types of receiving sets, with particular reference to postbellum practice.

Thermophones or Hot-Wire Receivers. Elecn., vol. 83, no. 2155, Sept. 5 1919, p. 242, 1 fig. Technical note on relationship between watts in wire and diameter of wire. Hot-wire receiver is not considered to be sufficiently developed to be ready to replace electromagnetic receiver for all branches of telephony, but it is said that it has already filled conditions which electromagnetic failed to do.

TELEPHONE REPEATERS. Telephonic Repeaters, A. B. Hart. Instn. Post Office Elec. Engrs., no. 75, Nov. 22, 1918, 46 pp., 10 figs. Review of conditions which have led to evolution of telephonic repeater as at present used in post office service, together with data offered as being of assistance in constructing estimates for telephonic repeater equipments, and suggestions in regard to changes in design, construction and maintenance of telephone lines that writer believes must be introduced if full advantage is to taken of telephonic repeaters.

TELEPHONY, TOLL TRAFFIC. Mathematical Study of Toll Traffic, Carroll O. Bickelhaupt. Telephony, vol. 77, no. 9, Aug. 30, 1919, pp. 12-15, 6 figs. Determination of arithmetic mean, standard deviation and probable error of the mean in analysis of long distance and toll traffic data. Technical statistical method now applied to study of telephone traffic.

TELEPHONY, SECRET. Process of Secret Telephony. (Sur un procédé de téléphonic secrète). Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 4, July 28, 1919, pp. 177-179, 1 fig. Account of how voice or musical air is deformed at other points than receiving station of circuit in which telephonic current is interrupted periodically.

THERMOPHONES. *See Receiving Sets.*

TRANSATLANTIC COMMUNICATION. Transatlantic Radio Communication, E. F. W. Alexanderson. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 10, Oct. 1919, pp. 1077-1093, 15 figs. Account of operation of present transatlantic stations and description of radio transmitting system at New Brunswick, N.J., which comprises special means for generating, modulating and radiating continuous wave energy. Article contains also account of multiple-antenna system of radiation.

TRANSMISSION. Principles of Radio Transmission and Reception with Antenna and Coil Aerials, J. H. Dellinger. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 10, Oct. 1919, pp. 1095-1150, 17 figs. Mathematical study of coil aerial as direction finder, interference preventer, reducer of strays and submarine aerial. Experiments are quoted which verify conclusions reached and formulae are presented for designing aerial for any radio station.

TRANSMITTER. Inductively Coupled Transmitter for Extremely Short Wave Lengths. Wireless Age, vol. 6, no. 11, Aug. 1919, p. 20, 3 figs. Elements arranged summetrically about common axis.

Development of Arc Radio Transmitters, Adrien L. Anderson and Harold F. Elliott. Elec. World, vol. 74, no. 9, Aug. 30, 1919, pp. 452-456, 7 figs. Noting how prevention of eddy current and corona losses and insulation breakdown is effected.

The Marconi Timed-Spark Continuous-Wave Transmitter, Philip R. Coursey. Wireless Age, vol. 7, no. 78, Sept. 1919, pp. 310-316, 6 figs. Noting specially feature for securing correct synchronization of impulse.

Vacuum Valves. The Theory of Valve Rectification, W. S. Barrell. Wireless World, vol. 7, nos. 77 and 78, Aug. and Sept. 1919, pp. 244-246, and 337-340, 7 figs. Aug.: Arrangement for connecting three-electrode valve of simple circuit. Sept.: Study of phenomena taking place in grid-filament circuit.

See also Amplifiers.

The Lamp-Valve in Radiotelegraphy. (La lampe-valve en radiotélégraphie), Henry Janne. Association des Ingénieurs Electriciens Sortis de l'Institut Electrotechnique Montéfiore, Bulletin, vol. 1, nos. 3, 4, 5, 6, 7, March, Apr., May, June, July, 1919, pp. 96-160, 13 figs. Study of its operation for (1) generating electric oscillation, (2) detecting, and (3) amplifying flatened waves. (To be continued.)

Weagant X-Stopper. *See Interference Elimination.*

TRANSFORMERS, CONVERTERS, FREQUENCY CHANGERS

Air-Blast Transformers. Maintenance of Air-Blast Transformers. Elec. Ry. Jl., vol. 54, no. 9, Aug. 30, 1919, pp. 424-426, 4 figs. Practice of United Railways of St. Louis where 63 air-blast transformers are kept in continuous service, noting special cover designed to prevent fires.

Booster Transformers. Principles of Booster Transformers, C. M. Jansky. Elec. Rev., vol. 75, no. 9, Aug. 30, 1919, pp. 341-344, 8 figs. Formulæ for finding percentage of boosting and choking of singlephase and polyphase transformers under different conditions.

Furnace Transformers. Transformers and Connections to Electric Furnaces, J. F. Peters. Elec. Jl., vol. 16, no. 9, Sept. 1919, pp. 397-399, 7 figs. Concerning requirements of leads for large furnaces requiring over 10,000 amperes, especially at 60 cycles.

Large Transformers. Large Power Transformers, A. G. Ellis and J. L. Thompson. Elecn., vol. 83, no. 2155, Sept. 5, 1919, pp. 253-255, 3 figs. Writers refer to progress toward increased size of modern stations, generating units and transformers, and tendencies to higher pressures. Limiting sizes of transformers as effected by handling and cooling are discussed, and prices per kilovolt-ampere in relation to output, voltage and cooling are presented. (To be continued.) From paper presented before Instn. Elec. Engrs.

TRANSMISSION, DISTRIBUTION, CONTROL

Centralization. Centralization of Electrical Energy (Etat actuel des principaux transports d'énergie électrique), Pierre Moutier. Electricien, vol. 49, no. 1235, Aug. 31, 1919, pp. 76-80, 1 fig. Recent progress and consideration of future developments.

Condensers. Synchronous Condensers in High-Tension System, J. W. Andree. Elec. World, vol. 74, no. 11, Sept. 13, 1919, pp. 564-567, 5 figs. 52,500 Kva. of synchronous condenser capacity is used for extensive high-tension system of Southern California Co. Functions of condensers discussed. How equipment is operated for maximum economy.

Insulators. Locating Defective Transmission-Line Insulators, T. F. Johnson, Jr. Elec. World, vol. 74, no. 11, Sept. 13, 1919, pp. 568-572, 5 figs. Details of "Buzz-stick" method that can be used on live high-voltage lines to detect faulty insulators of suspension or pin type, together with construction and use of special tools required.

Interconnection. California 220,000 Volt—1100 Mile—1,500,000-Kw. Transmission Bus, R. W. Sorensen, H. H. Cox and G. E. Armstrong. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 9, Sept. 1919, pp. 1027-1038, 5 figs. Jl. Electricity, vol. no. 5, Sept. 1, 1919, pp. 202-205, 4 figs. Scheme for interconnection of all California power plants.

Layout, Transmission Line. Laying Out a Power Transmission Line, Charles R. Hart. Elec. Ry. Jl., vol. 54, no. 12, Sept. 20, 1919, pp. 561-564, 3 figs. Concerning selection of route, clearances and pole and tower spacing with regard to maintenance as well as construction costs.

Power-Factor Correction. Power-Factor Correction by Use of the Static Condenser, O. C. Roff. Elec. Rev., vol. 75, no. 11, Sept. 13, 1919, pp. 423-427, 8 figs. Characteristics of static condenser installations. Causes of low power factor. Operating costs and purchase price. Paper read before Penn. Elec. Assn.

Substations. Railway Converter Substations—III, C. F. Lloyd. Power House, vol. 12, no. 12, Aug. 5, 1919, pp. 334-337, 4 figs. Information concerning class of equipment to be used and its arrangement in substation building.

The Substations of Electro-Chemical Industries (In Japanese), S. Fukuda. Denki Gakkwai Zasshi, no. 373, Aug. 10, 1919.

The Nisqually Substation at Tacoma, Washington. Jl. Electricity, vol. 43, no. 6, Sept. 15, 1919, pp. 257-258, 3 figs. Description of equipment and operation.

Switches. Automatic Isolation of Faults on High-Tension A. C. System. Iron & Coal Trades Rev., vol. 99, no. 2687, Aug. 29, 1919, pp. 266-267, 10 figs. Particulars of various types of protection gear for tripping switches automatically.

Transmission Circuits. Electrical Characteristics of Transmission Circuits—III, Wm. Nesbit. Elec. Jl., vol. 16, no. 9, Sept. 1919, pp. 385-396, 11 figs. Tables for determining approximate size of conductor corresponding to given I^2R transmission loss for any ordinary voltage or distance.

WIRING

Mine Wiring. Modern Mine-Wiring Practice, Terrell Croft. Coal Age, vol. 16, no. 12, Sept. 18, 1919, pp. 480-485, 21 figs. Particulars of methods and appliances employed at various plants.

GENERAL SCIENCE

PHYSICS

Acoustics. Detection of Submarine by Sound Waves. (Etude des ondes acoustiques, la propagation des ondes vibratoires et l'écoute sous-marine.), H. Brillié, Génie Civil, vol. 75, no. 9, Aug. 30, 1919, pp. 194-199, 10 figs. Technical study of physical questions involved in transmission of sound waves through different media. (Continuation of serial.)

Sound Waves (Etude des ondes acoustiques), H. Brillié. Génie Civil, vol. 75, no. 8, Aug. 23, 1919, pp. 171-175, 5 figs. Technical principles of acoustics involved in submarine detection. (To be continued).

Velocity of Sound in Sea Water (Sur une mesure de la vitesse de propagation des ondes sonores dans l'eau de mer), M. Marti. Comptes rendus des séanees de l'Académie des Sciences. vol. 169, no. 6, Aug. 11, 1919, pp. 281-212. Measurement effected by the French Naval Hydrographic Service at Cherbourg. Value obtained was 1503.5 m. per sec. at temperature of 14.5 deg. cent.

The Speed of Sound Pulses in Pipes, Arthur L. Foley. Phys. Rev., vol. 14, no. 2, Aug. 1919. pp. 143-151, 3 figs. Measured by photographic method modified so as to obtain instantaneous photograph of sound pulse part of which had come through a tube while another part had come through free air.

Sound Emitter and Sound Receiver—II (Schallgeber und Schallempfänger), W. Hahnemann and H. Hecht. Physikalische Zeitschrift, vol. 20, no. 11, June 1, 1919, pp. 245-251, 2 figs. The Electro-mechanical transformer as receiver.

Atomic Structure. A Mathematical Investigation of the Stability of Dr. A. W. Stewart's Atom. Leonard C. Fackson. Lond., Edinburgh and Dublin Phil. Mag., vol. 38, no. 224, Aug. 1919, pp. 256-266, 4 figs. Conditions for equilibrium and stability are obtained and applied to several special cases among simplest atom. It is found in each case that equilibrium cannot be maintained indefinitely for inner ring of negative electrons, even in entire absence of external perturbing forces. Thus, on atomic theory considered, instability is placed to account of those elements which are found to be least unstable in reality.

Cellular Structure. Cellular Solidification (Solidification cellulaire), M. C. Dauzère. Annales de Physique, vol. 12, July-Aug. 1919, pp. 5-106, 57 figs., partly on 12 supp. plates. Study of cellular structure in inanimate solids and determiuation of conditions under which it takes place during solidfication.

Emulsions. Investigations Concerning Oil-Water Emulsion, Alex. W. McCoy, H. R. Shidel and E. A. Trager. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1513-1537, 24 figs. Laboratory experiments conducted to determine compositions and properties of emulsified oil lead to conclusions that permanent B. S. is emulsion of very small water bubbles in oil having diameter generally less than 0.5 mm. Behavior of emulsion on heating is suggested as basis for division into two groups—(1) when water separates from oil rapidly with small amount of heating, and (2) when water can be removed by distillation.

Ionization. Ionization by Collision (Contribution à l'étude de l'ionisation par choc), M. Bianu. Radium, vol. 11, no. 7, May 1919, pp. 195-197, 4 figs. Experiments in air and water vapor.

Luminescence. Electrolytic Luminescence of Certain Metallic Anodes. (Phénomènes de luminescence électrolytique présentés par certaines anodes métalliques), James Lavaux. Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 4, July 28, 1919, pp. 180-182. Anodic polarization of aliminum, magnesium. zinc and bismuth.

Microphones. *See Acousticsr*

Theoretical Basis for the Construction of Microphones (Theoretische Grundlagen zur Konstruction Zweckmässiger Kikrophone), Ph. Broemser. Telegraphen-u. Fernsprech-Technik, vol. 8, no. 1, Apr. 15, 1919, pp. 6-8. Formulæ given for number of vibrations and sensitivity show that it is possible to increase number of vibrations without reducing thereby sensitivity.

Molecular Weights. An Alignment Chart for the Solution of Molecular Weight and Vapour Density Problems, Leslie J. Harris. Chem. News, vol. 119, no. 3094, Aug. 1, 1919, pp. 49-51, 1 fig. Arranged to read molecular weight of vapor density direct from weight and volume.

Optics. To the Theory of Polarization Prisms—III (Zur Theorie der Polarisationsprismen), H. Schulz. Zeitschrift f. Instrumentenkunde, vol. 39, no. 5, May 1919, pp. 154-157, 2 figs. Color dispersion.

Photography. Application of Dicyanin to the Photography of Stellar Spectra, Paul W. Merrill. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 507-536, 8 figs. Application of certain special physical and chemical properties of matter as means of quantitatively measuring radiant energy.

Radiance. Determination of Fundamental Domain of Automorphous Group (Sur la formation du domaine fondamental d'un groupe automorphe), M. G. Humbert. Comptes rendus des Séances de l'Académie des Sciences, vol. 169, no. 5, Aug. 4, 1919, pp. 205-211. Simplification of formulæ used in method of radiance.

Radio Activity. Volatility and the Active Deposit of Thorium (Volatilité du dépôt actif du thorium), T. Barratt and A. B. Wood. Radium, vol. 11, no. 7, May 1919, pp. 198-199, 2 figs. Writers conclude from experiment that products B and C cannot be separated by heating in the interval from 750 to 1200 deg. cent. Scheme illustrating transformations of thorium is suggested.

New Fluorescent Screene for Radioscopic Experiments (Sur de nouveaux écrans fluorescents pour la Radioscopie), P. Roubertie and A. Nemirovsky. Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 5, Aug. 4, 1919. pp. 233-234. Prepared without platinum, with cadmium tungstate.

The Radio Activity of Rubidium (Uber die Radioaktivität des Rubidiums), Otto Hahn and Martin Rothenbach. Physikalische Zeitschrift, vol. 20, no. 9, May 1, 1919, pp. 194-202, 3 figs. Comparison of various old rubidium salts with each other; penetration of B-rays of rubidium; total activity of B-rays of rubidium as compared with those of uranium.

Structure of Matter. Collision of a-Particles with Light Atoms, E. Rutherford. Nature, vol. 103, no. 2595, July 24, 1919, pp. 415-418. Experimental proofs that ordinary law of force holds for electrified bodies at exceedingly minute distances. Discourse delivered at Royal Instn.

Emission Spectra and Atomic Structure, John William Nicholsou. Jl. Chem. Soc., vol. 115-116, no. 681, July 1919, pp. 855-864. Concerning nature of emission spectra.

The Electron Theory of Metals in the Light of Experiments,—Thermoelectric Power and Resistance of Bismuth as Function of Field (Un confronto fra la teoria elettronica dei metalli e l'esperienza. La relazione fra potere termoelettrico e resistenza del bismuto, come funzioni del campo), M. La Rosa. Il Nuovo Cimento, vol. 18, no. 2, July 1919, pp. 39-55. Technical interpretation of experimental results reported in Il Nuovo Cimento, vol. 18, no. 7, July 1919, pp. 26-28.

Spectrum Analysis. Abnormal Birefringence of Torbenite, N. L. Bowen. Am. Jl. of Sci., vol. 48, no. 285, Sept. 1919, pp. 195-198, 2 figs. It was found that mineral was positive for red end of spectrum, negative for blue end and isotropic in green at about 515 u u.

The X-Ray Spectra of the Elements (Sur les Spectres de rayons X des Sciences, vol. 169, no. 3, July 21, 1919, 1919, pp. 134-136. Measurements of spectrum K of rhodium and absorption spectrum L of radium.

The Quantitative Spectra of Lithium, Rubidium, Caesium, and Gold, A. G. G. Leonard and P. Whelan. Scientific Proc. Roy. Dublin Soc., vol. 15, no. 25, Feb. 1918, pp. 274-278, 1 fig. on supplement plate. Experimental work done with view to facilitating use of spectrograph. Result of experiments.

Measurements of Wave Lengths in the Spectrum of Neon, Keivin Bums, W. F. Meggers, and Paul W. Merrill. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 765-775. Measurements made with interferometer of 55 lines in region 3369A to 8495A.

Measurements on the Index of Refraction of Air for Wave Lengths from 2218 A to 900 A, W. F. Meggers and C. G. Peters. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 697-740, 7 figs. By means of Fabry and Perot interferometer. Sections of circular fringes, produced by various radiations from a source of light illuminating parallel plates of interferometer, were photographed either with a grating or a rock-salt prism spectrograph, first when space between plates was evacuated and then when dry air at measured temperature and pressure was present.

Wave Lengths in the Red and Infra-Red Spectra of Iron, Cobalt, and Nickel Ares, W. F. Meggers and C. C. Kiess. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 637-651. Application of photographic sensitometry of investigations of standard wave lengths and spectrum analysis. Measured lengths are presented in tables.

Spectroradiometric Investigation of the Transmission of Various Substances, W. W. Coblentz, W. B. Emerson, and M. B. Long. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 653-676, 20 figs. Especially colored fluorite, light filters, and colored glasses.

The L-Series in the Tungsten X-Ray Spectrum, Oswald B. Overn. Phys. Rev., vol. 14, no. 2, Aug. 1919, pp. 137-142, 4 figs. Dershem's results said to have been verified for most part within 1.10 per cent, six new lines reported discovered and two groups of lines suggested.

Spectral Energy Distribution in the Acetylene Flame, W. W. Coblentz. Jl. Franklin Inst., vol. 188, no 3, Sept. 1919, pp. 399-401, Table giving spectral energy transmission of cylindrical acetylene flame, both from observation and computation with Wien's equations.

The Series Spectrum of Helium (Das Serienspektrum des Heliums), A. Lande. Physikalische Zeitschrift, vol. 20, no. 10, May 15, 1919, pp. 228-234, 3 figs. Calculation of eccentric ring displacement *d* in field of valence electron.

The Flash Spectrum, S. A. Mitchell. Proc. Am. Philosophical Soc., vol. 58, no. 4, 1919, pp. 265-268. From observations of sun's eclipses. It is concluded from measurements that flash spectrum is reversal of Fraunhofer spectrum.

Temperature Distribution. Temperature Distribution in Solids during Heating or Cooling, E. D. Williamson and L. H. Adams. Phys. Rev., vol. 14, no. 2, Aug. 1919, pp. 99-114, 4 figs. Equations are derived for following shapes: Rectangular parallelopiped, long rectangular rod, thin slab, cylinder, long cylindrical rod, sphere. A method of measuring thermal diffusivity involving determination of temperature-time relation at center of symmetrical solid whose surface is heated either at uniform rate or very suddenly is outlined.

Viscosity. Viscosity, Nicolas Flamel. Sci. Am. Supp., vol. 88, no. 2278, Aug. 30, 1919, pp. 130-131, 4 figs. Methods and apparatus for estimating aud measuring it. Translated from La Nature, (Paris).

MATHEMATICS

Equations. Irregular Singularities of Lineal Differential Equations (Sur les Singularités irrégulières des équations différentielles linéaires), René Garnier. Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 5, Aug. 4, 1919, pp. 223-226. In Comptes Rendus, t. 168, 1919, p. 142 et 452, writer discussed fusion of close regular singular points and calculation by means of irregular equation of elements of invariants of monodromic group of regular equation. Present note completes producing results and gives new applications.

Harmonics. Zonal Harmonics of High Order in Terms of Bessel Functions, John R. Airey. Proc. Roy. Soc., vol. 96, no. A674, Aug. 1, 1919, pp. 1-8. From consideration of Legendre's equation.

Integration. Rieman's Method of Integration (Sur l'intégration riemanienne), M. Arnaud Denjoy. Comptes rendus des séances de l'Académie des Sciences, vol. 169, no. 5, Aug. 4, 1919, pp. 219-221. How this method leads to Lebesque's definition of the integral.

Polynomials. Euler's Polynomials (Sur les polynomes d'Euler), N.-E. Norlund. Comptes Rendus des séances de l'Académie des Sciences, vol. 169, no. 5, Aug. 4, 1919, pp. 221-223. Properties of polynomials of negative order. Additional to note by some writer in Comptes Rendus of July 28, in which he discussed properties of polynomials of positive order.

Probabilities, Theory. Note on Approximations in the Theory of Probabilities, T. J. I'a. Bromwich. Lond., Edinburgh & Dublin Phil. Mag., vol. 38, no. 224, Aug. 1919, pp. 231-235. Formula for increasing approximation in Bernoulli's theorem, beyond terms of $1/n^2$ order.

Surfaces, Theory. Memoir on the General Theory of Surfaces and Rectilinear Congruences, Gabriel M. Green. Tran. Am. Math. Soc., vol. 20, no. 2, Apr. 1919, pp. 79-153. Study of differential geometry of surfaces from projective point of view, principally with a view to determining projective substitute for normal to surface. Concept assumed as fundamental was the following: At every regular point of a curved surface there exists an osculating quadric, which is cut by the tangent plane of the surface in the asymptotic directions at the point of contact.

CHEMISTRY

Air. New Forms of Instruments for Showing the Presence and Amount of Combustible Gas in the Air, E. R. Weaver and E. E. Weibel. Dept. Commerce, Scientific Papers of Bur. of Standards, no. 334, June 23, 1919, 90 pp., 21 figs. Description of devices developed by Bur. of Standards, principles upon which they operate, results of tests showing their accuracy and reliability, and discussion of their application.

Alloys. *See Ores and Alloys.*

Ammonia Oxination. Analytical Method for Determining Efficiency of Ammonia Oxidation, D. F. Gaillard. Jl. Indus. & Eng. Chem., vol. 11, no. 8, Aug. 1, 1919, pp. 745-747, 1 fig. "Bulb" method of analysis.

Analysis. The Use of Freezing-Point Determinations in Quantitative Analysis, Charles Edward Fawsitt. Jl. Chem. Soc., vol. 115-116, no. 681, July 1919, pp. 801-808. Method of estimating ingredient in substance by finding freezing-point depression of substance in ingredient as solvent and also in some other solvent is found to be applicable only by special cases where it is possible to experiment previously with samples of substance somewhat similar to the one under investigation.

See also Air, Ammonia, Battery Acid, Foods, Gas Mixtures, Lead, Magnesium, Marbles, Ocean Currents, Ores and Alloys, Paper, Starch, Steel.

Battery Acid. Determination of Iron in Battery Acid by the Ferricthiocyanate color, Ernest Nyman. Can. Chemical Jl., vol. 3, no. 9, Sept. 1919, pp. 298-300. As to rapidity and accuracy, method was found to compare favorable to both gravimetric and volumetric permanganate methods.

Catalysis. Some Problems in Contact Catalysis, Wilder D. Bancroft. Gen. Meeting, Am. Electrochem. Soc., Paper no. 6, Sept. 23-26, 1919, pp. 41-43. Concerning reaction of phosgene with water.

On the Oxidation of Phenols by Gaseous Oxygen and the Catalytic Effect of Metals, F. W. Skirrow. Can. Chemical Jl., vol. 3, no. 9, Sept. 1919, pp. 292-294, 1 fig. Account of experiments.

Carbon Activation. The Activation of Carbon, N. K. Chaney. General Meeting of the Am. Electrochem. Soc., paper no. 13, Sept. 23-26, 1919, pp. 157-166. Discussion of general theory of nature of active carbon and its relations to generally occurring forms of carbon.

Chemical Affinity. Chemical Affinity and Atomic Valence, G. Ciamician and M. Padoa. Sci. Am. Supp., vol. 88, no. 2279, Sept. 6, 1919, pp. 154-155. Relation between chemical and thermal energy and modern views of constitution of atom. Translated from Jour. de Chim. Physique (Geneva).

Coagulation. Heat of Coagulation (Ueber Flockungswärme), H. R. Kruyt and Jac. van. der Spek. Kolloid-Zeitschrift, vol. 24, no. 5, May 1919, pp. 145-155, 2 figs. Discussion of Berthelot, Thomsen, Wiedemann and Ludeking, Graham and other methods.

Colloids. Colloidchemical Studies of Kongo Ruby (Kolloidchemische Studien am Kongorubin), Wolfgang Ostwald. Kolloidchemische Beihefte, vol. 10, nos. 6-12, 1919, pp. 179-288, 3 figs. Study on the theory of indicators and the theory of color changes in organic matter.

Enamel Ware. Acid Test on Enamel Ware, W. D. Collins. Jl. Indus. & Eng. Chem., vol. 11, no. 8, Aug. 1, 1919, pp. 757-759. Account of acid tests made on sixty-one samples of enamel ware from twenty-six different manufacturers.

Foods. The Estimation of Sulphates in a Concentrated Electrolyte and the Determination of Sulphur in Foods, Vernon K. Krieble and Autrey W. Mangum. Jl. Am. Chem. Soc., vol. 41, no. 9, Sept. 1919, pp. 1317-1328. Laboratory study of oxidation of foods by sodium peroxide and precipitation of sulphate as barium sulphate in solutions containing large amounts of sodium chloride.

Gas Mixtures. Industrial Analysis of Gas Mixtures by the Refractometric Method. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 392-393, 7 figs. How to use Lord Rayleigh's interferometer and how to interpret measurements effected with it. Translated from Chimie et Industrie, June 1919.

Glucinium, J. S. Negru. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 353-359, 1 fig. Historical account of discovery, uses, treatments of glucinium minerals for glucina, and method of effecting chemical and electrochemical separation of glucinium.

Iron Penetration by Hydrogen. The Penetration of Iron by Hydrogen, T. S. Fuller. General Meeting of the Am. Electrochem. Soc., paper no. 9, Sept. 23-25, 1919, pp. 77-93, 4 figs. Results of experiments showing effect of various conditions on penetration of iron by nascent hydrogen at temperatures from 20° to 100° cent. It was found that velocity of hydrogen penetration is greater for a unit immersed without electrical connections, in 1 per cent sulphuric acid than four units electrolyzed as cathode in like solution, with current densities up to ohe half an ampere.

Lead. Titrometric Determination of Antimony in Lead (Uber die titrimetrische Bestimung des Antimons in Hartblei), A. Wogrinz and R. Gohring. Des Metall, no. 9, May 10, 1919, pp. 117-118. Description and results of tests; analysis of weight; titration.

Magnesium. The Alkalimetric Determination of Small Amounts of Magnesium, P. L. Hibbard Jl. Indus. & Eng. Chem., vol. 11, no. 8, Aug. 1, 1919, pp. 753-754. Suggests changes in Bruckmiller's method for determining magnesium by titration of ammonum magnesium phosphate.

MARBLES. Physical and Chemical Tests on the Commercial Marbles of the United States, D. W. Kessler. Techn. Papers Bur. Stand., no. 123, July 15, 1919, 54 pp., 8 figs. Chemical analyses made on 42 samples for purpose of classification and determination of harmful elements. Volume resistivity determinations made on a number of samples to determine their relative value for electrical insulators and the variation of this value under different conditions of moisture. Carbonic-acid tests also included.

OCEAN CURRENTS. Detecting Ocean Currents by Observing Their Hydrogen-ion Concentration, Alfred Goldsborough Mayor. Proc. Am. Philosophical Soc., vol. 58, no. 2, 1919, pp. 150-160, 1 fig. Observations are said to have established that easterly moving water in Tropical Pacific is commonly less alkaline tban that of general region in which it occurs. Having this and similar established conditions writer suggests detection of currents by testing sea water with a few drops of red dye thymolsulphonephthalein.

ORES AND ALLOYS. A Rapid Method for Determining Nickel and Cobalt in Ores and Alloys—III, W. R. Schoeller and A. R. Powell. Analyst, vol. 44, no. 521, Aug. 1919, pp. 275-280. Application of iodide process to certain ores and alloys.

PAPER. *See Starch.*

PHENOL OXIDATION. *See Catalysis.*

PIEZOCHEMISTRY. Piezochemical Studies; experimental test of Braun's Law—XV (Piezochemische Studien. Experimentelle Prufung des Braunschen Gesetzes), Ernst Cohen and A. L. Th. Moesveld. Zeitschrift für physikalische Chemie, vol. 93, no. 4, 1919, pp. 385-515, 8 figs. Investigations included determination of temperature coefficient of solubility, pressure coefficient of solubility, hypothetical change of volume and hypothetical temperature of solubility.

SOLUTIONS. The Freezing Point of Solutions, with Special Reference to Solutions containing Several Solutes, Charles Edward Fawsitt. Jl. Chem. Soc., vol. 115-116, no. 681, July 1919, pp. 790-801. Writer believes as result of calculations and observations that in freezing-point determinations, there may with advantage be substituted for W, weight of solvent, expression $W = bw$ where w is weight of solute and b is constant which depends both on solute and solvent, and is determinable by experiment.

The Determination of the Rate of o ution of Atmospheric Nitrogen and Oxygen by Water—I, W. E. Adeney and H. G. Becker. Scientific Proc. Roy. Dublin Soc., vol. 15, no. 31, Aug. 1918, pp. 385-404, 9 figs., partly on supplement plates. Experiments conducted by studying influence of thickness of layer of de-aerated water upon rate at which it becomes re-aerated with view to obtaining data by means of which factor of depth of water could be eliminated, when considering question of rate of solution by surface layer of water.

Study of Solutions. (Etudes sur les solutions), A. Reychler. Jl. de Chimie Physique, vol. 17, no. 2, June 30, 1919, pp. 209-265, 5 figs. Technical notes on Perrin's constants, osmotic pressure, vapor tension, cryoscopy and dissociation of dissolved electrolytes.

Complete Review regarding Solutions of Oceanic Salts—I (Vollständige Uebersicht uber die Lösungen ozeanischer Salze), E. Jänecke. Kali, vol. 13, no. 10, May 15, 1919, pp. 161-164, 6 figs. Extract of series of articles published by author in "Zeitschrift fur anorganische Chemie." Studies of oceanic salt deposits. Graphs.

STARCH. The Quantitative Estimation of Starch in Paper, V. Voorhees and Oliver Mamm. Paper, vol. 24, no. 25, Aug. 27, 1919, pp. 15-19. Account of investigations. Suggested experimental procedure.

STEEL. An Electrolytic Resistance Method for Determining Carbon in Steel, J. R. Cain and L. C. Maxwell. Jl. Indus. & Eng. Chem., vol. 11, no. 9, Sept. 1919, pp. 852-860, 6 figs. Method for determining carbon dioxide by absorbing it in barium hydroxide solution and measuring resistance change of solution in relation to its concentration. Absorption vessel with electrolytic resistance cell incorporated is illustrated and described.

STRUCTURE OF MATTER. The Positions of Atoms in Metals, A. W. Hull. Proc. Am. Inst. Elec. Engrs., vol. 38, no. 10, Oct. 1919, pp. 1171-1192, 16 figs. Photographic patterns of concentric circles assumed by particles of metal when X-Ray beam passes through fine powder of it are presented and discussed.

See also Physics (Structure of Matter).

TIN. The Analysis of Alloys of Tin, Archibald Craig. Jl. Indus. & Eng. Chem., vol. 11, no. 8, Aug. 1, 1919, pp. 750-753. Discussion of conditions of greatest accuracy of gravimetric method, based on nitric acid separation.

INDUSTRIAL TECHNOLOGY

ALCOHOL. Alcohol from Sulphibe Waste Liquor, Ralph H. McKee, Paper, vol. 24, no. 15, June 18, 1919, pp. 34 and 36. Results of experiments at Columbia Univ. Paper read before Technical Assn. of Pulp & Paper Indus.

ALKALI. Conditions of British Alkali Works, Chem. Age, vol. 1, no. 7, Aug. 2, 1919, pp. 189-190. Annual report of chief inspector. Also in Chem. Age, vol. 1, no. 8, Aug. 9, 1919, pp. 218-220.

AMMONIA. The Yield of Ammonia in the Distillation of Coal, Friedrich Sommer. Gas World, vol. 71, no. 1828, Aug. 2, 1919, pp. 20-21. Writer claims that a method of determining nitrogen, in which coal is burned in intimate contact with copper oxide, gives excellent results with organic compounds of known composition and with coals. From Stahl and Eisen.

Ammonia in Producer Gas, F. K. Ovitz. Chem. Engr., vol. 27, no. 9, Sept. 1919, pp. 239, 241. Tests made to determine amount of ammonia in gas from producer of Smith type.

Direct and Indirect Ammonia Recovery, Thomas B. Smith. Chem. Engr., vol. 27, no. 9, Sept. 1919, pp. 219-221. Fact of these two methods of ammonia recovered upon by-products of coking process.

CATALYSIS. Recent Developments in Industrial Catalysis, Hugh S. Taylor. Chem. Age, vol. 1, nos. 7 and 8, Aug. 2 and 9, 1919, pp. 186-188 and 212-214. Aug. 2: Effect of promoters. Promoters are agents which, wben added to catalysis, produces large increase in catalytic acceleration. Aug. 9: Attempts to synthesize alcohol from acetylene; alcohol from wood waste.

See also Hydrogen Cyanide.

CHARCOAL. Gas Works Carbonize Cbarcoal for Gas Masks, W. E. Brophy. Gas Age., vol. 44, no. 5, Sept. 1, 1919, pp. 189-192, 5 figs. Illustrating flow sbeet Age, vol. 44, no. 5, Sept. 1, 1919, pp. 189-192. 5 figs. Illustrating flow sheet of charcoal process and materials, and arrangement of carbonizing units.

COLOGNE. Some Chemical Plants in the Cologne Area—II, A. J. Allmand and E. R. Williams. Jl. Soc. Chem. Indus., vol. 38, no. 16, Aug. 30, 1919, pp. 303R-304R. Aluminum and zinc plants of Elektrometallurgische Weke, at Horrem.

COTTRELL PROCESS. Application of the Cottrell Process to the Recovery of Fume from Silver Refining Operations, W. G. Smith and A. A. Heimrod. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 360-363, 3 figs. Construction of header chambers, electrode tubes and electrode system, how operation control of recently installed fume precipitator at works of U. S. Metals Refining Co., at Cbrome, N. J.

DYES. Tungsten and Molybdenum Dyes (Wolfram-und Molybdänfarben), Th. Hertwig. Sprechsaal, vol. 52, no. 24, June 12, 1919, pp. 199-200. Formulae for making orange and red ceramic colors.

HYDROGEN CYANIDE. The Catalytic Reduction of Hydrogen Cyanide, Sydney Barratt and Alan Francis Titley. Jl. Chem. Soc., vols. 115 & 116, no. 682, Aug. 1919, pp. 902-907, 1 fig. Experiments claimed to have shown that platinum catalyses reduction of bydrogen cyanide by gaseous hydrogen above 120 deg. cent. and readily above 180 deg. cent.

LIQUID AIR. Liquid Air and Oxygen in Industry. Engineering Review, vol. 33, no. 2, Aug. 15, 1919, pp. 35-37, 5 figs. Describing properties and manufacture of liquid oxygen indicating purpose to which it bas been put, and some of directions in whicb writer believes it will probably develop.

LIXIVIATION. Continuous Lixiviation in a Counter Current (Kontinuierliches Laugen im Gegenstrom), H. Bueler de Florin, Metall und Erz, vol. 7, no. 7, Apr. 8, 1919, pp. 141-147, 6 figs. Ore extraction apparatus without and witb filter; cascade apparatus with filter; box extractor without filter.

NITRE-CAKE. Utilization of Nitre-Cake, Gilbert T. Morgan. Economic Proc. Roy. Dublin Soc., vol. 2, no. 13, Marcb 1917, pp. 238-247, 1 fig. on supplement plate. Experiments described as having shown that niter-cake can be converted into soda-lime or soda-lead glass witb recovery of not less tban two-thirds of contained sulphur.

NITROGENOUS COMPOUNDS. The Production of Nitrogenous Compounds Synthetically in the United States and Germany. Robert E. McConnell. Jl. Indus. & Eng. Chem., vol. 11, no. 9, Sept. 1919, pp. 837-841, 5 figs. With forecast of military and naval methods of conditions which may prevail five to fifteen years in the future and suggestions to provide means to contend with such conditions.

Effect of Partial Vacuum on the Manufacture of Nitrogen Oxide by Means of the Electric Arc. (Action de la dépression sur la formation de l'oxyde d'azote ay moyen de l'arc électrique), E. Brinner and Ph. Naville. Jl. de Chimie Physique, vol. 17, no. 2, June 30, 1919, pp. 329-363, 5 figs. Although mixture of hydrogen and nitrogen most favorable theoretically for synthesis of ammonia is one volume of nitrogen to three volumes of hydrogen, experiments have shown that best mixture in practice is five volumes of nitrogen to one of hydrogen. Article describes experiments undertaken to determine reason for this apparent anomaly.

PHOTOGRAPHIC MATERIALS. Photoelectric Sensitivity of Bismuthinite and Various Other Substances, W. W. Coblentz. Bul Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 591-604, 1 fig. Results of investigation (1) for increase in electrical conductivity caused by action of light upon substances, and (2) for photoelectrical activity when substances were charged to negative potential in evacuated chamber and exposed to light.

POISON GASES. The Manufacture of War Gases in Germany, James F. Norris. Jl. Indus. & Eng. Chem., vol. 11, no. 9, Sept 1919, pp. 817-829, 10 figs. Account of inspection trip made by representatives of American army to investigate chemical factories in occupied zones along Rhine. How various gases were prepared is indicated.

Potash Recovery at Cement Plants, Alfred W. G. Wilson. Canada Dept. Mines, Bul. no. 29, May 6, 1919, 34 pp., 10 figs., on supp. plates. Potash recovery, fuel economy, elimination of dust nuisance, reduction of power costs and more complete utilization of waste heat with consequent reduction of coal consumption are considered as closely related problems that merit careful study. Also in Jl. Soc. Chem. Indus., vol. 38, no. 15, Aug. 15, 1919, pp. 314T-318T.

The Potash Industry of the United States and its Possibilities for future Production, Arthur E. Wells. Bur. Mines, Minerals Investigation, Preliminary Report, Aug. 1919, 20 pp. Potasb from saline lakes; as by-product from cement kilns and blast furnaces; potash from silicate rocks; potash from alunite, from organic sources otber tban kelp and potash from kelp. Brief outline of commercial possibilities.

The Potash Industry. U. S. Tariff Commission, Washington, 1919, 52 pp. Prepared for use of Committee on Ways and Means, House of Representatives

Potash from Kelp: The Experimental Plant of the United States Department of Agriculture. Preliminary Paper, J. W. Turrentine and Paul S. Shoaff. Jl. Indus. & Eng. Chem., vol. 11, no. 9, Sept. 1919, pp. 864-874, 6 figs. One hundred tons of raw kelp per day are subjected to process involving drying, destructive distillation, lixiviation, evaporation, and fractional crystallization. It is confidently believed that by-products, kelp oils, creosote, pitch ammonia, bleaching carbons, salt and iodine, will be made to yield sufficient revenue to enable potash salts to be marked successfully in competition with potasb from foreign sources.

From the Laboratory Practice of a Potash Chemist—I (Aus der Laboratoriumspraxis das Kalichemikers), H. Bokemüller. Kali, vol. 13, no. 8, Apr. 15. 1919, pp. 123-130. Data collected in practice extending over period of 32 years, Tables.

Non-German Sources of Potash, Arthur Holmes, Geol. Mag., vol. 6, no. 8, Aug. 1919, pp. 340-350, 1 fig. Abyssinian deposits; composition of American potash brine.

The Alsatian Potash Industry, Frank K. Cameron. Chem. Engr., vol. 27, no. 9, Sept. 1919, pp. 209-213. Part writer considers deposits and mines of Alsace will play in world market.

Potash Deposits of Alsace (Le champ de potasse d'Alsace), Aimé Witz. Revue Générale des Sciences, vol. 30, nos. 15-16, Aug. 15-30, 1919, pp. 477-488, 1 fig. Geological description and discussion of economical and financial features of their exploitation.

PULP. Manufacturing Paper Pulp from Sawdust. Paper, vol. 24, no. 26, Sept. 3, 1919, pp. 19-20, 1 fig. Specifications of Dutch process. From Paper Making (London.)

Pulp Discoloration, C. L. Bachelder. Paper, vol. 24, no. 25, Aug. 27, 1919, pp. 20-21, 1 fig. Effect of sixteen hours drying at various temperatures on color of different pulps. From research conducted at Forest Products Laboratory at U. S. Dept. of Agriculture.

Paper Pulp Manufacture in Australia, Gerald Lightfoot. Paper, l. vol. 24, no. 25, Aug. 27, 1919, pp. 24-26. Pulping qualities of bamboo grass. (Continuation of serial.)

The Allen-Moore Cell in the Pulp and Paper Mill, F. H. Mitchell. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 370-375, 12 figs. Summaries of operating reports.

RUBBER. Eight Years' Work on Synthetic Rubber. India Rubber Jl., vol. 58, nos. 7 and 8, Aug. 16, and 23, 1919, pp. 17-20 and 16-18. German war time uses described. (Translated from Gummi Zeitung.)

Hard Rubber Manufacture and Markets. Raw Material, vol. 1, no. 6, Aug. 1919, pp. 299-203, 7 figs. Standard market forms and products commonly manufactured.

TANNING. The Chrome Tanning Industry. Chem. Age, vol. 1, no. 6, July 26, 1919, pp. 161-164. Comparative positions of America and Great Britain.

MARINE ENGINEERING

AUXILIARY MACHINERY

GYROSTABILIZER. On Gyrostabilizer for Ships (In Japanese), N. Watanabe. Jl. Soc. Naval Architects, vol. 24, Apr. 1919.

SHIPS

AIR FLOW OVER REAR DECK. Air Flow Over Rear Deck of Battleship Pennsylvania, A. F. Zahm. Jl. Franklin Inst., vol. 188, no. 3, Sept. 1919, pp. 389-397, 11 figs. Tests made with navy model of battleship Pennsylvania, both in natural condition and with shelving deck placed above rear part, in 8 ft. x 8 ft. wind tunnel, to determine aerodynamical and structural conditions suitable for landing light airplanes upon after-deck of full-scale ship.

BARGES. Designs Modern Inland Barges. Mar. Rev., vol. 49, no. 10, Oct. 1919, pp. 461-463, 6 figs. partly on suppl plate. Details of various types of barges and towboats.

CANAL VESSELS. *See River and Canal Vessels.*

CARGO STEAMERS. *See Freight Steamship.*

CHINESE-BUILT STEAMERS. The Chinese-built Passenger and Cargo Steamers "Mylie" and "Gweneth." Shipbuilder, vol. 21, no. 109, Sept. 1919, pp. 135-138, 2 figs. Principal dimensions are, length overall, 261 ft.; length between perpendiculars, 250 ft.; breadth moulded, 40 ft.; depth moulded, 40 ft.; dead weight loaded, 3000 tons.

COMPOSITE SHIPS. Ballin Composite Ships of 4,400 Tons D. W. Mar. Eng., vol. 24, no. 10, Oct. 1919, pp. 680-684, 11 figs., partly on supp. plates. Outstanding feature of hull is steel topside construction in combination with double diagonal planking under fore and aft course of heavier outside planking.

CONCRETE SHIPS. Reinforced Concrete Barges and the Navigation on the Seine during Hostilities (Les chalands en ciment armé et la navigation sur la Seine pendant les hostilités), Ch. Lavaud. Mémoires et Compte Rendu des travaux de la Société des Ingénieurs Civils de France, vol. 72, nos. 4, 5 & 6, Apr.-June 1919, pp. 163-178. From technical considerations as well as statistics of operation it is concluded that industrial value of reinforced-concrete barges has been sufficiently established.

Precast Members Used for British Concrete Barges. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 507-508, 7 figs. Details of members of precasting concrete bridges of 1,000-ton capacity.

DESIGN. Point of Gravity in Ship Construction (Schwerpunktslagen), Wilhelm Schmidt. Schiffbau, vol. 20, no. 15, May 14, 1919, pp. 389-393, 6 figs. Describes simple method for determining point of gravity of area, outlines of which correspond to parabola or m-th degree.

See also Air Flow.

New Data on Ship Stresses. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 550-553, 10 figs. Results of strainograph measurements on ships at sea and during launching. Strainograph registers changes in gage length by drawing curve on moving strip of paper.

The Resistance of Ships (In Japanese), N. Yokota. Jl. Soc. Naval Architects, vol. 24, Apr. 1919.

Resistance Tests of Keels Used in Mercantile Vessels. (Essais de résistance des carènes appliqués à des navires de commerce), Ch. Doyere. Bulletin Technique du Bureau Veritas, vol. 1, nos. 2 and 3, July-Aug. 1919, pp. 19-24 and pp. 35-43, 12 figs. Precautions to be taken and reservations to be introduced in interpreting experiments conducted with models. Tests at Grenelle basin discussed and interpreted.

EXTENSOMETER RECORDING. A Recording Extensometer and the Measured Stresses in a Concrete Hull, Franklin R. McMillan. Eng. & Contracting, vol. 52, no. 13, Sept. 24, 1919, pp. 360-362, 10 figs. Strainograph used for measuring stresses in vessel during launching and under actual conditions of service. From paper presented at annual meeting of Am. Concrete Inst.

FREIGHT STEAMSHIP. A Modern Steel Freight Steamship, D. D. Thomas. Int. Mar. Eng., vol. 24, no. 9, Sept. 1919, pp. 592-600, 20 figs. partly on two supplement plates. Factors determining size of vessel and type of propelling machinery; details of 8800 deadweight ton, turbine-driven ship.

Italian Geared Turbine Cargo Steamers, C. E. Spinnler. Pac. Mar. Rev., vol. 16, no. 9, Sept. 1919, pp. 77-82, 13 figs. Details of Franco Tosi turbine installation on 8000-ton cargo steamers.

Skinner & Eddy's 10,400 Ton Freighters. Pac. Mar. Rev., vol. 16, no. 9, Sept. 1919, pp. 97-98, 3 figs. partly on supplement plate. Length overall, 439 ft. 9½ in.; breadth molded, 55 ft.; depth molded to shelter deck, 36 ft.; designed load draft, 26 ft. 6 in.

RIVER AND CANAL VESSELS. Large Program of River and Canal Vessel Construction now under Way. Mar. Eng., vol. 24, no. 10, Oct. 1919, pp. 671-678, 10 figs. Types under construction for Railroad Administration for New York barge canal, Mississippi and Warrior River.

ROLLING OF SHIPS. Experiments on the Rolling of Ships (In Japanese), H. Suyehiro. Jl. Soc. Naval Architects, vol. 24, Apr. 1919.

RUDDERS, KITCHEN, REVERSIBLE. Proposed Method of Maneuvering Vessels. Motorship, vol. 4, no. 10, Oct. 1919, p. 42, 14 figs. "Kitchen" reversible rudders. It consists of two curved deflectors formed of parts of circular cylinder, partly enclosing propeller; by suitable mechanism deflectors are made to turn together in same direction or equally in opposite directions.

TRAWLER AND DRIFTER COMBINED. A Combined Trawler and Drifter. Shipbuilding & Shipping Rec., vol. 14, no. 9, Aug. 28, 1919, pp. 237-239, 7 figs. Principal dimensions are: Length between perpendiculars, 85 ft.; breadth, 19 ft.; depth, molded, 10 ft. 3 in.

Drifters and Trawlers. Mar. Eng., vol. 24, no. 10, Oct. 1919, pp. 665-669, 6 figs. British drifters, for Canadian company, built of wood with length of 84 ft. and breadth of 19¼ ft.

TERMINALS

DRYDOCK, FLOATING. Twenty-Thousand-Ton Floating Dry Dock. Mar. Eng., vol. 24, no. 10, Oct. 1919, pp. 661-665, 7 figs. Put in operation by Bethlehem Shipbuilding Corporation. Dock is of pontoon type, making use of individual wooden pontoons and continuous side wings of steel.

SEATTLE. World's Largest Pier for Seattle, G. F. Nicholson. Freight Handling & Terminal Eng., vol. 5, no. 8, Aug. 1919, pp. 291-292. Length, 2560 ft.; width, 365 ft. Type of construction and mechanical handling equipment.

YARDS

BARGE REPAIRS. Repairing in Four Weeks a 500-Ton Reinforced Concrete Barge, which fell, when being launched, from a Height of Six Feet (Réparation en quatre semaines d'un bateau en ciment armé de 500 tonnes, tombé, au lancement, d'une hauteur de 6 pieds), Ch. Lavaud. Mémoires et compte rendu des travaux de la Société des Ingénieurs Civils de France, vol. 72, nos. 4, 5 & 6, Apr.-June 1919, pp. 179-182. Rigidity of reinforced-concrete construction evidenced by fact that straight lines of vessel in question were not deformed.

BETHLEHEM. Ocean-Going Tugs Built at the Moore Plant of the Bethlehem Shipbuilding Corporation, Ltd. Int. Mar. Eng., vol. 24, no. 9, Sept. 1919, pp. 587-591, 6 figs. Tugs are 150 ft. long overall, 141 ft. 3½ in. between perpendiculars, 27 ft. 6 in. molded beam, and 16 ft. 8 in. molded depth at lowest point of sheer.

CLYDE. Development of a Clyde Shipyard. Shipbuilding & Shipping Rec., vol. 14, no. 8, Aug. 21, 1919, pp. 209-211, 3 figs. Plans involving laying-out of six building berths, four of which will be able to accommodate vessels of about 650 ft. in length, and the remaining two will be made suitable for dealing with ships over 750-ft. long.

KIEL. Second 40,000 Ton Floating Dock at the Imperial Ship Yards at Kiel (Zweites 40,000 Tonnen-Schwimmdock der Reichswerft in Kiel), B. Meyer. Sshiffbau, vol. 20, no. 17, June 11, 1919, pp. 451-458, 13 figs., partly on supp. plate. Total length of dock is 220 m. length of each pontoon 36 m; width 47 m; lifting time for maximum load 2 hours; lowering time 1 hour.

MALCOLM PNEUMATIC TOOLS. A New Adjunct to Pneumatic and Electric Hand-Tools in Shipbuilding. Shipbuilder, vol. 21, no. 108, Aug. 1919, pp. 77-78, 2 figs. Malcolm arrangement for suspension of pneumatic or other portable tools when being used on perpendicular surfaces.

MOBILE. Great Shipbuilding Plant at Mobile, Subsidiary of United States Steel Corporation. Manufacturers Rec., vol. 76, no. 10, Sept. 4, 1919, pp. 115-120, 13 figs. Noting type of town building for white and colored employees.

ROUMANIAN SHIPYARDS. The German-Roumanian Shipyards at Giurgui (Der deutsch-rumanische Werftbau Giurgui), E. Foerster. Zeitschrf. des Vereins deutscher Ingenieure, vol. 63, nos. 23 and 24, June 7 and 14, 1919, pp. 525-531 and 557-561, 39 figs. Details as to economical and technical aspects, size and design of yards; housing of workmen.

STATEN ISLAND SHIPYARD. Staten Island Shipyard Greatly Enlarged to Meet Demands for War Work. Int. Mar. Eng., vol. 24, no. 9, Sept. 1919, pp. 608-617, 17 figs. Addition to concrete ways, 400 ft. by 60 ft. to care for construction of ships of 10,000-tons displacement. Arrangement of space beneath ways for rivet storage. Pneumatic tool storage. Riggers loft and offices for foreman, quoted as unique feature.

William Gray & Co. Shipyard. The War Shipyard of Messrs. William Gray & Co. (1918), Ltd. Shipbuilder, vol. 21, no. 108, Aug. 1919, pp. 79-94, 21 figs., partly on supplement plates. It consists of four building berths, each capable of accommodating a vessel of about 440-ft. long, with necessary shops and fitting-out quay.

VARIA

Crankshaft Repairs at Sea. An Extensive Repair Job at Sea, H. W. Sebreck. Motorship, vol. 4, no. 9, Sept. 1919, p. 42, 4 figs. Temporary repair of crankshaft in single screw motorship "Lidvard" (formerly "Pangan") now belonging to Norwegian Government. Translated from Skibsbygning.

Fueling at Sea. Fueling at Sea, H. C. Dinger. U. S. Naval Inst. Proc., vol. 45, no. 199, Sept. 1919, pp. 1607-1612, 4 figs. Instructions prepared on occasion of oiling destroyers at sea. Destroyers were taken in tow abreast by collier and maintained in that position while oiling.

Navigation. Selection of Terrestrial Points of Reference in Coastal Navigation. (Sul punto rilevato), A. Iachino. Rivista Marittima, vol. 52, no. 7, July 31, 1919, pp. 7-27, 11 figs. Concerning probable error resulting from relative position of points selected and ratio of their distances to ship.

Towing Experiments. New Formula for Towing Experiments (Eine neue Formel für Schleppversuche), Bruckhoff. Schiffbau, vol. 20, no. 16, May 28, 1919, pp. 419-423. Although writer thinks that the opinion may be expressed that by the new formula EPS values are apparently too small, it is exactly the small "effective power" between the EPS calculated by this formula and the IPS which will help to solve the problem of actual efficiency of propeller.

MECHANICAL ENGINEERING

AIR MACHINERY

Air-Operated Tools. The Use of Compressed Air in Modern Industry, A. W. Swan. Can. Machy., vol. 22, no. 10, Sept. 4, 1919, pp. 253-255, 8 figs. Study on use of air operated tools in mining, contracting, foundry, shipbuilding and machine shop.

Centrifugal Compressors. Centrifugal Compressors (Das allgemeine Verhalten der Kreiselverdichter), Gustav Fluegel. Zeitschrift des Vereins deutscher Ingenieure, vol. 63, no. 20, May 17, 1919, pp. 455-460, 5 figs. Basic characteristics of centrifugal compressors both with casing that has no cooling device and with cooled casing. Also translated in Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 795-799 and p. 858, 5 figs.

Pickling Machine. Compressed Air Operated Pickling Machine. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 442-443, 3 figs. Installation of Mesta pickling machine at Consolidated Expanded Metal Company utilizes compressed air to avoid installing high pressure boilers.

Reciprocating Compressors. Development of Reciprocating Air Compressors, S. T. Nelson, Eng. & Min. Jl., vol. 108, no. 13, Sept. 27, 1919, pp. 533-536, 3 figs. Machines of small capacity were formerly not expected to be efficient; change from steam to electric drive said to have resultc in mant makesbift devices.

Wind Motor. A Six-Foot Experimental Wind Motor, C. Blazdell. Model Engr. & Elecn., vol. 41, no. 955, Aug. 14, 1919, pp. 145-151, 7 figs. Constructed hy writer with intention of utilizing power to drive small dynamos. (To be continued.)

CORROSION

Copper Corrosion. Corrosion of Copper—X, XI, XII, F. Bengough and O. F. Hudson. Metal Industry, vol. 15, nos. 7, 8 and 9, Aug. 15, 22 and 29, 1919, pp. 125-128, 144-145 and 168-170, 4 figs. Aug. 15: Influence of deposits on corrosion of condenser tubes. Aug. 22: Action of varied diluted acid solution on copper and brass. Aug. 29: Causes of condenser tube and ferrule corrosion. (From Fourth Report of Corrosion Committee of Inst. of Metals).

Iron Corrosion. Corrosion of Iron (La corrosion del hierro, Latham Clarke. Boletin de la Sociedad de Fomento Fabril, vol. 36, no. 6, June 1919, pp. 370-374. Suggestions in regard to applying paint as a protection.

Pipe Corrosion. Tests on Deoxidation of Hot Water during the Past Year, F. N. Speller. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 2, April 1919, pp. 141-144. Irene Kaufman Settlement pipe corrosion tests conducted at Pittsburg Testing Laboratory.

Selective Corrosion. Selective Corrosion (Die selektiven Korrosionen), F. V. Wurstemberger. Schweizerische Bauzeitung, vol. 74, no. 8, Aug. 23, 1919, pp. 91-94. Causes of development and means for its prevention.

FORGING

Drop Forging. Drop-Stamping, Drop-Forgings, etc.—VII, Joseph Horner. Mech. World, vol. 66, no. 1702, Aug. 15, 1919, p. 79, 10 figs. Examples of provision of gutters for reception of fin.

FOUNDRIES

Alloy Castings. Making Alloy Castings at Cramp's. Foundry, vol. 47, no. 331, Sept. 15, 1919, pp. 641-646, 10 figs. With reference to tests made of metals used and finished products in brass, bronze and alloy foundry.

Brass Foundry. The Manufacture of Brass Products. Metal Industry, vol. 15, no. 9, Aug. 29, 1919, pp. 166-167, 2 figs. Notes on development of brass industry in Great Britain.

Bronze Foundry. Bronze Foundry (La fonderie de bronze), Alex. Legrabd. Fonderie Moderne, vol. 12, no. 3, March 1919, pp. 62-65, 1 fig. Description of a crucible furnace. Suggested remedies against separation of elements in copper-tin alloys.

Castings. On Modern Casting (in Japanese), Nazaro Okajima. Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 58, July 1919.

Notes on Casting (in Japanese), Ninshiro Hayashida. Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 58, July 1919.

Relation between Structure and Strength of Casting (in Japanese), Kuniichi Tawara. Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 58, July 1919.

Centrifugal Casting. Notes on Permanent Moulds and Centrifugal Castings, J. E. Hurst. Foundry Trade Jl., vol. 21, no. 12, Aug. 1919, pp. 558-562 and discussion, pp. 562-563, 4 figs. Principally how to overcome cracking and distortion of cast iron dies. Paper presented before Conference of British Foundrymen's Assn.

Condenser Castings. Making and Casting Cylindrical Condensers—II, III, Ben Shaw. Mech. World, vol. 66, no. 1702 and 1704, Aug. 15 and 29, 1919, p. 78 and 103-104, 5 figs. Aug. 15: Preparing boards so that they can be swept in sections. Aug. 29: Preparation of loam pattern for head.

Core Box. Core Box Construction—I, Joseph Horner. Foundry Trade Jl., vol. 21, no. 212, Aug. 1919, pp. 568-572, 18 figs. Illustrating various types of construction.

Crucibles. The Manufacture and Handling of Crucibles, Jonathan Bartley. Metal Indus., vol. 17, no. 9, Sept. 1919, pp. 414-416, 3 figs. Causes of their failure in metal melting practice.

Drying Chambers. Economical Utilization of Fuels in Drying Chambers of Foundry (Zur Frage der wirtschaftlichen Ausnutzung der Brennstoffe in Giessereitrocknungsanlagen), Wolfgang Mann. Giesserei-Zeitung, vol. 16, no. 7, Apr. 1, 1919, pp. 97-100, 7 figs. Drying chambers with overhead furnace; temperature curves; new drying method of molding sand. (Concluded).

Duplexing Process. New Duplexing Process is Invented, H. E. Diller. Foundry, vol. 47, no. 331, Sept. 15, 1919, pp. 662-665, 9 figs. High-carbon steel is melted in electric furnace and transferred to converter to be finished. Good grade of metal said to be obtained at low cost in this way.

Dust. How to Reduce Dust in Foundries (Die Mittel zur Verminderung des Staubes in Giessereien). Metall-Technik, vol. 45, nos. 19-20, May 17, 1919, pp. 73-74. Describes types suited for various conditions.

Electric Steel Foundry. Experiences in Elec. Steel Foundry Elec. World, vol. 74, no. 12, Sept. 20, 1919, pp. 630-634, 3 figs. Data on steel furnace performance, together with results obtained with electric core baking.

Electrically-Melted Steel Castings, John A. Holden. Foundry Trade Jl., vol. 21, no. 212, Aug. 1919, pp. 584-585. Illustrating with microphotographs coarse structure of badly annealed slowly-cooled casting, and of same steel completely annealed and cooled in current of air.

Examination of Castings. Experimental Examinations of Cast-Iron Castings (in Japanese), Kansei Ono. Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 58, July 1919.

Foundry Management. Hoosier Foundry Seeks Difficulties, D. M. Avey. Foundry, vol. 47, no. 328, Aug. 1, 1919, pp. 505-509, 9 figs. Iron Trade Rev., vol. 65, no. 11, Sept. 11, 1919, pp. 701-705, 9 figs. How Electric Steel Co. of Indiana conducts study of processes for which casting is intended and the properties desired in part to be made before production is attempted.

A Study of Improved Methods in an Iron Foundry, C. S. Myers. Foundry Trade Jl., vol. 21, no. 212, Aug. 1919, pp. 578-580. Movement study, training and instance in which organization material, combined with specially advised system of payment are said to have effected considerable increase of output with reduced hours of work.

Improved Methods in a Foundry. Metal Industry, vol. 15, no. 9, Aug. 29. 1919, pp. 161-162. Quoting instance in which movement study, training and organization of material, combined with specially devised system of payment, it is said, effected considerable increase of output with reduced hours of work.

Production Cost and Profit Control in Non-Ferrous Foundries, Walter Glen Scott. Metal Indus., vol. 17, no. 9, Sept. 1919, pp. 417-420, 1 fig. Method for keeping in touch with cost of a product at any stage of its manufacture.

Making Foundry more Attractive, F. H. Bell. Can. Machy., vol. 22, no. 5, July 31, 1919, pp. 98-100, 7 figs. Emphasizes that better and more wholesome shop and working conditions would do much to make foundry a more attractive place in which to work.

Metal Molds. Using Metal Denseners and Molds, E. B. Brougball. Foundry, vol. 47, no. 328, Aug. 1, 1919, pp. 514-518, 7 figs. Sponginess in connecting sections between thin and thick casting parts, it is stated, may be remedied hy metal denseners properly used. Permanent metal molds are recommended. From paper presented before Birmingham branch of British Foundrymen's Assn. and Staffordshire Iron & Steel Inst.

Model Foundry. Government Builds Model Foundry. Foundry, vol. 47, no. 331, Sept. 15, 1919, pp. 651-653, 7 figs. For making gray-iron and steel castings for the Navy. Plant represents investment of $1,500,000 in building alone.

Molding Machines. Pointers on Molding Car Couplers. Foundry, vol. 47, no. 328, Aug. 1, 1919, pp. 499-504, 11 figs. How molding machines are rigged. System for handling molds.

Special Rig for Continuous Foundry. Foundry, vol. 47, no. 331, Sept. 15, 1919, pp. 654-658, 8 figs. Four machines make molds with green-sand cores for tractor transmission housings; floor space saved hy pouring as soon as molds are finished and shaking out while hot.

Molding Sand. A comparison of British and American Molding-Sand Practice, P. G. H. Boswell. Foundry Trade Jl., vol. 21, no. 212, Aug. 1919, pp. 552-556 and discussion, pp. 556-557. Including table giving advantages and disadvantages of artificial and natural bonds in molding sands. Paper presented at Conference of British Foundrymen's Assn.

Pattern Plates. Pattern Plates for the Production of Light Castings, H. Sherburn. Foundry Trade, Jl., vol. 21, no. 212, Aug. 1919, pp. 564-566 and discussion, 566-567. Advises that range of uses of boxes to he operated be kept down to lowest possible figure. Paper read before Conference of British Foundrymen's Assn.

PATTERNS. Patternmaking Methods—II. Machy. (Lond.), vol. 14, no. 380, Aug. 21, 1919, pp. 620-622, 9 figs. Typical examples of pattern work and methods used in general patternmaking practice.

Cylinder Patterns—I, Jos. A. Shelly. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 67-70, 9 figs. Methods of laying out and constructing patterns and core boxes for pump cylinders.

Making the Pattern for a Four-Bladed Propeller, J. A. McEwan. Can. Foundryman, vol. 10, no. 9, Sept. 1919, pp. 250-251, 9 figs. Illustrating manner of preceeding.

PLATE CASTING. A Plate Problem, G. C. Swift. Foundry Trade Jl., vol. 21, no. 211, July 1919, pp. 463-470, 15 figs. Casting oblong plate 37 in. long, 16½ in. wide and 1/16 in. thick. Composition of alloy was 67 parts copper, 11 parts zinc, 1¼ parts tin and ¾ part lead.

POURING DEVICE. Labor is Saved by Pouring Device. Foundry, vol. 47, no. 328, Aug. 1, 1919, pp. 519-520, 3 figs. Iron Trade Rev., vol. 65, no. 10, Sept. 4, 1919, pp 637-638, 2 figs. Device consists of cylindrical ladle mounted on trunnions in such a way that iron may be discharged through nozzles which become submerged when ladle is rotated.

SHIP CASTINGS. Castings for Ship Construction—VII and X, Ben Shaw and James Edgar. Foundry, vol. 47, no. 328 and 331, Aug. 1 and Sept. 15, 1919, pp. 523-527 and 647-650, 50 figs. Aug. 1: Laying out and building patterns for propeller brackets. Sept. 15: Methods for molding and casting large propeller brackets, together with necessary precautions as to drawbacks and shrinkage. Also in Foundry Trade Jl., vol. 21, no. 211, July 1919, pp. 471-476, 30 figs.

SHRINKAGE. Shrinkage of Castings (Du retrait des pièces à la fonte), J. Duponchelle. Fonderie Moderne, vol. 12, no. 3, March 1919, pp. 50-54, 6 figs. Table is presented giving shrinking in length, in surveys and in volume of various metals and alloys used in foundries.

THIN METAL SECTIONS. How Water Shut-Off Boxes are Made. Foundry, vol. 47, no. 328, Aug. 1, 1919, pp. 494-498, 6 figs. Rigging required by reason of thin metal sections.

TURBINE, WATER WHEEL. Molding and Casting a Turbine Water Wheel, F. H. Bell. Can. Foundryman, vol. 10, no. 9, Sept. 1919, pp. 242-243. Noting order in which different parts are placed when ramming up mold.

FUELS AND FIRING

ALCOHOL. Alcohol as Fuel. South African Eng., vol. 30, no. 7, July 1919, pp. 119-120, South Africa as a possible exporter.

BLUE WATER GAS. Blue Water Gas as a Metallurgical Fuel, A. E. Blake. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 443-444. Approximate cost of twin blue water-gas sets with daily capacity of twenty-five million cubic feet. Cost of blue water-gas vs. producer gas per million Btu.

COKE. Coke for the Annular Furnace (Nochmals Koks für den Ringofen), Dr. Loeser. Ziegelwelt, vol. 50, nos. 31-32, 33-34 and 35-36. Apr. 26, May 3 and 10, 1919, pp. 178-181, 192-194 and 205-206. Writer comes to conclusion that coke cannot be recommended as sole fuel, neither in connection with bituminous coal because this latter requires mild normal draft while coke needs strong draft.

FUEL CONSERVATION. Fuel Economy in Manufacturing Works—I, Charles F. Wade Eng. & Indus. Management, vol. 2, no. 8. Aug. 21, 1919, pp. 235-236, 1 fig. General outline of causes which contribute to inefficiency.

FUEL OIL, COAL COMPETITION. The Competition of Fuel Oil with Coal. Coal Trade Jl., vol. 50, no. 37, Sept. 10, 1919, pp. 1109-1111. Analyses of threatened competition of fuel oil with coal.

FURNACE REFUSE. Loss due to Carbon in Furnace Refuse, C. H. Berry. Power, vol. 50, no. 13, Sept. 23, 1919, pp. 500-502, 2 figs. Alignment chart for computing it.

GASEOUS FUEL. The Utilization of Gaseous Fuel in Commercial Practice, F. W. Epworth.Gas World, vol. 71, no. 1827, July 26, 1919, pp. 65-67, 7 figs. Including calculated diagrams giving percentage of total heat contained in fuel product at various temperatures. Paper presented to Soc. of British Gas Industrie.

GASIFICATION OF Coal. Gasification of Coal and Economical Utilization of Fuels (Kohlenvergasung und rationelle Ausnutzung der Brennstoffe), M. Dolch. Montanistische Rundschau, vol. 11, no. 11, June 1, 1919, pp. 327-331. Economic aspects of gasification in comgination with by-product extraction. (To be continued.)

GASOLINE-KEROSENE MIXTURES. The Flash and Burning Points of Gasoline-Kerosene Mixtures, James T. Robson and James R. Withrow. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp 244-252, 7 figs. Effect of gasoline content on flash and burning points of kerosene; Foster closed cup and Cleveland type open cup methods compared; flash and burning points of kerosene mixed with "low-test" gasoline, "high-test" gasoline and "petroleum ether."

ILLINOIS COAL. Bureau Tests Illinois Coal, R. S. McBride and I. V. Brumbaugh. Gas. Rec., vol. 16, no. 4, Aug. 27, 1919, pp. 17-20, 3 figs. Bureau of Standards experimental tests of Orient coal to investigate influence of temperature on quality of coke produced.

KEROSENE. *See Gasoline-Kerosene Mixtures.*

KILNS. Abnormal Draft Conditions in Porcelain Kilns as the Cause of Various Defects in Burning (Anormale Zugverhältnisse bei Porzellanbrennöfen als Ursache versheidener Brennfehler), Otto Wilhelm. Sprechsaal, vol. 18, no. 16, Apr. 17, 1919, pp. 115-117. According to writer, the chemical constitution of gases is of minor importance, but special care must be taken that combustion in fire box is complete, so that products of incomplete combustion, such carbo-hydrogen, etc., do not reach the kiln and there precipitate on wares of lower temperature.

OIL FUEL FOR SHIPS. Oil Fuel for Ships. Times Eng. Supp., no. 538, Aug. 1919, p. 249. Comparison with coal.

PULVERIZED COAL. The Use of Pulverized Coal, William H. Odell. Steam, vol. 23, no. 3, Sept. 1919, pp. 63-65, 8 figs. Raymond system of pulverizing coal and air separation. (To be continued).

The Use of Pulverized Coal—III. Engineer, vol. 128, no. 3316, July 18, 1919, pp. 50-53, 15 figs. Illustrating its applications to metallurgy.

Pulverized Coal—Some National Considerations, L. C. Harvey. Engineer, vol. 128, no. 3321, Aug. 22, 1919, pp. 173-174. Writer anticipates world-wide interest for burning fuels in powder form. He advises developing further work along lines undertaken by American engineers.

Pulverized Coal in Boiler and Furnace. Iron Age, vol. 104, no. 11, Sept. 11, 1919, pp. 709-710. Comparison with producer gas as fuel for open-hearth furnaces.

FURNACE

HEAT TREATING FURNACES. Heating Furnaces and Annealing Furnaces—IX, W. Trinks. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 423-427, 7 figs. Charts for computing boiler horsepower available from waste heat of furnace.

Heat-Treatment Furnaces at the Sheffield-Simplex Motor Works, Limited. Iron & Coal Trades Rev., vol. 99, no. 2688, Sept. 5, 1919, pp. 299, 3 figs. Producers are fired with gas coke. Consumption is said to be 5 cwts. per 24 hrs. for a pair of the small or one of larger furnaces.

KILN, MULTIPLE STACK. Multiple Stack Kiln Solves Burning Problems, N. Hermes. Brick & Clay Rec., vol. 55, no. 3, July 29, 1919, pp. 214-215. 5 figs. Type recommended for burning of high-grade ware.

OIL FURNACE. Economy in Industrial Fuel Oil Furnaces, Max Sklovsky. Am. Mach., vol. 51, no. 11, Sept. 11, 1919, pp. 495-500, 13 figs. Results of experiments undertaken to determine best method of obtaining high furnace efficiencies.

GAGES

CERTIFICATION OF GAGES. Certification of Gages at Bureau of Standards, H. L. Van Keuren. Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 800-802, 2 figs. Outline of more important pieces of apparatus used for gage inspection.

GAGE LIMITS. Gage Limits in Interchangeable Manufacture, E. C. Peck. Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 803-805 and 858. Writer discusses merits of English and metric systems and suggests that 10 inch meter would be a most desirable unit; he also gives explanation of terms allowance and tolerance and outlines method for using gages in strict interchangeable quantity production.

GAS ENGINEERING

BRITISH GAS PLANTS. Financial Status of British Gas Undertakings, Norton H. Humphrys. Gas Age, vol. 44, no. 6, Sept. 15, 1919, pp. 238-239. Price for gas; profits and restrictions are discussed.

GAS AS FUEL. Gas as a Substitute for Petro and Petroleum Products. Jl. Roy. Soc. Arts, vol. 67, no. 3484, Aug. 29, 1919, pp. 639-641. Report of Inter-Departmental Committee appointed by British Government to study possibilities of employment of gas in substitution for gasoline and petroleum products as source of power, especially in motor vehicles.

GASOMETERS. Study of the Large Gasometers (Etude des grands gazomètres), L. Schaffner. Mémoires et compte rendu des travaux de la Société des Ingénieurs Civils de France, vol. 72, nos. 4, 5 and 6, April-June, 1919, pp. 238-277, 24 figs. Design, formulae and calculations.

MANUFACTURING COSTS. Cheaper Gas, R. O. Wynne-Roberts. Gas Industry, vol. 19, no. 9, Sept. 1919, pp. 239-240. Recommending experiments and investigation to the end of discovering cheaper method of manufacture.

OVENS. Kalamazoo Gas Oven Plant, Walter V. Turner. Gas Rec., vol. 16, no. 4, Aug. 27, 1919, pp. 11-14, 7 figs. Mechanical equipment in installation of 15 horizontal slot ovens.

POWER PLANTS, GAS WORKS. Gas-Works Power Plants, H. C. Widlake. Gas Jl., vol. 147, no. 2934. Aug. 5, 1919, pp. 286-287. Concerning advisability of carrying out alterations which involve scrapping of an existing power motor of an electric motor.

PURIFICATION. "The Backward Rotation" System of Purification, Gas. Jl., vol. 147, no. 2933, Aug. 12, 1919, pp. 339-342, 1 fig. Ammonia losses in direct process of sulphate making.

SAFETY LAMPS. Height of Gas in Safety Lamp, C. M. Young. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1207-1211, 2 figs. Experiments to correlate change of temperature of source of ignition with change of height of cap produced.

STAFFORD GAS WORKS. The Stafford Gas Works equipped for New Demands. Gas. Jl., vol. 147, nos. 2936 and 2937, Aug. 19 and 26, 1919, pp. 387-389 and 443-445, 10 figs. Large scheme effecting change in plant and processes. Among new features are vertical retort-house, MacLaurin centrifugal washers, neutral process ammonia plant, gas holder and tank holding one million cubic feet.

STANDARDS. Cheaper Gas by Revising Present Standards. Contract Rec., vol. 33, no. 37, Sept. 10, 1919, pp. 859-860. Use of lignite fuels and relaxation from present high calorific value recommended as means for decreasing cost of production.

HANDLING OF MATERIALS

ASH HANDLING EQUIPMENT. Mechanical Sand and Ash Handling Plant of the Austrian State Railroad at Worgl (Die mechanische Besandüngs-und Ascheabfuhranlage im Heizhause Worgl der d.-o. Staatshahnen). Zeitschr. des oesterr. Ingenieur-u. Architekten-Vereines, vol. 71, no. 17, Apr. 25, 1919, pp. 159-161, 9 figs. Locomotive shed is also equipped with electrically-operated coal loading device.

Chute, Spiral. Speed up Production by Systematic Handling, J. H. Moore, Can. Machy., vol. 22, no. 10, Sept. 4, 1919, pp. 250-252, 5 figs. Illustrating operation of spiral chute between floors.

Coal Handling. Transport and Handling of Coal—II, John H. Anderson. Tran. Inst. Marine Engrs., vol. 31, no. 244, July 1919, pp. 131-218 and discussion pp. 218-219, 89 figs. Methods employed in Great Britain for handling of coal in bulk.

Handling Machinery Application. Machinery to Help Solve the Problem of High Wages, Labor Shortage and Shorter Hours Demand, Zenas W. Carter. Manufacturers Rec., vol. 76, no. 11, Sept. 11, 1919, pp. 103-106, 6 figs. Illustrating material-handling machinery.

Jeffery Equipment. Transferring Your Produce Efficiently, J. H. Moore. Can. Machy., vol. 22, no. 11, Sept. 11, 1919, pp. 277-278, 5 figs. Illustrating uses of Jeffery equipment.

Shop Transportation. Shop Transportation, J. H. Moore. Can. Machy., vol. 22, no. 5, July 31, 1919, pp. 122-131, 24 figs. Handling of materials as one of chief factors in efficient shop operation.

Small Shop. The Handling of Material in the Small Shop. Can. Machy., vol. 22, no. 5, July 31, 1919, pp. 110-111, 2 figs. It is said that solution to handling problem is often very simple matter if thought out seriously.

HEAT TREATING

Case Hardening. Practical Talks on Casehardening, Theodore G. Selleck. Jl. Am. Steel Treaters Soc., vol. 1, no. 10, Sept. 1919, pp. 325-335, 7 figs. Including suggested rules for heat treatment.

High-Speed Steel. American Practice for Hardening High Speed Steel. Proc. Steel Treating Research Soc., vol. 2, no. 6, 1919, pp. 34-36 and (discussion), pp. 36-42 and 45. Methods of treating alloys which conform to generally accepted views relative to composition giving maximum cutting efficiency.

High Speed Steel—Its Metallography and Heat-Treatment, G. J. Horvitz. Jl. Am. Steel Treaters Soc., vol. 1, no. 10, Sept. 1919, pp. 342-348, 13 figs. Illustrating with photomicrograph microstructure of metal at various stages in heat-treatment process.

Rail Material. Heat Treatment as Applied to Railway Materials, C. B. Bronson. Jl. Am. Steel Treaters Soc., vol. 1, no. 10, Sept. 1919, pp. 336-341. Sound steel seem as fundamental basis for successful heat treatment. Process for heat treatment of rail steel of air-cooling method described.

HEATING AND VENTILATION

Battleship. Report of Committee to Co-operate with U. S. Navy Dept.—1. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 301-322, 4 figs. Investigations in regard to heating, ventilating and humidifying battleships and submarines.

Heating Installations. Heating and Ventilating Systems at the U.S. Government's Smokeless Powder Plant at Nitro, W. Va., G. W. Hubbard. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 287-293. Steam for manufacturing processes and for heating buildings throughout manufacturing department taken directly from high pressure mains run above ground in wooden bents.

Plumbing Regulations. Recent Amendments to the New York City Plumbing Regulations Discussed, Albert L. Webster. Am. Architect, vol. 116, no. 2281, Sept. 10, 1919, pp. 361-365, 4 figs. Amendments permit restricted use of approved anti-siphon traps. Writer discusses relative merits of vented bend trap and anti-siphon trap.

Radiation, Computations. Standard Rules for Computing Required Radiation. Power Plant Eng., vol. 23, no. 18, Sept. 15, 1919, pp. 822-824. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 323-328. Standard formulae adopted for computing steam and hot water radiation by Nat. District Heating Assn.

Remodeling a Heating System. Re-Modeling a Heating System, Helen R. Innis. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 281-285, 1 fig. Detials of all conditions changes made and resultant improvements in plant of Brooklyn Standard Union, daily newspaper.

School Rooms. Heating and Ventilating the Standard School House, J. D. Cassell. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 261-266. Features of various systems. Writer advocates use of synthetic air chart for determining percentage of perfect ventilation, as originated by Dr. E. Vernon Hill, Chief of Ventilating Division of Chicago Dept. of Health.

Sprinkler System for Hot-Water Heating. Utilization of Automatic Sprinkler System for Hot-Water Heating, A. W. Moulder. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 273-280, 9 figs. Sketch showing typical combination installation.

Steam Heating. A Discussion of Steam Heating, James A. Donnelly. Steam, vol. 23, no. 3, Sept. 1919, pp. 66-69, 2 figs. Establishment of standard methods of proportioning direct radiation and standard sizes of steam and return mains. (To be continued.)

Ventilation. A Comparative Study of Natural and Mechanical Ventilation for School Rooms, F. Gardner Legg & W. F. Walker. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 243-252, 8 figs. Investigations of Sanitary Bureau of Detroit Dept. of Health. Object was to determine what qualities must be present in class rooms so that physical well-being, comfort and mental alacrity of pupils may be at as high a standard as possible.

Classroom Ventilation, Konrad Meier. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 253-261. Discussion of data presented in Bul. no. 68, Reprint Series, Dept. of Health of City of New York.

HOISTING AND CONVEYING

Belt Conveyors. Belt Loading and Carrying System at Cement Mill Quarry, W. A. Scott. Belting, vol. 15, no. 5, Sept. 5, 1919, pp. 15-17, 5 figs. Inclined conveyors with combined capacity of 240 tons of material per hour.

Possibilities of Steel Belt Conveyor. Iron & Coal Trades Rev., vol. 99, no. 2687, Aug. 29, 1919, pp. 261, 3 figs. As competitor with rubber and fabric belts.

Bin Elevators. Special Features in Some Eastern Sand and Gravel Plants. Rock Products, vol. 22, no. 18, Aug. 30, 1919, pp. 18-20, 5 figs. Bin elevators avoid use of elevated bins; pan conveyor takes place of standard belt; skip hoists.

Conveyors, Gravity. The Economical Employment of Gravity Conveyors, J. Edward Schipper. Automotive Industries, vol. 41, no. 10, Sept. 4, 1919, pp. 467-472, 7 figs. Economy of system claimed because it is said not to involve further expense or worry after being installed.

Cranes. The Use of the Crane in Modern Industry, J. H. Moore. Can. Machy., vol. 22, no. 9, Aug. 28, 1919, pp. 217-220, 5 figs. Illustrating its advantage in speeding up work.

A New 250-Ton Hammerhead Crane. Shipbuilder, vol. 21, no. 108, Aug. 1919, pp. 64-67, 2 figs. Constructed in connection with building of Vaterland. It differs from existing cranes in that jib carrying load is adjustable vertically through a certain angle to permit lowering loads on to deck of vessel. From Zeitschrift des Vereines deutscher Ingenieure.

French Firm Constructs Reinforced Concrete Crane. Contract Rec., vol. 33, no. 35, Aug. 27, 1919, pp. 818-819, 1 fig. Crane has capacity of 6600 lb. and span of 32.8 ft. Rolling gear is removable and so attached that it can be adjusted to take care of any warping of crane. Translated from Génie Civil.

Semi-Portable Dock Cranes at Boston Army Base Wharf. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 516-517, 2 figs. Four hoists with 4-ton maximum capacity travel on tracks outside of wharf shed and load vessels in dock.

Electric Hoisting Machinery. Development of Electric Hoisting Machinery (Die Entwicklung des elektrischen Fordemaschinen-Antriebs). Schweizerische Bauzeitung, vol. 74, no. 8, Aug. 23, 1919, pp. 95-97, 8 figs. Diagrams of machines with various types of drums.

Handling Coal and Ashes with Electric Hoists, James Monroe. Power Plant Eng., vol. 23, no. 18, Sept. 15, 1919, pp. 801-804, 9 figs. Illustrating types of systems and apparatus used in medium-size plants.

Hoisting Rigs. Removing and Replacing Ceiling Motor Armatures, T. H. Fenner. Power House, vol. 12, no. 12, Aug. 5, 1919, pp. 347-348, 3 figs. Heavy rigging designed to handle heavy armatures with minimum of labor and time.

Skip Hoists. Induction Motor Drive for Skip Hoists, F. R. Burt. Elec. Jl., vol. 16, no. 9, Sept. 1919. pp. 381-382, 4 figs. Scheme showing relative positions of equipment and manner in which material is handled; also graphic records of load and speed with buckets empty and when hoisting full bucket.

Winding Drum. Bi-Conical Winding Drum at a Belgian Colliery, A. Bertiaux. Colliery Guardian, vol. 118, no. 3060, Aug. 22, 1919, p. 490, 3 figs. Driven by double-cylinder horizontal engine with cranks set at 90 deg. Translated from Annales des Mines de Belgique.

HYDRAULIC MACHINERY

Discharge Coefficients of Poncelet Outlets. Experimental Determination of Discharge Coefficients of Poncelet-Outlets for Water and Sodium Chloride Brine and Discussion of their Relationship (Die experimentelle Bestimmung der Ausflusskoeffizienten von Poncelet-Oeffnungen für Wasser und Kochsalzsole und Erorterung des inneren Zusammenhanges der Koefficienten), Adolf Schneider. Forschungsarbeiten auf dem Gebiete des Ingenieurwesens, no. 213, 1919, 66 pp., 48 figs. Description of apparatus; measurements; test results; coefficients are given for different heights, temperatures and concentrations.

Gate Closure, Pressure Rise. Pressure Rise Caused by Gradual Gate Closure, Norman R. Gibson. Can. Engr., vol. 37, no. 11, Sept. 11, 1919, pp. 295-299, 7 figs. Derivation of formulae which include friction. (Concluded.)

Generator, 32,500-Kvs. A 32,000-Kvs. Waterwheel Generator, R. B. Williamson. Elec. World, vol. 74, no. 9, Aug. 30, 1919, pp. 456-458, 4 figs. One of three units under way for Niagara Falls. Generator and wheel casing are rigidly connected. Weight, 300 tons.

Governors for Water Turbines. Sewer Universal Governor for High-head Hydraulic Pelton Turbines. (Le régulateur universel système Seewer pour turbines hydrauliques à haute chute, Pelton), A. Strickler. Bulletin Technique de la Suisse Romande, vol. 45, no. 17, Aug. 23, 1919, pp. 169-171, 3 figs. Regulation effected by changing form of jet by means of movable guiding elements within admission nozzle.

Hydroelectric Station, Small. Rebuilding of a Small Hydroelectric Station. Elec. World, vol. 74, no. 9, Aug. 30, 1919, pp. 462-464, 6 figs. Twice as much output obtained from same amount of stream flow when hydroelectric station is rebuilt after washout. Cost per horsepower is about $80.

McClure Hydro-Electric Plant. The McClure Hydro-Electric Plant. Eng. & Min. Jl., vol. 108, no. 11, Sept. 13, 1919, pp. 457-460, 4 figs. Water flows through 13,600 ft. of 7-ft. pipe under 420-ft. head.

Water Hammer. Water Hammer in Conduits under Pressure (Note sur le Calcul de coup de belier dans les conduites sous pression), Ed. Carey. Bulletin Technique de la Suisse Romande, vol. 45, no. 17, Aug. 23, 1919, pp. 174-175, 1 fig. Applications of Michand-Gariel formula. (Continuation of serial).

INTERNAL COMBUSTION ENGINES

Air-Cooling. Air-Cooling for Automobiles. Autocar, vol. 43, no. 1244, Aug. 23, 1919, pp. 271-272, 6 figs. Some details of cylinder design in relation to causes and prevention of overheating troubles.

AKROYD CYCLE ENGINES. Akroyd Engine Cycles, Herbert Akroyd Stuart. Gas Engine, vol. 21, no. 9, Sept. 1919, pp. 275-281, 16 figs. Concerning origin of pure air compression with automatic ignition in crude oil engines. Writer offers arguments in substantiation of his contention that the term "semi-Diesel" is a misnomer.

BENZOL. The Use of Benzol and Benzol Mixtures as Motor Fuel, I. C. Mackie. Can. Chemical Jl., vol. 3, no. 9, Sept. 1919, pp. 295-297. Results of analytical work undertaken to determine effect of various settings of carburetor needle valve and also effect of surrounding temperature both by gasoline and benzol products.

CARBURETORS. Mathematical Study of the Operation of Constant-Level Spray Carburetors (Etude Mathématique de fonctionnement des carburateurs à giclage et à niveau constant). Génie Civil, vol. 75, no. 7, Aug. 16, 1919, pp. 148-152, 5 figs. Conditions for their automatic operation. (Concluded.)
The New Sthenos Carburetor. Autocar, vol. 43, no. 1234, Aug. 16, 1919, pp. 249-250, 6 figs. Based on principle of flowmeter, instrument is designed to regulate delivery of gasoline to give correct mixture at any running speed.
The Asmo Carburetor. Autocar, vol. 43, no. 1244, Aug. 23, 1919, pp. 280, I fig. Instrument creates automatically its own vacuum feed.

DIESEL ENGINES. Official Report on First Shipping Board Diesel Engine. Motorship, vol. 4, no. 9, Sept. 1919, pp. 34-35, 1 fig. Thirty-day non-stop full-power test of McIntosh and Seymour 750-b.hp. marine engine.
Winton Diesel Oil Engine. Power, vol. 50, no. 12, Sept. 16, 1919, pp. 453-455, 5 figs. Details of type built for stationary service for district connection to generators, pumps, etc.
Practical Operation of Marine Diesel Engines, K. Carlsen. Motorship, vol 4, no. 9, Sept. 1919, pp. 40-41, 2 figs. Method of starting engine.
Control of Diesel Engines, David Bruce. Motorship, vol. 4, no. 10, Oct. 1919, pp. 32-36, 13 figs. Particulars of various maneuvering mechanisms.
The Diesel Engine in the Southwest, B. V. E. Nordberg. Eng. & Min. Jl., vol. 108, no. 12, Sept. 20, 1919, pp. 497-500, 3 figs. Economy of power secured from this source compared with that from steam.
Diesel Engines in Mine Power-Plants, C. Legrand. Min. & Sci. Press, vol. 119, no. 11, Sept. 13, 1919, pp. 369-372 2 figs. Reports that two vertical two-cycle engines, each with five cylinders and rated at 1250 b.hp. at sea-level have given satisfactory service at mines situated at elevation of 5950 ft. above sea level.
Some Notes on the Vickers Diesel Engine. Engineer, vol. 128, no. 3322, Aug. 29, 1919, pp. 198-200, 3 figs. Engines dealt with were made in great hurry to meet urgent national requirements during war.
The White Diesel Heavy Oil Engine. Shipbuilding & Shipping Rec., vol. 14, no. 10, Sept. 4, 1919. pp. 263-265, 3 figs. Details of construction and results of tests.

DOXFORD OIL ENGINE. The Doxford Oil Engine. Engineer, vol. 128, no. 3316, July 18, 1919, pp. 64-65, 1 fig. How principle of engine has been transformed to make engine a hot-bulb engine instead of Diesel.

FUEL MIXTURES. The possibilities of New Fuel Mixtures for Internal-Combustion Engines, E. Humboldt. Power, vol. 50, no. 11, Sept. 9, 1919, pp. 418-420. Concerning production of cheap and cleaner substitute for gasoline by mixing with engine distillate a small amount of ether and alcohol.
See also Benzol.

FUTURE OF INTERNAL COMBUSTION MOTOR. The Future of the Internal Combustion Motor (De toekomst der verbrandings-motoren), F. A. Smit Kleine. Ingenieur, vol. 34, no. 33, Aug. 16, 1919, pp. 605-607. With special reference to Professor Meyer's article on this subject published in Ingenieur, no. 17, April 26, 1919.

HEAVY DUTY ENGINE. A Heavy Duty Engine for Tractors and Trucks. Automotive Industries, vol. 41, no. 12, Sept. 18, 1919, pp. 576-577, 4 figs. Valve rods are enclosed and other features of design are introduced to make engine dustproof.

HEAVY OIL ENGINES. Official Test Report De La Vergne Heavy-Oil Marine Engine. Motorship, vol. 4, no. 10, Oct. 1919, pp. 26-27, 6 figs. Consumption of lubricating oil, heat balance and temperature in crank case in 14-day test. (Concluded.)

HOT-PLATE ENGINES. *See Kromhout Engines.*

KROMHOUT ENGINE. A Dutch Marine Oil-Engine Motorship, vol. 4, no. 10, Oct. 1919, pp. 40-41, 5 figs. Kromhout hot-plate ignition two-cycle type engine.

MOTOR CAR ENGINES. Motor-Car Engines. Times Eng. Supp., no. 538, Aug. 1919, p. 253. Claimed advantages for air-cooled type.
Constitutional Defect in Four-Cylinder Engine and Remedy, Laurence H. Pomeroy. Automotive Industries, vol. 41, no. 12, Sept. 18, 1919, pp. 556-558, 6 figs. Discussion of American and European practices in building of motor car engines.

PRODUCER GAS ENGINE. The Gorham Producer Gas Engine. Pac. Mar. Rev., vol. 16, no. 9, Sept. 1919, pp. 149-152, 4 figs. Arranged for running in either direction, reversal being accomplished by use of compressed air furnished by compressor mounted on and forming part of engine.

TURBINE, SANDERS. The Sanders Pressure Turbine. Autocar, vol. 43, no. 1245, Aug. 30, 1919, pp. 317-320, 9 figs. Model of a new form of petrol engine without reciprocating parts, capable of running at 4000 r.p.m. and receiving 40,000 power impulses per minute.

VALVES, EXHAUST, PITTING. What Causes Pitting of Exhaust Valves? Automotive Industries, vol. 41, no. 10, Sept. 4, 1919, pp. 476-477. From investigation undertaken in connection with development of Rolls-Royce aircraft engines. Translated from La Technique Automobile et Aerienne.

LUBRICATION

Lubrication Principles, Robert June. Brick & Clay Rec., vol. 55, no. 7, Sept. 23, 1919, pp. 588-591, 2 figs. Writer contends that through a knowledge of how to save power, power plant operator may save, many times over each year, cost of lubricants; he also considers accurate knowledge of lubricants and lubrication as vitally important.

BALL BEARINGS. The Lubrication of Ball-Bearings, H. R. Trotter. Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 811-815, 5 figs. Instrument designed by writer for obtaining data regarding lubricants consists of revolving element driven by small motor and stationary element similar to block used in a Mitchell or Kingsbury bearing with suitable means of obtaining readings of inclination angle of block to revolving element.

CUTTING LUBRICANTS. Cutting Lubricants for Machine Tools, Reginald Trautschold. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 45-47. Table indicating suggested uses of lard oil compounds, soda water and soluble oils for different machining operations and metals.

MACHINE ELEMENTS AND DESIGN

BEARINGS, MARINE THRUST. Marine Thrust Bearings. Motorship, vol. 4, no. 10, Oct. 1919, pp. 28-30, 6 figs. Phenomena of film lubrication in pivoted-segments type. Paper read before Instn. Naval Architects.

BEARING, MICHELL JOURNAL. The Michell Journal Bearing. Engineer, vol. 128, no. 3322, Aug. 29, 1919, pp. 202-204, 10 figs. Adaptation of principle of bearing which has been employed for thrust blocks of marine engines of more than 10,000,000 hp. to journal bearings.

BEARINGS, ROLLER. Roller Bearing Types and Applications—II. Raw Material, vol. 1, no. 6, Aug. 1919, pp. 304-308, 16 figs. Construction features of principal makes.

CAMS. Cam Design and Construction, Franklin de R. Furman. Am. Mach., vol. 51 no. 12, Sept. 18, 1919, pp. 569-574, 10 figs. Miscellaneous types, minimum sizes and non-interference. (Continuation of serial.)

GEARS, RAWHIDE. The Strength of Rawhide Gears. Machy. (Lond.), vol. 14, no. 358, Aug. 7, 1919, pp. 559-560, 1 fig. Chart empirically devised and said to give same results as Lewis formula with correction for speed introduced by Carl G. Barth.

GEARS, REDUCTION. A War Time Lesson on Reduction Gears. Automotive Industries, vol. 41, no. 11, Sept. 11, 1919, pp. 516-522, 15 figs. From investigations conducted at McCook Field, Dayton, Ohio, it is shown that in considering special gearing, such as propeller reductions, usual limitations of standard pitches and angles of obliquity can be departed from to advantage.
Gearing as Applied to the Marine Steam Turbine. John Houston. Steamship, vol. 31, no. 363, Sept. 1919, pp. 65-67. Note on designing and installing helical spur wheel reduction gear. Paper read before Inst. of Marine Engrs.

SHAFTING. Theory and Practice in Shafting, Robert S. Lewis. Belting, vol. 15, no. 5, Sept. 5, 1919, pp. 27-31, 4 figs. Development formula for calculating weight.

SPECIAL MACHINE DESIGN. Principles of Special Machine Design. Machy. (Lond.), vol. 14, no. 360, Aug. 21, 1919, pp. 616-617. Analysis of Functions of special machines and important points to be observed in their design.

MACHINE SHOP

DRIVES. Converting Machines to Individual Drive. Elec. World, vol. 74, no 12, Sept. 20, 1919, pp. 637-640, 2 figs. Manner in which motors and control were made integral part of old belt-driven machines in plant where central-station service was installed.
Machine Tool Drives: Motors and Controllers, H. W. Tice. Jl. Engrs. Club Philadelphia, vol. 36, no. 171, Feb. 1919, pp. 47-51, 5 figs. Relative merits of a. c. and d. c. motors for planer drives; d. c. performance curves; a. c. performance curves.

ELECTRIC DRIVE. Electrically-Operated Machine Tools, E. Austin. Eng. & Indus. Management, vol. 2, no. 10, Sept. 4, 1919, pp. 292-293, 2 figs. Their advantages.

See also Drives.

FITTING SHOP PRACTICE. Machine and Fitting Shop Practice, Fred Horner. Mech. World, vol. 66, no. 1703, Aug. 22, 1919, p. 86, 3 figs. Chucks in which separate pads or segments are set in place to form gripping jaws. (Continuation of serial.)

FOUNDATIONS, MACHINERY. Making Templets for Machinery Foundations, Bruce Page. Power House, vol. 12, no. 12, Aug. 5, 1919, pp. 325-329, 14 figs. Says that templet drawings should be made for all except the simplest foundations and that drawings should be furnished the man who is to build the templet.

LATHE OPERATIONS. Machining Operations on Cast Iron Cylinders, Richard Vosbrink. Metal Trades, vol. 10, no. 9, Sept. 1919, pp. 406-408, 3 figs. Including diagrammatic sketch of lathe operations.

MILLING. Production Milling on Automatic Machines—I. Edward K. Hammond. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 48-55, 14 figs. Describing practice in milling of duplicate parts.

MONEL METAL. Working Monel Metal, Hugh R. Williams. Am. Mach., vol. 51, no. 11, Sept. 11, 1919, pp. 509-511, 3 figs. Curves showing influence of temperature on tensile strength and on torsional strength of metal rods.

OPTICAL METHODS OF COMPARISON. Some Optical Aids for the Engineer—I, Arthur C. Banfield. Machy. (Lond.), vol. 14, no. 360, Aug. 21, 1919, pp. 613-615, 9 figs. Points out advantages in adopting optical methods for comparison and for other purposes.

SHAFT STRAIGHTENING. Straightening Shaft of 45,000-Kw. Turbine, E. E. Cloek. Power, vol. 50, no. 10, Sept. 2, 1919, pp. 377-378, 1 fig. Shaft was straightened by heat-treatment method.

TAYLOR'S "CUTTING METALS." Supplement to Frederic W. Taylor's "On the Art of Cutting Metals"—I, Carl G. Barth. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 169-175, 1 fig. Reviews historical study of work and outlines engineering subjects that are to be treated in subsequent installments.

Thread Milling. Milling Threads, W. G. Dunkley. Machy. (Lond.), vol. 14, no. 360, Aug. 21, 1919, pp. 631-634, 7 figs. Determination of true form of thread on inclined section.

MACHINERY, METAL WORKING

Boring Machine. Horizontal Boring Machine. Engineer, vol. 128, no. 3320, Aug. 15, 1919, pp. 162-163, 2 figs. Special feature noted is controlling gear which is said to permit manipulation of machine in such a way that operator can have complete control without moving from one position.

Dividing Attachment. Dividing Attachment for 3½-in. and 4-in. Drummond Lathe, C. Young. Model Engr. & Elecn., vol. 41, no. 953, July 31, 1919, pp. 104-107, 8 figs. Attachment fits on lathe mandrel in place of gear used for screw cutting, fork engaging with one of studs in extra quadrant and used for carrying intermediate gears.

Edging Rolls. Using Edging Rolls in Brakdown Emergency, W. S. Standiford. Can. Machy., vol. 22, no. 11, Sept. 11, 1919, pp. 271-273, 2 figs. Illustrating set of edging rolls for edging small flat bars on guide mill.

Lathes. Le Blond Multi-Cut Semi-Automatic Lathes. Am. Mach., vol. 51, no. 12, Sept. 18, 1919, pp. 545-550, 10 figs. Specially valuable feature is said to be multiple use of simple lathe tools for more or less complicated jobs of facing or turning.

Sliding-Head Drop-Rail Lathe. Iron Age, vol. 104, no. 11, Sept. 11, 1919, pp. 720-722, 4 figs. Designed to give extra capacity without employing more than one spindle.

Lathe Tailstock. The Design and Construction of a 4½-in. Lathe Tailstock, G. Gentry. Model Engr. & Elecn., vol. 31, nos. 952 and 953, July 24 and 31, 1919, pp. 76-79 and 111-114, 6 figs. July 24: Scale working drawings. July 31: Machining of spindle. (Concluded.)

Planers. Heavy Machine Equipment at Panama, R. D. Gatewood. Am. Mach., vol. 51, no. 10, Sept. 4, 1919, pp. 463-465, 4 figs.Notably planing machine which handles works 96 in. high by 132 in. wide by 24 ft. long.

Saw, Metal. Vertical Metal Saw. Engineer, vol. 128, no. 3320, Aug. 15, 1919, p. 162, 4 figs. Of heavy and powerful construction, outstanding feature being angular disposition of saw frame and high speed.

MACHINERY, SPECIAL

Breaker, Coal. Rebuilding the Loree Breaker, W. S. Hutchinson. Coal Age, vol. 16, no. 9, Aug. 28, 1919, pp. 352-354, 6 figs. How coal breaker having capacity of 6000 tons per day was erected in 130 days.

Dredges. Floating Dredge at Western Indiana Gravel Plant, Terre Haute, Ind. Rock Products, vol. 22, no. 17, Aug. 16, 1919, pp. 20-22, 8 figs. Used to remove gravel to depth of 40 ft. below water level.

Grinding Machine. Designing a Special Machine, F. E. Johnson. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 56-59, 6 figs. Illustrating method of procedure by reference to developing special duplex grinding machine as example.

Lathe and Drill Textures. Quantity Production by the American Coin Register Company. Metal Trades, vol. 10, no. 9, Sept. 1919, pp. 398-400, 9 figs. Lathe and drill fixtures used.

Milling Machine Attachment. Some Labor-Saving Devices that have been developed in the Moore Shops. Metal Trades, vol. 10, no. 9, Sept. 1919, pp. 394-396, 8 figs. Such as attachment for LeBlond milling machine, which is used in making 5⅝-in. cut around corners oil-tight hatch-frame.

Mine Cars. The Quantity Manufacture of Mine Cars. Metal Trades, vol. 10, no. 9, Sept. 1919, pp. 403-404, 4 figs. Special tools developed for manufacturing Matteson car.

Scales. Tapered-Floor Track Scales, Canadian Pacific Railway. Ry. Rev., vol. 65, no. 10, Sept. 6, 1919, pp. 336-338, 7 figs. Rails are elevated and floor sloped to shed water crosswise.

Screen, Mitchell Vibrating. Description of the Mitchell Vibrating Screen. Sale Lake Min. Rev., vol. 21, no. 11, Sept. 15, 1919, pp. 28-30, 4 figs. Screen cloth is agitated at rate of 3600 vibrations a minute and strikes material with an ampact of from 500 to 1000 lb. The motor-actuated vibration is applied continuously to screening area by means of rigid arms or plates, fastened to ends of vibrator casing below.

Trench Machinery. Trench Machinery, A. E. Collins, Surveyor, vol. 56, no. 1435, July 25, 1919, pp. 55-59, 6 figs. Directs attention to machinery applicable to sewer and such-like trenches.

MATERIALS OF CONSTRUCTION AND TESTING OF MATERIALS

The Testing of Materials, Walter Rosenbain. Automotive Industries, vol. 41, no. 11, Sept. 11, 1919, pp. 508-510. Writer, who is connected with Nat. Physical Laboratory in Teddington, England, makes plea for simple tests of materials and for statement of results in definite, certain and understandable terms.

Anchor, Cast Steel. Investigation of the Failure of a Cast-Steel Anchor. Iron Age, vol. 104, no. 12, Sept. 18, 1919, pp. 773-774, 4 figs. How hard interior sections were caused by use of charcoal on the riser in a German foundry. From Stahl und Eisen.

Fatigue. The Fatigue of Nickel and Iron Wires when Subjected to the Influence of Transverse Alternating Fields, William Brown. Scientific Proc. Roy. Dublin Soc., vol. 15, no. 17, Jan. 1917, pp. 163-170, 3 figs. Including also experiments on subsidence of torsional oscillations in wire carrying electric current.

Impact Machines. Experimental Data Obtained on Charpy Impact Machine, F. C. Langenberg. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1471-1499, 21 figs. Results of experiments said to have indicated that material with lower elastic limit, lower tensile strength, slightly higher ductility and lower Brinell hardness has much higher shock strength, as determined by Charpy notched-bar specimen, either tensile or transverse.

Magnetic Field. The Twist and Magnetization of a Steel Tube in a Spiral Magnetic Field, F. E. Hackett. Scientific Proc. Roy. Dublin Soc., vol. 15, no. 33, Oct. 1919, pp. 415-430, 4 figs. Observations on the Wiedemann effect in steel tube in which twist was produced by combination of circular and longitudinal fields, are said to have given a spiral field whose axis coincided with axis of tube. Twist is said to have varied as sine of twice pitch-angle, this verifying Knott's formula.

See also Young's Modulus, Fatigue.

Mahogany. Mahogany, and the Recognition of Some of the Different Kinds of Their Microscopic Characteristics, Henry H. Dixon. Scientific Proc. Roy. Dublin Soc., vol. 15, no. 34, Dec. 1918, pp. 431-486, 138 figs. on 23 supplement plates. Examination covered 40 species of trees which yield mahogany.

Metal Washing. New Processes of Mechanical Testing of Metals (Nouveaux procédés d'essais mécaniques des métaux), Charles Frémont. Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 5, Aug. 4, 1919, pp. 228-231, 5 figs. Tension, compression and impact portable testing machines.

Notched Bar Tests. Impact Tests of Notched Bars (Sur les essais de flexion par choc de barreaux entaillés), A. Cornu-Thenard. Comptes Rendus des Séances de l'Académie des Sciences, vol. 169, no. 6, Aug. 11, 1919, pp. 272-275. It is concluded from tests that it is advisable to give notch (1) sufficiently small diameter, maximum recommended being 2 mm. for a 10×10 mm. bar, and (2) sufficiently large depth, one-half depth of bar being suggested as advisable practice.

See also Impact Machines.

Sheets, Galvanized Steel. Galvanized Steel Sheets. Iron & Coal Trades Rev., vol. 99, no. 2688, Sept. 5, 1919, pp. 289-290, 7 figs. Object of investigation was to study from a physical, chemical, microscopic and mechanical point of view the composition and finish of steel sheets and practice connected with their manufacture.

Steel. Practical Notes on Physical Tests of Steel—I, Austin B. Wilson. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 435-437 and p. 447, 1 fig. Details of testing and testing machines for making tensile and compression tests.

Tile, Drain, Shale. An Investigation of Tests of Iowa Shale Drain Tile, W. J. Schlinck. Iowa State College of Agriculture & Mech. Arts, Bul. 49, Eng. Experiment Station, vol. 16, no. 43, Mar. 27. 1919, pp. 5-55, 16 figs. Scope of investigations covered studies of methods and results of making sodium sulphate tests of pieces from tested drain tile as accelerated tests of resistance to freezing and thawing methods and results of making artificial freezing and thawing tests, effects of natural freezings and thawings upon whole tile; rate of absorption and necessary time of immersion in making absorption tests by immersion.

Tubes, Boiler, Testing. The Commercial Testing of Railway Materials, T. H. Sanders. Mech. World, vol. 66, no. 1703, Aug. 22, 1919, pp. 92-93. Testing of tubes for locomotive boilers. (Concluded.) Paper read before Junior Inst. of Engrs.

Young's Modulus. The Change in Young's Modulus of Nickel with Magnetic Fields, William Brown. Scientific Proc. Roy. Dublin Soc., vol. 15, no. 20, April 1917, pp. 185-192. Results obtained with longitudinal alternating fields and with transverse fields, direct and alternating, and also with longitudinal direct fields, with comparison of their effects on the same wire.

MECHANICAL PROCESSES

Drill Chuck Manufacture. Manufacturing a Drill Chuck, Fred. R. Daniels. Mach. (Lond.), vol. 14, no. 358, Aug. 7, 1919, pp. 553-557, 11 figs. Methods and fixtures developed in manufacture of "Ettco" drill chuck made by Eastern Tube & Tool Co., Brooklyn, N.Y.

Interchangeable Manufacture. Machine Design in Interchangeable Manufacturing Practice, Earle Buckingham. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 8-11, 1 fig. Function of machine design in promoting economical manufacture on interchangeable basis.

Locks. The Cylinder Lock—I, Ellsworth Sheldon. Am. Mach., vol. 51, no. 10, Sept. 4, 1919, 3 figs. Features of construction.

Painting and Upholstery. Finishing Bodies for Automobiles, C. A. Marston. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 207-211, 10 figs. Organizing operations of painting and upholstering.

Roller Chain Manufacture. Making Roller Chain—I. Machy. (Lond.), vol. 14, no. 361, Aug. 28, 1919, pp. 645-649, 8 figs. Special machines and fixtures developed in America for making sprocket chain.

Rolling Mills. Atlas Crucible Steel Increases Capacity for Making and Rolling High Grade Steels, H. Donald Dickinson. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 438-441, 5 figs. Three crucible melting furnaces and two Hercult electric furnaces used for melting steel.

New Structural Mill at Kiushu Steel Works Japanese Increase Steel Production. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 420-422, 4 figs. Rolling mill plant which is to consist of 84-in. plate mill, 35-in. blooming mill and 24-in. structural mill.

Erects Fabricating Shop in South. Iron Trade Rev., vol. 65, no. 10, Sept. 4, 1919, pp. 632-634, 5 figs. Plant containing blooming, bar and structural mills.

Sprocket Chain Manufacture. Making Diamond Sprocket Chain—II, Edward K. Hammond. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 25-28, 11 figs. Steps in process of assembling. (Concluded).

Upholstery. *See Painting and Upholstery.*

MECHANICS

CAMS. Technical Study of Mechanisms Operated by Cams (Etude rationnelle des méchanismes commandés par cames), Octave Lepersonne. Revue Universelle des Mines de la Métallurgie, vol. 2, no. 1, Mar.-Apr. 1919, pp. 433-500, 10 figs. Criticism of Prof. Hartmann's theory as presented in issues of Sept. 30 and Oct. 7, 1905, of Zeitschrift des Verein Deutscher Ingenieure; construction of profile necessary to assure permanent contact between parts of mechanism, with special reference to requirements for operation of balance in internal combustion engines (To be continued.)

DEFLECTION OF BEAMS AND RIGID FRAMES. Deflection of Continuous Beams and Rigid Frames, F. E. Richart. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 564-565, 3 figs. Formulae for computing maximum deflection in case of symmetrical loading and its application value in case of unsymmetrical loading.

ENGINE COLUMS DESIGN. The Design of Engine Columns—II, W. K. Wilson. Mech. World, vol. 66, no. 1704, Aug. 29, 1919, p. 102, 3 figs. Side-thrust curves for case of oil engine. (Continuation of serial).

MOMENTS, COMBINED BENDING AND TWISTING. Combined Bending and Twisting Moments, Victor M. Summa. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 41-42, 5 figs. Application of Rankine's formula to types of levers or cranks which are keyed or otherwise attached to shafts.

STRESSES, MATERIAL, EQUATIONS. The Equations for Material Stresses, and their formal solution, R. F. Gwyther. Lond., Edinburgh & Dublin Phil. Mag., vol. 38, no. 224, Aug. 1919, pp. 235-240. Equations based on "Doctrine of Material Stresses" contained in June Phil. Mag., vol. 35, p. 490, 1918, and the solution of these equations in Cartesian co-ordinates.

STRUTS. On the Stability of Long Struts of Variable Section, Akimasa Ono. Memoirs of the Coll. of Eng., Kyushu Imp. University, Fukuoka, Japan, vol. 1, no. 5, 1919, pp. 395-406, 4 figs. Formula for critical load developed from assumption that moment of inertia varies as n-th power of distance of section from free end.

MEASUREMENTS AND MEASURING APPARATUS

BALLS FOR GAGE CHECKING. Use of Balls in Measuring, G. C. Haneman. Machy. (Lond.), vol. 14, no. 358, Aug. 7, 1919, pp. 561-562, 2 figs. Illustrating methods of using finished balls for checking gage measurements.

CONDUCTIVITY OF METALS, THERMAL. An Apparatus for Determining the Thermal Conductivity of Metals, Gordon B. Wilkes. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp. 241-243. 1 fig. Consists essentially of a heater, guard-ring, two continuous flow calorimeters, and three thermocouples used in measuring temperature of different parts of specimen.

DYNAMOMETERS. Calculating Power Requirements for Small Machinery. Machy. (Lond.), vol. 14, no. 361, Aug. 28, 1919, pp. 662-663, 2 figs. Suggested form of indirect-reading dynamometer.

GAGES. *See Measurements and Measuring Apparatus. (Balls for Gage Checking.)*

HEAT METER. A New Compensated Heatmeter, Charles P. Frey. Chem. Engr., vol. 27, no. 9, Sept. 1919, pp. 215-218, 6 figs. Effect of line and thermo-couple resistance eliminated by means of simple operation. Developed at Bureau of Standards.

A New Compensated Heatmeter, Charles P. Frey. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp. 259-261, 7 figs. Fundamental principle of Harrison-Foote invention.

HYDROMETERS. Calculation of Hydrometer Degrees, Gravities and Weights with the Slide Rule, Wallace Savage. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 395-397, 2 figs. Formulae reduced to convenient expressions capable of direct calculation by means of slide rule.

INDICATORS. Using Indicator on Internal Combustion Engines, Ralph Miller. Power, vol. 50, no. 11, Sept. 9, 1919, pp. 422-423, 2 figs. Cards taken from 23 x 24-in. four-stroke-cycle oil engines running at 150 r.p.m.

MANOMETER, KNUDSEN'S VACUUM. A Form of Knudsen's Vacuum Manometer, Lewis F. Richardson. Phys. Soc. of London, vol. 31, no. 5, Aug. 15, 1919, pp. 270-277, 2 figs. Instrument as originally devised by Knudsen could only be kept in operation for a few minutes at a time; in form described apparatus can be maintained indefinitely and its range extends up to 2.0 dynes per sq. cm. Force of molecular bombardment is balanced by effect of magnetic field of special form, acting upon electric current attached to vane and temperature difference is measured by thermo-junction e.m.f. of which is balanced against same current in potentiometer.

PYROMETERS. Teaching Pyrometry, O. L. Kowalke. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1425-1427. Suggests introducing exercise that will bring out limitations and sources of error in pyrometer employed.

Optical and Radiation Pyrometry, Paul D. Foote and C. O. Fairchild. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1389-1455, 16 figs. General theory, diagrammatic sketches of various types used both in optical pyrometry and in radiation pyrometry, method of using each, and advantages and disadvantages of radiation pyrometry.

Industrial Applications of Disappearing-filament Optical Pyrometer, F. E. Bash. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1285-1299, 6 figs. In steel, non-ferrous, and glass industries.

Thermo-Electric Pyrometer for Metallurgical Purposes. Metal Industry, vol. 15, no. 9, Aug. 29, 1919, pp. 171 and 173, 2 figs. Indicating methods of maintaining cold junction at constant temperature.

Resistance Thermometry for Industrial Use, Charles P. Frey. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1437-1441, 2 figs. Construction and operation of commercial resistance thermometer.

Tin: An Ideal Pyrometric Substance, E. F. Northrup. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1443-1444. Particularly because of increase of given volume in resistivity with increase in temperature and decrease of given volume in density with increase in temperature.

Thermo-couple Installation in Annealing Kilns for Ootical Glass, E. D. Williamson and H. S. Roberts. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1445-1453, 3 figs. Essential features of system of temperature control evolved at plant at Pittsburgh Plate Glass Co.

Pyrometer Shortcomings in Glass-house Practice, W. M. Clark and Charles D. Spencer. Bul. Am. Inst. Min. & Metallurgical Engrs.. no. 152, Aug. 1919, pp. 1455-1458. Due, it is claimed, to lack of standardization of utilitarian type.

MICROSCOPES. Some Optical Aids for the Engineer—II, Arthur C. Banfield. Machy. (Lond.), vol. 41, no. 361, Aug. 28, 1919, pp. 650-652, 9 figs. Feature of high-grade measuring microscope built by Messrs. Adam Hilger, Ltd. Instrument is of lead-screw type, accuracy of reading being dependent entirely on accuracy of screw, the construction of which is said to make it in all respects the precision screw.

PHOTOMETERS. Computation of Precision Photometer Scales, Gordon Thompson. Tran. Illum. Eng. Soc., vol. 14, no. 6, Aug. 30, 1919, pp. 286-294, 2 figs. Method given consists in computing with logarithms sufficient manor divisions to serve as guiding points and then filling in intermediate points with aid of curves of tangents. Fundamental equation of scale is $I = K/D$ 2 where I is intensity of illumination, D is distance, and K constant.

PRESSURE AND TEMPERATURE SCALES. Absolute Scales of Pressure and Temperature, F. J. W. Whipple. Phys. Soc. of London, vol. 31, no. 5, Aug. 15, 1919, pp. 237-241, 1 fig. Urges general use of new scales of pressure and temperature which have been adopted by meteorologists. In pressure scale fundamental unit is the bar (pressure due to million dynes per sq. c.m.); temperature scale is pseudo-absolute scale, obtained by adding 273 deg. to centigrade scale.

PYRHELIOMETER. Some Characteristics of the Marvin Pyrheliometer, Paul D. Foote. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 605-635, 8 figs. Calibrating both by usual electrical method and by a radiometric method. In latter method known quantity of radiation from black body was allowed to fall upon pyrheliometer receiver in same manner as when employed for solar measurements.

Pyrometry and Steel Manufacture, A. H. Miller. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1501-1510. Method considered as best adapted for measuring bath temperatue is that of sighting optical pyrometer either on surface of spoonful of metal drawn from furnace or stream poured from spoon. In forge practice best method of measuring temperature is considered to be that of optical pyrometer directly on article to be forged while it is in its heating furnace.

Basis and Methods of Pyrometry (Grundlagen and Methoden der Pyrometrie), F. Henning. Physikalische Zeitschrift, vol 20, no. 2, Jan. 15, 1919, pp. 34-47, 4 figs. Theoretical bases; instruments and methods of measuring.

Temperature Indicating and Controlling Systems—III, Franklin D. Jones. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 12-17, 9 figs. Location and protection of thermo-couples; Prevention of errors in pyrometer readings; apparatus for determining hardening temperatures. (Concluded.)

SCALES. Trustworthiness of the Balance over Long Periods of Time, George Dean. Jl. Chem. Soc., vol. 115-116, no. 671, July 1919, pp. 826-828. Variation of 1.6 milligrams detected and attributed to gradual shifting of central knife edge.

SPEED INDICATORS. Electric Speed Indicators. Victor H. Todd. Power, vol. 50, no. 11, Sept. 9, 1919, pp. 421-422, 6 figs. Principle of operations, construction of features, method of gearing and application.

See also Tachometers.

The Waltham Speedometer. Autocar, vol. 43, no. 1245, Aug. 30, 1919, p. 333, 4 figs. New Instrument for which greater accuracy is claimed and which is operated by air pressure.

SPHEROMETER. A Spherometer of Precision, J. Guild. Sci. Am. Supp., vol. 88, no. 2281, Sept. 20, 1919, pp. 184-185, 3 figs. Designed with a view to obtain greater accuracy in determination of exact point of contact of micrometer leg with surface of lens or flat under examination than is usually obtained with spherometers of existing patterns. Paper read before Optical Soc.

TACHOMETERS. The Van Sicklen Chronometric Tachometer, Frank J. Feely. Aviation, vol. 7, no. 3, Sept. 1, 1919, pp. 137-138, 5 figs. Instrument has dial uniformly graduated from zero to 2500 r.p.m. for complete rotation of pointer, and, like other similar chronometric tachometers, its calibration is controlled by time of its watch unit.

See also Speed Indicators.

TEMPERATURE SCALES. *See Pressure and Temperature Scales.*

THERMOCOUPLES. *See Pyrometers.*

THERMOMETERS. *See also Pyrometers.*

VARIANCE OF MEASURING INSTRUMENTS. Variance of Measuring Instruments and Its Relation to Accuracy and Sensitivity, Frederick J. Schlink. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 741-764, 7 figs. With reference to calibration curves of typical instruments, which are presented to show character of hysteresis loops and nature and amount of various errors as actually determined.

VISIBILITY MEASUREMENT. The Low Visibility Phase of Protective Coloration, Lloyd A. Jones. Jl. Franklin Inst., vol. 188, no. 3, Sept. 1919, pp. 363-387, 7 figs. Theory upon which measurement and specification of visibility is based; description of instrument to measure visibility. (To be concluded.)

MOTOR CAR ENGINEERING

AXLES. Three Designs of LM Double Reduction Truck Axle. Automotive Industries, vol. 41, no. 10, Sept. 4, 1919, pp. 462-465, 10 figs. One recommended particularly for light work up to and including one and a half tons capacity; other two designs to be made in sizes of two to five tons.

Unusual Types of Axles on the German War Trucks—V, Arthur J. Slade. Automotive Industries, vol. 41, no. 10, Sept. 4, 1919, pp. 457-461, 17 figs. Front axles about equally divided between Elliot and reverse Elliot type. No roller bearings are used. From observations made of trucks handed over to A.E.F.

Accessibility and Sturdiness Feature New Line of Axles. Automotive Industries, vol. 41, no. 12, Sept. 18, 1919, pp. 559-561, 4 figs. Noting features which are said to have been adapted from lessons of the war.

Berliet. The Berliet Three Tonner. Motor Traction, vol. 29, no. 755, Aug. 20, 1919, pp. 157-158, 6 figs. Lower part of crankcase base chamber made detachable. Engine has bore of 110 mm., stroke of 140 mm., capacity of 1330 c.c. per cylinder, and is designed for speeds not exceeding 1250 to 1500 r.p.m.; it is rated at 22-hp.

Buses. London's New Motor Buses. Motor Traction, vol. 29, no. 756, Aug. 27, 1919, pp. 182-183, 6 figs. Designed with a view to reduce weight, in order to comply with police regulations, though carrying twelve additional passengers.

Clement-Bayard. The New 8 hp. Clement-Bayard. Autocar, vol. 43, no. 1244, Aug. 23, 1919, pp. 287-288, 9 figs. French light car having side by side valve engine, three speeds and electric lighting.

Connecting Rods. Connecting-Rods for Motor Trucks and Passenger Cars, Fred H. Colvin. Am. Mach., vol. 51, no. 10, Sept. 4, 1919, pp. 467-470, 10 figs. Methods of machine noting especially how concentration of machines eliminates handling of material and fixtures which reduce loss of cutting time

Dawson. The 11.9 h.p. Dawson. Autocar, vol. 43, no. 1245, Aug. 30, 1919, pp. 321-324, 10 figs. Fitted with high-efficiency engine, having special type of valve gear. Engine is of 4-cyl. overhead-valve type.

Garages. Practical Suggestions for the Construction, Equipment and Running of Automobile Garages (Praktische Vorschläge für den Bau, die Einrichtung und den Betrieb von Automobil-Garagen), Albert Neuburger. Automobil-Rundschau, vol. 18, nos. 7-8, Apr. 1919, pp. 60-70. Heating, illumination and ventilation. (To be continued.)

Impact on Road. Motor-Truck Impact on Roads Five Times Dead Load. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 573-575, 3 figs. Experiment of Bureau of Public Roads said to indicate that force is dependent on speed, power and condition of truck.

Impact Tests of Truck. Effect of Impact of Trucks, E. B. Smith and J. T. Pauls. Mun. Jl. & Public Works, vol. 47, no. 11, Sept. 13, 1919, pp. 162-164, 3 figs. Tests being made by Bur. of Public Roads indicate that there is general tendency of increased impact with higher speeds although relation between speed and impact is not constant; also general increase of impact with increase of height of drop.

Plows. Tractor Ploughing Machine of Unique Design, J. H. Rogers. Can. Mchy., vol. 21, no. 11, Sept. 18, 1919, pp. 293-296, 9 figs. Particular advantage claimed is that a plurality of ploughs can be carried by tractor, entire mechanism of machine being operated by tractor motor located on front end of framework.

Springing Device. A New Springing Device, W. Gorden Aston. Autocar, vol. 43, no. 1234, Aug. 16, 1919, pp. 244-245, 1 fig. Shocks met through variable leverage toggles, by coil springs.

Springs, Auxiliary. Supplemental Springs for Metal Tired German Trucks, Arthur J. Slade. Automotive Industries, vol. 41, no. 9, Aug. 28, 1919, pp. 409-412, 14 figs. Made necessary on account of substitution of steel for rubber tires.

Starters. Electrical Auxiliary Devices for Starting Systems, Fred J. Hoffman. Automotive Industries, vol. 41, no. 12, Sept. 18, 1919, pp. 568-570, 4 figs. Outlines of various types of cutout switches.

Three-Wheel Cars. A Car on Three Wheels. Autocar, vol. 43, no. 1244, Aug. 23, 1919, pp. 289-290, 3 figs. Specifications: 10-hp., 4-cyl. engine; two-speed epicyclic gear; quarter-elliptic front, semi-elliptic rear springs.

Tractors. Automotive Manufacturers Developing French Tractors, W. F. Bradley. Automotive Industries, vol. 41, no. 11, Sept. 11, 1919, pp. 526-529, 5 figs. Influence of war tank design in new tractors developed recently for France.

Wheels. Wheels for Power Vehicles (Das Kraftwagenrad), K. Bilau. Automobil-Rundschau, vol. 18, no. 7-8, Apr. 1919, pp. 71-74, 3 figs. Strength, light weight, resistance to various temperatures, some of their requirements.

PIPE

Wood-Stave Pipe. Kipawa Co's Pulp Mill and Power Development. Can. Engr., vol. 37, no. 12, Sept. 18, 1919, pp. 305-310, 16 figs. Noting details of wood-stave power pipe line 8 ft. in diameter.

Diagram for Computing Band Spacing for Wood-Stave Pipe Willis T. Batcheller. Eng. News-Rec., vol. 83, no. 10, Sept. 4, 1919, p. 472, 1 fig. For pipe 1 to 20 ft. in diameter, under heads of from 10 to 200 ft. and for band diameters of ⅜ to 1¼ in.

POWER GENERATION

Chesapeake and Ohio Power Plant. Chesapeake and Ohio Power Plant, C. L. Humphreys. Nat. Engr., vol. 23, no. 9, Sept. 1919, pp. 423-425, 3 figs. Plant supplies steam, air and electric power for general repair shops employing about 2500 men.

Electrification. The Energy Component in Industry. Elec. World, vol. 74, no. 12, Sept. 20, 1919, pp. 650-652, 9 figs. An analysis of extent to which power enters into manufacturing in United States. Electrification of industry is paralleled by lower unit energy costs and increased absorption of power.

France. Hydro-electric Energy in France, C. W. A. Veditz. Elec. Rev., vol. 75, no. 11, Sept. 13, 1919, pp. 438-439. How America can co-operate in hydro-electric development of France.

New Proposed Law for Controlling Development of Hydraulic Energy in France. (Le nouveau projet de loi sur les forces hydrauliques). Industrie Electrique, vol. 28, no. 652, Aug. 25, 1919, pp. 302-310. Administrative organization. (Concluded.)

Gas Works Power Plant. Gas Works Power Plants, H. C. Widlake. Gas. Jl., vol. 147, no. 2935, Aug. 12, 1919, pp. 336-338, 3 figs. Economical aspect of substituting steam engine for electric motor in gas works.

Government Ownership. Government Ownership of Water Powers and Electrochemical Industry, F. A. J. FitzGerald. Gen. Meeting Am. Electrochem. Soc., Paper no. 24, Sept. 23-26, 1919, pp. 305-317 and (discussion) pp. 317-328. Arguments advanced by advocates of government ownership are judged to be a priori and not based on actual experience. Examples of governmental activities in fields which can be undertaken by private enterprise are considered as offering evidence strongly against public ownership in such cases.

Hydraulic Steam Plants. *See Steam Hydraulic Plants.*

Interconnecting Systems. Developing Hydro-electric Power Sites. Power Plant Engr., vol. 23, no. 18, Sept. 15, 1919, pp. 806-808, 2 figs. Advantages of interconnecting system.s

Steam Hydraulic Plants. Combined Utilization of Steam Central Stations and Hydraulic Power Houses for the Distribution of Energy (L'emploi combiné des stations centrales à vapeur et des usines hydrauliques pour la distribution de l'énergie), E. de Marchena. Mémoires et compte rendu des travaux de la Société des Ingénieurs Civils de France, vol. 72, nos. 4, 5 & 6, Apr.-June 1919, pp. 278-311, 9 figs. Analysis of conditions existing in both types of central stations leads to conclusion that economical distribution of energy can best be effected by suitable combination of these two types.

United States. Growing Demand for Industrial Power, L. W. Alwyn-Schmidt. Power Plant Eng., vol. 23, no. 17, Sept. 1, 1919, pp. 774-776, 2 figs. Statistical gathered in U. S. and their economical significance.

Power Systems of the North Central States, Chester H. Jones. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 342-347, 9 figs. Statistics of present development and estimated figures of possible utilization.

POWER PLANTS

Boiler Rooms. Boiler Room Economy in Small Plants, M. B. Watson. Elec. News, vol. 28, no. 17, Sept. 1, 1919, pp. 27-28. Suggestions in regard to making systematic records. (To be concluded.)

Coal and Wood Furnaces Under Stirling Boilers. Power, vol. 50, no. 11, Sept. 9, 1919, pp. 414-417, 5 figs. Boiler plant where, it is said, $25,000 saving in coal per year is effected.

Boilers, Deterioration. Causes of Deterioration in Water Tube Boilers in Turbine Operation and Its Prevention (Die Ursachen der Zerstörungen an Wasserrohrkesseln im Turbinenbetrieb und die zu ergreifenden Gegenmassnahmen), Siegmon. Zeitschr. ds. Vereins deutscher Ingenieure, vol. 63, nos. 22 & 23, May 31, and and June 7, 1919, pp. 504-510 and 534-539, 12 figs. Causes said to be found in feed water, methods of operation and details of construction. (Concluded.)

Coal Handling. Equipment for Handling Coal and Ashes in Power Plants, Robert June. Elec. Rev., vol. 75, no. 12, Sept. 20, 1919, pp. 481-483, 3 figs. Influence of methods upon plant operation; classification of mechanical methods of handling coal and ashes; power calculations.

Condenser Tubes. Life of Brass Condenser Tubes, Guy D. Bengough and O. F. Hudson. Sci. Am. Supp., vol. 88, no. 2274, Aug. 2, 1919, pp. 75-77, Results of study of actions of certain metals in distilled and sea water, and possible protective measures. Summary of report to Inst. of Metals.

Edgewater Power House. Edgewater Power House in Operation. Power Plant Eng., vol. 23, no. 17, Sept. 1, 1919, pp. 753-760, 11 figs. Source of energy supply for North Central Ohio. Coal and water handling systems and method of reclaiming heat losses described as interesting installation features.

Engineers. Education of Power Plant Engineer, Edward H. Keauney. Nat. Engr., vol. 23, no. 9, Sept. 1919, pp. 426-430. Business methods as factor in power plant engineering. Value of intercourse with other engineers.

Erie Lighting Co. New Power Plant for Erie Lighting Co., Messrs. Day and Zimmermann. Am. Architect, vol. 116, no. 2282, Sept. 17, 1919, pp. 389-397, 18 figs. Structural framework is of steel. Turbine room has clear height of 40 ft. to lower chords of roof trusses, with crane rail located 31 ft. above floor level. Floor arches are of reinforced stone concrete.

Steam Exhaust, Utilization. Conservation of Coal by Saving Exhaust Steam in the Textile Industries, William B. Hoyt. Jl. Am. Soc. Heat & Vent. Engrs., vol. 25, no. 2, Apr. 1919, pp. 119-122. Recommendations for affecting conservation in felt mills, woolen mills and knitting mills.

Feed Water. How to Increase Boiler-Room Efficiency, D. S. Jacobus. Eng. & Contracting, vol. 52, no. 11, Sept. 10, 1919, pp. 306-307. Concerning law of efficiency due to impure feed water and bonusses for operating crews. Paper read before Am. Boiler Manufacturers' Assn.

Firing. Saving Coal in Power Plants. Universal Engr., vol. 29, no. 6, June 1919, pp. 32-37, 1 fig. Chief losses in boiler plant operation are said to be (1) dirty boiler, (2) leaky setting, (3) poor firing.

Oil Burners. Influence of Load on Pressures of Oil and Atomizing Steam in Oil Burners, C. R. Weymouth. Jl. Electricity, vol. 43, no. 5, Sept. 1, 1919, pp. 218-220, 7 figs. Charts showing results of test data in relationship of oil and steam pressures, which results in greatest boiler efficiency.

Records. Boiler-and Engine-Room Record Sheets, P. R. Duffey. Power, vol. 50, no. 12, Sept. 16, 1919, pp. 461-463, 3 figs. Illustrating various forms which are said to have been found serviceable in actual operation.

Stacks. Experiments on Stack Performance, Julian C. Smallwood. Power, vol. 50, no. 12, Sept. 16, 1919, pp. 464-467, 2 figs. Comparison of experimentally-determined temperatures, velocities and pressures with values assumed and results calculated in design.

STAND-BY OPERATION. Converting a Steam Plant to Stand-by Operation, L. M. Klauber. Power Plant Eng., vol. 23, no. 18, Sept. 15, 1919, pp. 815-817, 2 figs. Enumeration of problems encountered following tie-in with transmission service. From paper read before Pac. Coast Section, Nat. Elec. Light Assn.

SUPERHEATED STEAM. Industrial Uses of Superheated Steam, Alexander Bradley. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 2, Apr. 1919, pp. 123-132, 6 figs. Including results of comparative tests conducted by Engineering Dept. of Standard Oil Co., on oil pumping engines with saturated and superheated steam.

VACUUM. Vacuum—II, Roger Taylor. Power Plant Eng., vol. 23, no. 18, Sept. 15, 1919, pp. 809-812, 6 figs. Advantages of low pressure; controlling conditions.

PRODUCER GAS

AMMONIA IN PRODUCER GAS. Ammonia in Producer Gas, F. K. Ovitz. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp. 253-255. Tests made at factory of Hazel-Atlas Glass Co., Washington, Pa., to determine amount of ammonia in gas from producers of Smith type.

SMITH PRODUCER PLANT. Producer Gas Traction. Gas and Oil Power, vol. 14, no. 168, Sept. 4, 1919, pp. 178-180, 5 figs. Description of the Smith Producer Plant.

PUMPS

CONTROL. Automatic Pump Control, B. N. Everett. Power, vol. 50, no. 13, Sept. 23, 1919, pp. 496-499, 14 figs. Illustrating arrangements of automatic pump-control apparatus for motor and belt driven power pumps of both plunger and centrifugal types.

QUARRY Service. Pumps in Quarry Service—I. Stone. vol. 40, no. 7, July 1919, pp. 311-313. General requirements in American Quarries.

TURBINE PUMP, ELECTRIC. Economical Pumping by New Application of Electric Turbine Pump, H. Hughes. Iron & Coal Trades Rev., vol. 99, no. 2685, Aug. 15, 1919, pp. 210-211, 4 figs. Installation at Nantgarw Colliery which is 860 yards deep, for pumping 10,000 gallons of water per hour.

VACUUM PUMPS. A Volumetric Efficiency Test of a Vacuum Pump, George S. Tayman. Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 823-824. Pump tested was Laidlaw-Dunn-Gordon Duplex dry vacuum pump, size 18 in. by 12 in., when operating under different intake and discharge pressures.

WEIR, TURBO-FEED PUMP. The Weir Turbo-Feed Pump. Iron & Coal Trades Rev., vol. 99, no. 2685, Aug. 15, 1919, p. 203, 4 figs. Of impulse type with one pressure and several velocity stages.

REFRACTORIES

HAYDITE. Prominent Clay Men Organize to Make New Building Material. Brick & Clay. Rec., vol. 55, no. 6, Sept. 9, 1919, pp. 484-487, 2 figs. Historical account of development and outline of physical properties of "Haydite."

REFRIGERATION

BOYLE CURVE. *See Refrigerating Machinery.*

CODE, REFRIGERATING. Proposed Refrigerating Code. Power Plant Eng., vol. 23, no. 18, Sept. 15, 1919, pp. 825-827, 2 figs. As outlined for municipal and State regulations for refrigeration machines and plants. Approved by Council of Am. Soc. Refrig. Engrs.

DEHYDRATION. Dehydration in Absorption Machines, John E. Starr. Refrig., World, vol. 54, no. 9, Sept. 1919, pp. 11-12. Suggests keeping gas between the dehydrator and condenser at temperature 8° or 10° above temperature corresponding to pressure actually existing in condenser.

FOOD STORAGE. Cold Storage of Food—I and II, Ingrar Jorgensen and Walter Stiles. Sci. Am. Supp.. vol. 88, nos. 2279 and 2281, Sept. 6 and 20, 1919, pp. 150-151 and 178 and 192. Sept. 6: Technical considerations involved in developing appropriate types. Sept. 20: Concerning physical changes in meat preserved by cold storage. (From Science Progress, London.)

ICE-MAKING. Ice-Making in Florida. Southern Engr., vol. 32, no. 1, Sept. 1919, pp. 51-53, 5 figs. Main units consist of two 60-ton vertical Frick ammonia compressors, each driven by 15 x 28 x 28-in. tandem-compound Corliss engine.

PACKING HOUSES. Refrigerating Troubles in a Packing House Plant, J. C. Moran. Power, vol. 50, no. 12, Sept. 16. 1919, pp. 459-461, 2 figs. Remedying troubles due to inadequate cooling coil surface.

REFRIGERATING MACHINES. The Compression Refrigerating Machine, Gardner T. Voorhees. Ice & Refrigeration, vol. 57, no. 3, Sept. 1919, pp. 93-95, 1 fig. Construction and significance of Boyle curve. (Continuation of serial.)

See also Testing.

REFRIGERATING PLANTS. Getting a Refrigerating Plant Out of a Critical Situation, J. C. Moran. Power, vol. 50, no. 11, Sept. 9, 1919, pp. 429-430, 1 fig. Additional capacity secured by connecting individual branches to each of three ammonia compressors from top of main line instead of bottom.

TESTING. Rules for Testing Compresssion Refrigerating Plants (Regeln für Leistungsversuche an Kompressions-Kühlanlagen), Karl Fehrmann. Zeitschrift für die gesamte Kalte-Industrie, vol. 26. no. 4, Apr. 1919, pp. 25-28. Testing efficiency of evaporator; power consumption of condenser; water consumption of liquifier; power consumption of pumps, agitator, etc.

STANDARDS AND STANDARDIZATION

ECONOMIES. Industrial Viewpoint on Standardization, E. E. George. Elec. World, vol. 74, no. 12, Sept. 20, 1919, pp. 635-636. Instances emphasizing economies resulting from fixing standards.

ENGINEERING STANDARDS COMMITTEE. Engineering Standards Committee Proposes New Constitution. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 575-576. New draft provides for taking in other societies on equal basis and association plan for outside financing dropped.

GLASSWARE LABORATORY. Report of the Committee on the Standardization of Laboratory Glassware. Jl. Soc. Chem. Indus., vol. 38, no. 15, Aug. 15, 1919, pp. 280R-285R, 2 figs. Metric dimensions and capacities of accepted standards for cylindrical beakers, flasks, funnels, drying towers and graduated operators.

PYROMETER STANDARDIZATION. Metals for Pyrometer Standardization, Charles W. Waidner and George K. Burgess. Bul. Am. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1511-1512. Summary of work done by Bureau of Standards, with table giving values of freezing points and purity of standard pyrometric metals.

STANDARD DETERIORATION. Standardization, J. Fearn. Managing Engr., vol. 6, no. 4, Aug. 1919, pp. 83-86 and discussion, pp. 86-90. Necessity of conducting research work for determining standards.

STEEL STANDARDS. Foreign Steel Standards Compared to Ours—I, F. F. Macintosh. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 432-434. Although American practice is said to outstrip foreign competition in tonnage and cost, higher quality is considered as predominant characteristic of European Steel.

RESEARCH

CHEMICAL RESEARCH. Research and Application, Wm. H. Nichols. Science, vol. 50, no. 1288, Sept. 5, 1919, pp. 217-224. Illustrating by survey of chemical progress how research work has furthered scientific development. Also notes on appreciation of its importance by associations and organizations, principally Am. Federation of Labor. Paper read before Am. Chem. Soc.

UNIVERSITIES. The New Opportunity in Science, R. A. Millikan. Science, vol. 50, no. 1291, Sept. 26, 1919, pp. 285-297. Argues that universities cannot possibly fulfill their function of selecting and developing scientific men of outstanding ability unless they create within themselves the atmosphere of scientific research.

STEAM ENGINEERING

BLEEDER TURBINES. The Bleeder Turbine, Joseph Y Dahlstrand. Power Plant Eng., vol. 23, no. 17, Sept. 1, 1919, pp. 762-768, 13 figs. Its use, design and construction.

BLOWING BOILERS. An Apparatus for Surface Blowing of Boiler Water (in Japanese), T. Safto. Jl. Soc. Naval Architects, vol. 24, Apr. 1919.

BOILERS. An Improved Steam Boiler. Am. Marine Eng., vol. 14, no. 9, Sept. 1919, pp. 20-21, 3 figs. Primary object of invention is to obtain maximum steaming capacity for given area of grate surface, water passages being so arranged that proper circulation of water is insured and liberation of steam facilitated.

BOILERS, CLEANING. How Much Fuel Does a Clean Boiler Save? W. F. Schaphorst. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 456-457, 1 fig. Chart for determining fuel saved by clean boilers.

BOILER DETERIORATION. Causes of Deterioration in Water Tube Boilers in Turbine Drives and Their Prevention (Die Ursachen der Zerstörungen an Wasserrohrkesseln im Turbinenbetrieb und die zu ergreifenden Gegenmassnahmen), Siegmon. Zeitschrift des Ver. Deutsche Ingenieure, vol. 63, no. 21, May 24, 1919, pp. 473-479, 10 figs. Describes experiments with various methods of prevention and one finally adopted, viz., adding of oil to feed water.

See also Power Plants (Boiler Deterioration).

BOILER FITTINGS. Fittings for Steam Boilers—I, Edward Ingham. Colliery Guardian, vol. 118, no. 3060, Aug. 22, 1919, p. 489. Concerning arrangement of safety valves on large boilers.

BOILER PLUGS, FUSIBLE. Tin Fusible Boiler-Plug Manufacture and Testing, L. J. Gurevich and J. S. Hromatko. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1351-1360, 5 figs. From tests at Bureau of Standards, precautions to be taken in manufacture of fusible plugs are recommended, notable that pig tin should be at least 99.7 per cent pure, containing not more than 0.1 per cent lead, or 0.1 per cent zinc, which are requirements of Steamboat Inspection Service.

BOILERS, LOW-PRESSURE. Code for Testing Low Pressure Heating Boilers. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 2, Apr. 1919, pp. 212-214, and (discussion), pp. 215-218. Revision of form accepted by Soc. of Heat. & Vent. Engrs. in Jan. 1918.

Cracking of Cast-Iron Sectional Hot Water Boilers, Charles R. Honiball. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 25, no. 2, Apr. 1919, pp. 133-140. Results of investigations claimed to point out that to avoid cracking it is necessary to provide for easy and equable working avoidance of air locks or steam formation, continuous circulation and avoidance of deposit.

BOILERS, SUPERHEATED-STEAM. Boiler for Compound Superheater Engines, Midland Railway. Ry. Engr., vol. 40, no. 476, Sept. 1919, pp. 186-190, 13 figs. Constructed for working pressure of 225 lb. per sq. in., but safety valves for compound engines are adjusted to blow off at 190 lb. per sq. in. Fire box is of Belpaire type with inclined grate.

BOILERS, WATER-TUBE. The Cross Drum Type Heine Water Tube Boiler. Mar. Eng. & Can. Merchant Service Guild Rev., vol. 9, no. 8, Aug. 1919, pp. 271-273, 3 figs. Particularly as fitted in ships of United States Emergency Fleet.

Powdered Coal. Burning Pulverized Coal under the Boiler, Frederick A. Scheffler and H. G. Barnhurst. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, 451-454, 2 figs. Tables showing results of tests on pulverized fuel plants and data regarding installation boilers.

See also Fuel and Firing (Powdered Coal.)

Steam Engines, Single-Acting, High-Speed. A Single-Acting High-Speed Steam Engine, E. F. Truscott. Model Engr. & Elecn., vol. 41, no. 954, Aug. 7, 1919, pp. 121-123, 9 figs. Patented design with twin cylinders having cranks at 180 deg.

Turbines. Low-Pressure Turbines in Forge Shops, H. V. Schoepflin. Power, vol. 50, no. 12, Sept. 16, 1919, pp. 450-453, 6 figs. Economy of utilizing exhaust steam from hammers instead of wasting it to atmosphere. Details of apparatus required and problems to be considered in application.

Refinements in Turbine Design, A. G. Christie. Power, vol. 50, no. 10, Sept. 2, 1919, pp. 362-364, 4 figs. Article deals with forms of throats and mouths of nozzles, polished surfaces for diaphragms and thickness of blade edges.

Steam Turbines and Gears for Marine Service. Power, vol. 50, no. 11, Sept. 9, 1919, pp. 424-426, 4 figs. Greater speed for given weight of power plant, less operating expense, greater reliability, saving in fuel and greater efficiencies claimed as principal advantage of turbine drive with reduction gear for ship propulsion.

Valves, Drop. Notes on Drop Valves for Steam Engines, H. W. Morley. Sci. Am. Supp., vol.88, no. 2280, Sept. 13, 1919, pp. 164-165, 4 figs. Results of experience with slow-speed land engines discussed in their significance to designing other types.

THERMODYNAMICS

Heat Interchangers. Heat Interchangers (Echangeurs de Chaleur), G. Bastein. Mémoires et compte rendu des travaux de la Société des Ingénieurs Civils de France, vol. 72, nos. 4, 5 & 6, Apr.-June 1919, pp. 183-237, 3 figs. Theoretical analysis of phenomena taking place in heat interchangers operating by contact of two fluids with separating medium.

Latent Heat Formulae. Latent Heat and Surface Energy—I, D. L. Hammick. Edinburgh & Dublin Phil. Mag., vol. 38, no. 224, Aug. 1919, pp. 240-245. Expression connecting internal latent heat and surface energy, and discussion of its agreement with available data.

WELDING

Aluminum. New Method for Soldering Aluminum (Ein neues Verfahren zum Löten von Aluminium). Autogene Metallbearbeitung, vol. 12, no. 4, Apr. 1919, pp. 57-62. 12 figs. Using "Foramus" solder, which is made in bars 4, 7 and 10 mm. thick and can be used for soldering sheets, pipes, aluminum with copper, and is also made in a special quality with low melting point for repairing delicate aluminum parts.

Boiler-Welding. Standard Boiler Welding. Welding Engr., vol. 4, no. 9 Sept. 1919, pp. 21-25, 27 figs. Oxy-acetylene and electric welding on the Kansas City Southern Railroad.

Electric Welding. Electric Welding: Its Theory, Practice, Application and Economics, H. S. Marquand. Elecn., vol. 83, nos. 2152, 2153 and 2154, Aug. 15, 22 and 29, 1919, pp. 175-176, 194-196 and 217-219. 14 figs. Aug. 15: Example of welding broken cast-steel crankshaft. Aug. 22: Discusses economics effected by machine welding and describes testing of electric welds. Aug. 29: Economical advantages of machine welding.

Welding by Electricity, Jos. Grine. Ry. Jl., vol. 25, no. 9, Sept. 1919, p. 16, 4 figs. Illustrating repairing of broken cylinder of H-6 type locomotive where front of valve chamber and exhaust port as well as upper half of cylinder were broken.

The Plastic-Arc Welding System. Engineer, vol. 128, no. 3316, July 18, 1919, pp. 56-57, and 60, 8 figs. It was by means of this system that German steamers interned in American harbors were repaired. Article describes system with reference to manner in which it was applied to repairing ships.

The A. C. System of Arc Welding. Engineer, vol. 128, no. 3322, Aug. 29, 1919, pp. 213-214, 4 figs. With exposition of advantages claimed for this system.

Iron and Steel and the Welding of Each, E. Wanamaker and H. R. Pennington. Ry. Elec. Engr., vol. 10, no. 9, Sept. 1919, pp. 305-308, 3 figs. Study of effect of arc and of properties, composition and classification of metals.

Electric Arc Welding as it Stands To-day (Der heutige Stand der elektrischen Lichtbogen-Schweissverfahren), Schimpke. Das Metall, vol. 1919, no. 10, May 25, 1919, pp. 131-133, 3 figs. Discussion of the Benardos, Slavianoff, Zerener, Kjellberg and other methods.

Jigs. Welding Jigs and How to Overcome Distortion, C. S. Milne. Can. Machy., vol. 22, no. 9, Aug. 28, 1919, pp. 228-229, 2 figs. Illustrating welding fracture in rim of cast iron gear wheel to transmit 240 hp. (Concluded.) Paper read before British Acetylene & Welding Assn.

Oxy-Acetylene Welding. Oxy-Acetylene Welding Instruction for Shop Work, Alfred S. Kinsey. Gas Age, vol. 44, no. 5, Sept. 1, 1919, pp. 203-206, 5 figs. Illustrating repair work.

The Judgment of the Oxy-Acetylene Process, Alfred S. Kinsey. Can. Machy., vol. 22, no. 11, Sept. 11, 1919, pp. 280-281. Sees process as engineering success and fine commercial asset.

Oxy-Hydrogen Gas Welding. Oxy-Hydrogen Gas—Its Uses at the J. I. Case Thresbing Machine Company, Manufacturers of Tractors and Farm Implements, Charles Kandel. Am. Gas. Eng. Jl., vol. 111, no. 11, Sept. 13, 1919, pp. 219-222, 5 figs. Purity of gases produced insures maximum efficiency for cutting and welding parts of Case farm implement products.

Weld Production. Some Interesting Welds (Einige interessante Schweissarbeiten). Autogene Metallbearbeitung, vol. 22, nos. 7-8, Apr. 1919, pp. 31-32, 6 figs. High-pressure distributor; cooling aggregate; pressure cylinder; tank car for high-pressure gases.

Repairing Engine Cylinders by Autogenous Welding (Ueber die Ausbesserung schadhafter Motorzylinder mittels der autogenen Schweissung). Autogene Metallbearbeitung, vo. 22, no. 7-8, Apr. 1919, pp. 27-30, 2 figs. Preventing hard seams and dripping of iron from welds. (To be continued.)

Interesting Examples of Welding and Cutting, Frank C. Perkins. Can. Machy., vol. 22, no. 5, July 31, 1919, pp. 135-137, 6 figs. Discussing the oxy-acetylene and oxy-hydrogen methods together with detailed data; American and French torches are described.

Wrought Iron Welding. Welding Wrought Iron and Steel, H. L. Unland. Elec. Ry. Jl., vol. 54, no. 12, Sept. 20, 1919, pp. 581-582. Suggestions in regard to practical procedure.

WOOD

Laminated Wood. Reducing Shrinkage and Swelling in Laminated Wood Construction, J. S. Mathewson. Aviation, vol. 7, no. 3, Sept. 1, 1919, p. 140. Remarks based on experimental research conducted at U. S. Forest Products Laboratory.

VARIA

Atmospheric Pollution. Atmospheric Pollution from the Engineer's Standpoint, John B. C. Kershaw. Engineer, vol. 128, no. 3322, Aug. 29, 1919, pp. 197-198. Information contained in report of Advisory Committee attached to Meteorological Office deals with results obtained by observation of atmospheric pollution in London, Manchester, Glasgow and other towns in the years, 1917-1911.

Bibliographic Classification. Role and Importance of a Universal Bibliographic Classification (Role et importance d'une classification bibliographique universelle.) Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 4, July and Aug. 1919, pp. 67-69. Comparative study of decimal classification used by International Institute of Bibliography and numerical alphabetic classification of the International Catalogue of Scientific Literature In former each article is classified with number in which each figure represents standard branches of signs according to adopted scale; in latter classification is made by means of letters and numbers.

Boxes, Packing. On the Packing Box (In Japanese), Katsuzo Okamoto. Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 22, no. 57, June 1919.

Control of Industries, British. The Control of Industry: Nationalisation and Kindred Problems. Ry. Gaz., vol. 31, no. 8, Aug. 22, 1919, pp. 233-234. Comments and recommendations of a Committee of the Federation of British Industries, representative of some 18,000 manufacturing and producing firms having a united capital of $25,000,000,000.

Diving Suit. Self-Contained Diving Suit Providing Normal Respiration (Scaphandre autonome à respiration normale), A. Boutan. Jl. des Usines à Gaz, vol. 43, no. 15, Aug. 5, 1919, pp. 233-237, 2 figs. Air made to pass through device formed of thin sheets wet with caustic potash solution.

Farm Equipment. What Engineering and Agriculture Can Do to Increase Earning Possibilities in Rural Districts (Aufgaben fur Technik und Landwirtschaft zur Hebung der Erwerbsmöglichkeit auf dem Lande), Kurt Krohne. Zeitschrift des Vereins deutscher Ingenieure, vol. 63, no. 20, May 17, 1919, pp. 449-455, 5 figs. Efficiency of small farming enterprises; requirements of mechanical devices in agriculture; selecting mechanical farm equipment.

Interchangeable Manufacture. Terms Used in Interchangeable Manufacturing, E. Buckingham. Machy. (Lond.), vol. 14, no. 361, Aug. 28, 1919, pp. 653-655, 4 figs. Definitions explaining practical limitations.

Metric System. Not Ten But Twelve! Wm. Benj. Smith. Science, vol. 50, no. 1289, Sept. 12, 1919, pp. 239-242. Against adoption of metric system in United States and Great Britain.

Patent Law, British. Broader Conditions in Proposed British Patent Law. Automotive Industries, vol. 41, no. 11, Sept. 11, 1919, pp. 524-525. As of interest to American manufacturers. Provisions under which any person may apply to controller alleging that there has been abuse of monopoly rights under a patent and asking for relief, are quoted.

Petroleum Engineer's Education. Mid-Continent Section Meeting of A.S.M.E. Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 816-817. Suggests outlines of course (1) as technical preparation for petroleum field engineering, (2) in petroleum refining engineering, (3) in petroleum production engineering.

Public Works Department. National Public Works Department versus Corps of Engineers, Isham Randolph. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 561-562. Passage of Jones-Reavis bill urged on ground that great harm would result from injection of military system into activities of civil life.

METALLURGY

ALUMINUM

Alloys. Constitution and Metallography of Aluminum and Its Light Alloys with Copper and with Magnesium, P. D. Merica, R. G. Waltenberg and J. R. Freeman, Jr. Dept. of Commerce, Scientific Papers of Bur. of Standards, no. 337, Aug. 16, 1919, pp. 105-119, 28 figs., partly on eight supplement plates. Temperature-solubility curves of $CuAl_2$ and Mg_4Al_3 in aluminum determined by method of annealing and microscopic examination. Aluminum said to dissolve about 4.2 per cent copper as $CuAl_2$ at 525 deg. cent. and about 12.5 per cent. magnesium at Mg_4Al_3 at 450 deg. cent.

Aluminum Alloys (Quelques Alliages divers d'Aluminium), J. Escard. Métaux, Alliages et Machines, nos. 7-8, July-Aug. 1919, pp. 1-4. Alloys used for making machine parts which are subjected to continuous friction. (Concluded).

Aluminum, Aluminum Alloys and their Strengths (Betrachtungen über Aluminium, Aluminiumlegierungen und deren Festigkeit.), Hugo Rieger. Giesserei-Zeitung, vol. 16, no. 10, May 15, 1919, pp. 151-153. Results of tests made by German Imperial Navy Office. Compositions of various alloys. (Concluded.)

The Effect of Amalgamation upon the Single Potentials of the Binary Alloys of Aluminum with Copper, Zinc and Nickel, Louis Kahlenberg and John A. Montgomery, General Meeting of the Am. Electrochem Soc., paper no. 12, Sept. 23-26, 1919, pp. 123-156, 13 figs. Experiments showed that by amalgamation initial potentials of alloys which contained less than 35 per cent of nickel were much higher than potentials measured upon unamalgamated specimens. Just as in aluminum copper series, there was a break in curve plotted from readings made upon amalgamated alloys of aluminum and nickel.

Studies of technical Aluminum Alloys (Studien über technische Aluminiumlegierungen), E. H. Schulz. Metall und Erz, vol. 7, no. 5, March 8, 1919, pp. 91-101, 30 figs. Aluminum alloys, partly annealed and partly cold worked were tested as to their strength and resistance to corrosion; these alloys contained besides small quantities of manganese and magnesium either 7 per cent zinc or copper up to 4 per cent.

BLAST FURNACES

AIR, PREHEATING. Conditions required for obtaining favorable Results in Preheating of Air in Blast Furnaces (Die thermischen baulichen und betrieblichen Bedingungen für einen günstigen Wirkungsgrad der Winderhitzung bei Hochöfen), Hugo Bansen. Stahl u. Eisen, vol. 39, no. 19, May 9, 1919, pp. 493-497, 5 figs. Amount of air and temperature of air; heating area; size of heater, radiation losses and their dependence on amount of exhaust and its velocity. (To be concluded.)

GAS WASHERS. Increasing Wet Gas Washer Efficiency, George B. Cramp. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 430-432. Suggests use of corrugated sheets for baffles in blast furnace gas washer to more thoroughly clean gas and to increase available cleaning surface.

POWDER COAL. Pulverized Coal in Blast Furnaces. Iron & Coal Trades Rev., vol. 99, no. 2685, Aug. 15, 1919. pp. 204-205, 4 figs. Account of experiments conducted at various places, notably at Tennessee Copper Co.'s Smelter.

COPPER AND NICKEL

NICKEL-COPPER ALLOYS. Magnetic Properties of Nickel and Copper Alloys (Propiedadies magnéticas de las Aleaciones de Niquel y Cobre), Antonio Fonseca. Contribucion al estudio de las ciencias fisicas y matematicas, Universidad Nacional de la Plata, vol. 11, no. 36, July 1918, pp. 175-191, 7 figs. Experimental. It is concluded that contrary to Tammann's supposition solutions of ferromagnetic metals in non-magnetic crystals may produce ferromagnetic alloys; also nickel and copper alloys are placed in type IV of Roozeboom's mixtures.

ROLLING SHEET COPPER. Influence of Preparation and Rolling on Sheet Copper, W. Müller. Metal Industry, vol. 15, no. 6, Aug. 8, 1919, pp. 101-102. Experimental study of influence of degree of rolling, method of preparation and direction of rolling on properties of sheet copper and also effect of pre-treatment on results of annealing. (From Forshungsarbeiten auf dem Gebiete des Ingenieurwesens.)

FERROUS ALLOYS

ELECTRIC FURNACE. The Manufacture of Ferro-Alloys in Electric Furnaces, C. B. Gibson. Elec. Jl., vol. 16, no. 9, Sept. 1919, pp. 366-372, 3 figs. Including commercial uses of the various alloys and manner of computing required power to accomplish smelting reaction.

FLOTATION

COLLOIDS. Notes on Troubles from Colloids in Flotation. Eng. & Min. Jl., vol. 108, no. 12, Sept. 20, 1919, pp. 510-512. Survey of opinions of flotation experimenters, particularly in regard to whether physical or chemical qualities of primary slime are responsible for its action on flotation.

COPPER. The No. 1 Concentrator of the Mountain Copper Company, Lloyd C. White. Min. & Sci. Press, vol. 119, no. 10, Sept. 6, 1919, pp. 331-334, 4 figs. Flow-sheet of mill, which is said to be one of first in California to use flotation.

A Metallurgical Journey to Shasta, California—V, Herbert Land. Min. & Sci. Press, vol. 119, no. 12, Sept. 20. 1919, pp. 397-400. Smelter fume; the Fields and Hall process; flotation concentrate.

FURNACES

Application of Electrical Energy to the Melting of Metals, H. A. Greaves. Elect., vol. 83, no. 2155, Sept. 5, 1919, pp. 256-257, 5 figs. Method said to enable three-phase or two-phase current to be applied to a furnace with unequal resistance in one of phases and still maintain a balanced load as regards both power and power factor on primary phase. From paper read before Instn. Elec. Engrs.

BRASS MELTING, ELECTRIC. Electric Brass Melting—Its Progress and Present Importance, H. M. St. John. Elec. Jl., vol. 16, no. 9, Sept. 1919, pp. 373-380. Advantages claimed for electric melting are metal saving, improved quality, exact temperature control, increased production, elimination of crucible cost, economical operation of large units and better working conditions.

Operating Brass-Making Induction Furnaces, R. N. Blakeslee, Jr. Elec. World, vol. 74, no. 12, Sept. 20, 1919, pp. 642-644, 4 figs. Experience dealing with problems of furnace lining, charging, mixing of zinc and removal of zinc oxide deposit.

CRUCIBLE FURNACES. Electric Furnace Developments for Metals. Metal Indus., vol. 17, no. 9, Sept. 1919, pp. 424-427, 6 figs. Crucible in which heat is produced directly in crucible wall.

ELECTRIC FURNACES, TESTING. Commercial Testing of Metallurgical Electric Furnaces, H. M. St. John Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 377-392, 5 figs. Interpretation of collected data, summarizing results, conclusions as to suitability, reliability, production, cost of operation and maintenance and other considerations.

MOFFAT ELECTRIC STEEL FURNACE. The New Moffat Electric Steel Furnace, W. F. Sutherland. Mar. Eng. & Can. Merchant Service Guild Rev., vol. 9, no. 8, Aug. 1919, pp. 288-289, 3 figs. In order to prevent trouble encountered by reason of crescent-shaped masses of partially fused raw material found clinging to walls between electrodes, body of furnace is shaped to conform to lines of current flow in bath of molten metal.

ROSENHAIN FURNACES. Use of Modified Rosenhain Furnace for Thermal Analysis, H. Scott and J. R. Freeman, Jr. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1429-1435, 5 figs. Modification consisted of substituting in place of motor propulsion a gravity drive controlled by hydraulic cylinder with relief valve, the opening of which was regulated to allow of any desired rate of motion.

STEEL FOUNDRIES, ELECTRIC. Electric Furnaces for Steel Foundries, W. E. Moore. Elec. Jl., vol. 16, no. 9, Sept. 1919, pp. 360-366, 3 figs. With historical introduction of development of electric furnaces and table showing comparison of open hearth and electric furnace steel.

STEEL FURNACE. Developments in Electric Iron and Steel Furnaces, J. Bibby. Elecn., vol. 83, no. 2154, Aug. 29, 1919, pp. 214-216, 3 figs. Including graphs showing fuel and energy consumption for electrical reduction of magnetite. From paper read before Instn. of Elec. Engrs.

ZINC, ELECTRIC ROASTING. Electrolytic Zinc. C. A. Hansen. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1247-1281, 16 figs. Description and operation of experimental electric roasting furnace.

IRON AND STEEL

CARBON-FREE ALLOYS. Electrical Production of Carbon-Free Alloys, E. F. Northrup. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp. 258-259, 2 figs. Scheme of furnace.

CAST IRON. Cast Iron under Heat Influences, E. Adamson. Iron & Coal Trades Rev., vol. 99, no. 2686, Aug. 22, 1919, pp. 239-240, 2 figs. Experiments made by writer and other investigators studied to determine influence of temperature on molecular structure of cast iron.

COMPOSITION. The Effect of Certain Elements on the Properties of Steel, N. J. Gerbert. Jl. Am. Steel Treaters Soc., vol. 1, no. 10, Sept. 1919, pp. 349-359. Shows by means of examples how to proceed in order to obtain a steel complying with specific requirements from a carbon steel containing a known percentage of carbon.

ELECTROLYTIC IRON. Manufacture, Properties and Industrial Utilization of electrolytic Iron (Fabrication, propriétés et utilisation industrielle du fer électrolytique), Jean Escard. Genie Civil, vol. 75, nos. 8, 9 and 10, Aug. 23, 30 and Sept. 6, 1919, pp. 165-171, 199-201 and 225-226, 16 figs. Aug. 23: Historial account of development of manufacturing process; photomicrographs showing structure of various specimens Aug. 30: Curves showing variation of electric resistance, thermoelectricity and expansion of electrolytic iron; also hysteresis curve of ordinary iron compared with that of electrolytic iron. Sept. 6: Comparative graphs showing variation in length of electrolytic iron bars and nickel steel bars under influence of heat. (Concluded.)

FERRITE CRYSTALLIZATION. Inclusions and Ferrite Crystallization in Steel, Edward G. Mahin. Jl. Indus. & Eng. Chem., vol. 11, no. 8, Aug. 1, 1919, pp. 739-745, 33 figs. Technical study and experimental research lead to following conclusions: (1) Recurrence of ferrite ghosts after repeated thermal treatment is due largely to phosphorus banding, and (2) that even after phosphorus distribution has been made uniform, repeated heating followed by slow cooling still leaves inclusions surrounded by ferrite.

FRACTURES. On the Inter-crystalline Fracture of Metals under Prolonged Application of Stress (Preliminary Paper), Walter Rosenhain and Sydney L. Archbutt. Proc. Roy. Soc., vol. 96, no. A674, Aug. 1, 1919, pp. 55-68, 8 figs. partly on three supplement plates. As result of observations theory is put forward that constituent crystals of metal are held together by amorphus inter-crystaline cement, which in some metals is sufficiently mobile to yield to tendency of any applied stress to produce flow.

HIGH-SPEED STEEL. British Practice in High-Speed Steel. Iron Age, vol. 104, no. 11, Sept. 11, 1919, pp. 703-707, 8 figs. Investigation of forging operations of cogging, rolling, etc. It is believed that, for an efficient forging, temperatures must be used which are appreciably higher than those generally accepted as correct.

IMPURITIES. Reducing Non-Metallic Impurities in Steel, L. B. Lindemuth. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 445-447. Selection of runner bricks, temperature control and rate of pouring considered as essential. First quality bricks for ladle lining.

INCLUSIONS. *See Ferrite Crystallization.*

LIME. The Uses of Lime in Ore Dressing and Metallurgy, Paul T. Bruhl. Rock Products, vol. 22, no. 16, Aug. 16, 1919, pp. 33-35. Noting limiting impurities.

MAGNET STEEL. Steel for Magnets—VI. Mech. World, vol. 66, no. 1704, Aug. 29, 1919, pp. 100-101, 2 figs. Magnetic testing. (Continuation of serial).

MANGANESE STEEL. Manganese-Steel Making by the American Manganese Steel Company. Metal Trades, vol. 10, no. 9, Sept. 1919, pp. 387-391, 7 figs. General layout and notes on operation. Three-ton Herould furnace with basis lining of magnesite brick is used.

Metallurgical Calculation. Modern Steel Metallurgical Calculations—II, Charles H. F. Bagley. Blast Furnace & Steel Plant, vol. 7, no. 9, Sept. 1919, pp. 427-430. Bessemer acid process; Bessemer basic process; basic open hearth process with direct molten metal; cold pig and scrap in hot metal open hearth basic practice. Paper read before British Iron & Steel Inst.

Sheet Manufacture. Features of the Iron and Steel Sheet Industry—II. Raw Material, vol. 1, no. 6, Aug. 1919, pp. 290-297, 10 figs. Commercial varieties of sheets and qualities imparted to them by different processes.

Transformations. Effect of Rate of Temperature Change on the Transformations in an Alloy Steel, Howard Scott. Dept. Commerce, Scientific Papers of Bur. of Standards, no. 335, July 10, 1919, 100 pp., 7 figs. Results of previous investigators taken to show that with occurrence of a split transformation on cooling alloy steels from increasingly higher temperatures (1) when higher temperature transformation *Ar'* is observed with low values of *T* maximum, troostite or a decomposition product results and (2) when lower temperature transofrmation *Ar''* is observed with high values of *T* maximum, martensite is resulting product.

NON-FERROUS ALLOYS

Alloys. Alloys and how they are made (Ausgewählte Kapitel aus der Legierungskunde), E. H. Schulz. Das Metall, no. 9, May 10, 1919, pp. 118-120. Influence on the physical properties of method of pouring and time of cooling; combination of alloys with very low melting point; German silver alloy. (To be continued.)

Brass. Thermal Expansion of Alpha and of Beta Brass Between 0 and 600° C, in Relation to the Mechanical Properties of Heterogeneous Brasses of the Muntz Metal Type, P. D. Merica and L. W. Schad. Bul. Bur. of Standards, vol. 14, no. 4, July 12, 1919, pp. 571-590, 15 figs. Measurements showing difference in thermal expansion of alpha and of beta brass of compositions which normally are in equilibrium in such alloys as Muntz metal, naval brass, etc.

Lead Alloys. Lead-Sodium-Mercury and Lead-Sodium-Tin Alloys (Ueber Blei-Natrium-Quecksilber- und Blei-Natrium-Zinn-Legierungen), J. Goebel. Zeitschrift des Vereins deutscher Ingenieure, vol. 63, no. 19, May 10, 1919, pp. 424-430, 32 figs. Constitution, hardness, flexibility.

Zinc Alloys. Study of Copper-Aluminum-Zinc Alloys with high Percentage of Zinc (Studie über die hochzinkhaltigen Kupfer-Aluminum-Zink-Legierungen), E. H. Schulz and M. Waehlert. Metall und Erz, vol. 7, no. 8, Apr. 22, 1919, pp. 170-176, 38 figs., partly on supp. plate. Thermic and metallographic tests; Zn-Cu and ZnAl systems; surface of melting diagram. (To be concluded.)

OCCLUDED GASES

Deoxidation of Steel. Determining Gases in Steel and the Deoxidation of Steel, J. R. Cain. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1309-1322. Report of work at U. S. Bureau of Standards.

Gases, Chemical Effects. Experiments to determine Chemical Effects of Gases on Iron and whether they follow definite Law; also Nature of their Combinations with non-metallic Bodies at Higher Temperatures (Untersuchungen über die Gesetzmässigkeit der chemischen Einwirkungen der Gase auf Eisen und seine Verbindungen mit Nichtmetallen bei höheren Temperaturen), Friedrich Schmitz. Stahl u. Eisen, vol. 39, no. 15 & 16, Apr. 10 & 17, 1919, pp. 373-381 & 406-413, 10 figs. Changeability of dissociation temperatures; practical application of ability of dissociation of chemical combinations. Tempering with hydrogen.

MICROPHOTOGRAPHY

Aluminum Ingots. Metallography of Aluminum Ingot, Robert J. Anderson. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp. 229-234, 32 figs. Study of microstructure, with notes on influence of quality of ingot on resultant castings and a tentative explanation of differential etching. Extract from forthcoming publication of Bur. of Mines.

Radiometallography. (La radiométallographie.) Revue générale de l'Electricité, vol. 6, no. 8, Aug. 23, 1919, pp. 231-233, 10 figs., on two supplement plates. Account of experiments performed and apparatus developed for applying radiometallography in industry. Paper read before joint meeting of Faraday and Tontgen Societies.

Radiometallography, Robert Hadfield. Jl. Am. Steel Treaters Soc., vol. 1, no. 8, May 1919, pp. 256-269, 12 figs. Account of Professor Bragg's researches in England. Also summary of various contributions to furthering industrial application of radiometallography, which have appeared in various leading journals in America, France, Japan and Germany.

Steel, Galvanized. Metallographical Study on Galvanized Steel (In Japanese), Y. Taji. Jl. Soc. Naval Architects, vol. 24, Apr. 1919.

MINING ENGINEERING

BASE MATERIALS

Gravel. *See Sand.*

Gypsum. Progress of the Gypsum Industry, Curtis F. Columbia. Cement, Mill & Quarry, vol. 15, no. 5, Sept. 5, 1919, pp. 13-16, 3 figs. Prospecting, quarrying and mining, and growth of production.

Magnesite. The Magnesite Industry in the United States, W. C. Phalen. Min. & Sci. Press, vol. 119, no. 9, Aug. 30, 1919, pp. 295-298, 5 figs. Bases on data compiled by U. S. Geological Survey, Div. of Mineral Resources.

The Magnesite Industry. U. S. Tariff Commission, Washington, 1919. 23 pp. Prepared for use of Committee on Ways and Means House of Representatives.

Magnesite: Its Geology, Products and Their Uses, C. D. Dolman. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1193-1202, 2 figs. Notes on magnesite industry in Washington and its possibilities. With abundant water-power available on Spokane, Pend Oreille and Kettle Rivers and with raw materials, such as clays, waste wood and magnesite in large quantities close at hand, writer sees great opportunities for building up important and revolutionizing industries in Northwest.

Magnetite. The Magnetic Properties of Varieties of Magnetite, Ernest Wilson and E. F. Herroun. Phys. Soc. of London, vol. 31, no. 5, Aug. 15, 1919, pp. 299-315 and discussion pp. 315-318, 2 figs. Examination of crystallized, compact specimens and detached particles In each case susceptibility was found to vary with magnitude of magnetizing force after manner of iron, relative variation being much more pronounced in case of specimens having higher susceptibility.

Marble. The Marble of Spitzbergen. Stone, vol. 40, no. 7, July 1919, pp. 317-318. Particulars of deposit.

Sand. Nature, Origin and Properties of Sand. Rock Products, vol. 22, no. 17, Aug. 16, 1919, pp. 23-25, 1 fig. Classification of sand. Physical properties. Second article.

Sand and Gravel in Ontario, A. Ledoux. Report Ontario Bureau of Mines, vol. 27, no. 11, 1918, 138 pp., 47 figs. Including review of characteristic properties of sand and gravel and methods of testing applied.

Stone. The Commercial Sizes of Crushed Stone Aggregates, F. H. Jackson. Public Roads, vol. 2, no. 14, June 1919, pp. 35-40. Survey of present practice in states of Ohio, Kentucky, Tennessee, North Carolina and Georgia.

COAL AND COKE

Anthracite Distribution. Distribution of Anthracite, A. S. Learoyd. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1301-1308. Work done by anthracite division Bureau of Distribution, of U. S. Fuel Administration.

Belgium. The Coal Deposits of Belgium (Les Gisements Houillers de la Belgique), Armand Renier. Annales des Mines de Belgique, vol. 20, no. 3, 1919, pp. 871-875, 9 figs. Tectonic description of deposits; their international relations; theories explaining their formation. (Continuation of serial.)

Carbonization. Carbonization of Coal, W. S. Kirkpatrick. Engr. World, vol. 15, no. 5, Sept. 1, 1919, pp. 39-41. Carbonization of lignite suggested as means of great economic waste.

Coke Ovens. Temperatures in By-Product Coke Oven Practice, R. S. McBride and W. A. Selwig. Gas Age, vol. 44, no. 6, Sept. 15, 1919, pp. 235-237, 5 figs. Account of tests made by chemists of U.S. Bureau of Standards and U.S. Bureau of Mines at Koppers plant at St. Paul.

Coke Plants. New Coke Plant of La Belle Iron Works. Iron Age, vol. 104, no. 11, Sept. 11, 1919, pp. 699-701, 1 fig. Plant has two batteries, each of 47 standard Koppers 12½-ton ovens, and is planned to permit duplication.

Coking. Coking of Illinois Coal in Koppers Type Oven, R. S. McBride. Gas Age, vol. 44, no. 5, Sept. 1, 1919, pp. 197-201, 2 figs. Operating test at St. Paul plant of Minnesota By-Product Coke Co. conducted jointly by Nat. Bureau of Standards and Bureau of Mines.

Handling Machinery. Modern Coal and Ash Handling Plants—II. Coal Trade Jl., vol. 50, no. 37, Sept. 10, 1919, pp. 1112-1113, 3 figs. Handling arrangement at various plants.

Jasper Park Collieries. Mines of the Jasper Park Collieries, Ltd., at Pocahontas, Alberta, J. H. McMillan. Coal Age, vol. 16, no. 13, Sept. 25, 1919, pp. 522-526, 11 figs. Cross-section of strata, showing formation; proposed new method of working No. 2 mine.

Oxidation of Coal. The Oxidation of Coal, Frederick Vincent Tideswell and Richard Vernon Wheeler. Jl. Chem. Soc., vol. 115-116, no. 681, July 1919, pp. 895-902, 2 figs. Preliminary account of investigation on relative tendencies to spontaneous ignition of the several distinct portions into which a banded bituminous coal can be separated.

Pennsylvania. Low-Sulfur Coal in Pennsylvania, H. M. and T. M. Chance. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1459-1468. Description of deposits.

Power Plants. Illinois Coal-Mine Power Plants, E. Steck. Coal Age, vol. 16, no. 9, Aug. 28, 1919, pp. 355-356. Power for operating power-plant equipment purchased in order to bring its cost prominently to notice of management periodically.

Saar Valley. Historical Development and Economical Importance of the Saar Valley (Die geschtichliche Entwicklung und wirtschaftliche Bedeutung des Saargebiets), Hatzfeld and Schreiber. Zeitschr. f. d. Berg-, Hütten und Salinenwessen, vol. 67, no. 1, 1919, pp. 33-80. Tables showing tonnage of bituminous coal mined for years from 1907-1913; coke production; pig iron production; steel and ammonia production.

Tipples. Avoidable Degradation of Coal, Benedict Shubart. Coal Age, vol. 16, no. 10, Sept. 4, 1919, pp. 401-403, 3 figs. In tipple design, gravity is a convenient force to utilize, but careful control is advised.

Union Colliery Company. Union Colliery Co.'s Mine, Dowell, Ill. Electrical Min., vol. 16, no. 3, July 1919, pp. 51-70, 46 figs. Plan, equipment and operation of Kathleen Coal Mine. Reference is made especially to electrical features of mine.

COPPER

Concentrate, Nodulizing. Nodulizing Copper Concentrate, Oscar Lachmund. Can. Min. Inst. Bul., no. 89, Sept. 1919, pp. 950-954. Comparative study of value of briquetting, sintering and nodulizing as methods of putting concentrate in proper physical condition for blast furnace practice.

Health Mining District, Idaho. The I. X. L. Copper Prospect, Robert N. Bell. Eng. & Min. Jl., vol. 108, no. 10, Sept. 6, 1919, pp. 400-402, 4 figs. Property in Heath Mining District, in Adams County, Idaho, described as a possible "porphyry copper" deposit, though evidence of zone surface oxidation is lacking.

EXPLOSIVES

BLASTING. Advantages of Electrical Blasting, J. B. Stoneking. Cement, Mill & Quarry, vol. 15, no. 5, Sept. 5, 1919, pp. 35-37, 5 figs. For igniting blasting powder and detonating dynamite, electrical method is considered superior to others in spite of higher initial cost.

Blasting with Liquid Air in Potash Mines (Das Schiessen mit flüssiger Luft im Kalibergbau), Gropp. Kali, vol. 13, no. 6, Mar. 15, 1919, pp. 95, 6 figs. Technical and economical experience gained at Wintershall and Sachsen-Weimar mines. (Continued from no. 2.)

GEOLOGY AND MINES

AMBER. Amber and Its Origin, George F. Black. Am. Mineralogist, vol. 4, no. 8, Aug. 1919, pp. 97-99. Geological formation.(Continuation of serial.)

CONDUCTIVITY OF EARTH, SPECIFIC. Method for determining specific Conductivity of the Earth (Uber ein Verfahren zur Bestimmung der spezifischen Leitfanigkeit des Erdbodens), M. Abraham, H. R. von Traubenberg and J. Pusch. Physikalische Zeitschrift, vol. 20, no. 7, Apr. 1, 1919, pp. 145-147. Tables showing results of measurements.

CRYSTALS, SPECTRAL DIAGRAMS. Complete Spectral Diagrams of Cyrstals (Vollständige Spektraldiagramme von Kristallen), H. Seemann. Physikalische Zeitschrift, vol. 20, no. 8, Apr. 15, 1919, pp. 169-175, 5 figs. Reflecting structure areas of secondary spectra; direction of secondary spectra.

FLUORITE. Fluorite from Madoc, Ontario, T. L. Walker. Am. Mineralogist, vol. 4, no. 8, Aug. 1919, pp. 95-96, 1 fig.Described as possessing particular brilliance, luster, perfection of crystallization and transparency in relatively large pieces.

"Blue John" and Other Forms of Fluorite, Bertram Blount and James Harry Sequeira. Chem. News, vol. 119, no. 3098, Aug. 29, 1919, pp. 102-103. Experiments with X-rays said to have furnished evidence in support of theory that there is no substantial difference between fluorspar and "Blue John" except in respect to small amount of organic matter which gives color to the latter. From Trans. of Chem. Soc.

GOGEBIC RANGE. Geology of the Gogebic Range and its Relation to recent Mining Developments—I, II and III, W. C. Hotchkiss. Eng. & Min. Jl., vol. 108, nos. 11, 12 and 13. Sept. 13, 20 and 27, 1919, pp. 443-452, 501-507 and 537-541, 24 figs. Sept. 13: Alterations of iron formation have changed iron carbonate to oxide, removed chert from parts of iron-bearing series and caused formation of ore-bodies. Sept. 20: Defining contact between two general sub-divisions of iron-bearing formation. Sept 27: Influence of faults on forming of ore-bodies said to be such that careful study is necessary in planning development work.

HEMATITE MAGNETITE RELATIONS. *See Magnetite Hematite Relations.*

LEADHILLITE. *See Linarite and Leadhillite.*

LINARITE AND LEADHILLITE. Linarite and Leadhillite from Idaho, Earl V. Shannon. Am. Mineralogist, vol. 4, no. 8, Aug. 1919, pp. 93-94. From stopes in Caledonia Mine.

MAGNETITE HEMATITE RELATIONS. Some of the Relations of Magnetite and Hematite, T. M. Broderick. Economic Geology, vol. 14, no. 5, Aug. 1919, pp. 353-366, 10 figs. Based on examination of 40 polished sections of magnetite-hematite ores from widely scattered localities.

MAGNETISM, TERRESTRIAL. The Secular Variation of Terrestrial Magnetism in Siberia, Boris Weinberg. Terrestrial Magnetism and Atmospheric Electricity, vol. 24, no. 2, June 1919, pp. 65-86, 1 fig. Results of investigations and calculations of points and distant epochs of corrections applied to observed values in order to reduce them to standard epochs.

The Vertical Intensity Variometer, George Hartnell. Terrestrial Magnetism and Atmospheric Electricity, vol. 24, no. 2, June 1919, pp. 49-64, 3 figs. Characteristic features of Z-variometer, in which magnet is supported by agate knife-edge or by pair of steel points resting on horizontal plane.

SEA-LEVEL, MEAN. Mean Sea-Level, Rolf Witting. Nature, vol. 103, no. 2599, Aug. 21, 1919, pp. 493-495, 3 figs. Extrinsic and intrinsic fordes which contribute to determine "level" of sea illustrated by reference to mean sea-level in Baltic Sea.

VARIOMETER. See Magnetism, Terrestrial.

IRON

MINNESOTA. Minnesota State-Owned Iron Mines. Eng. & Min. Jl., vol. 108, no. 10, Sept. 6, 1919, pp. 388-389, 1 fig. Administration of commonwealth lands, leased to operators on royalty basis, with minimum yearly shipments specified, vested in state auditor and organized mines department. Official report pronounces system a success.

LEAD, ZINC, TIN

LEAD SMELTERY. A New South Wales Lead Smeltery. Eng. & Min. Jl., vol. 108, no. 10, Sept. 6, 1919, pp. 394-396, 1 fig. Cockle Creek silver-lead works of the Sulphide Corporation, Ltd., treat complex ores by roasting and blast-furnace smelting, followed by refining of base bullions.

ZINC ORES. Zinc Ore. U. S. Tariff Commission, Washington, 1919, 46 pp. Prepared for use of Committee on Ways and Means, House of Representatives.

The Wisconsin Zinc District, W. F. Boericke and T. H. Garnett. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1213-1235, 5 figs. Possibilities of field estimated from rescords of past production which is quoted as having increased from 1900 tons in 1904 to over 250,000 tons in 1917.

MAJOR INDUSTRIAL MATERIALS

MANGANESE. Manganese Ore. U. S. Tariff Commission, Washington, 1919, 28 pp. Prepared for use of Committee on Ways and Means, House of Representatives.

PYRITES. Pyrites and Sulphur Industry. U. S. Tariff Commission, Washington, 1919, 31 pp. Prepared for use of Committee on Ways and Means, House of Representatives.

MINES AND MINING

APEX LAW. New Angles to the Apex Law, John A. Shelton. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1417-1423, 1 fig. Importance of stability of titles in furthering prosperity of community.

CRUSHING. Crushing Practice, New Cornelis Copper Co., W. L. Dumoulin. Bul. Am. Inst. Min. & Meatllurgical Engrs., no. 152, Aug. 1919, pp. 1203-1206. Two crushing plants: Primary plant which consists of one no. 24 Gates, style K, gyratory crusher, followed four Gates no. 8, style K, gyratory crushers; and secondary plant which consists of four units of 48-in. Symons vertical-shaft disk crushers, each unit consisting of three crushers, one coarse Symons and two fine Symons.

DRAINAGE. How the Drainage Problem of Edna No. 2 Mine was Solved, Donald J. Baker. Coal Age, vol. 16, no. 11, Sept. 11, 1919, pp. 434-435, 1 fig. Drainage of two mines lead to central pump and pumped from there with electrically-driven wood-lined triplex pump.

DRILLING. Pneumatic Drilling in Mines of Liege (L'Application des Marteaux Pneumatiques). Annales des Mines de Belgique, vol. 20, no. 3, 1919, pp. 1053-1076, 10 figs. Showing results of comparative experiments on efficiency of Liegeois, Bolide, Thomas, La Bege and Ingersoll hammers.

Sinking the "H" Shaft at the Pabst Mine, A. J. Wagner. Eng. & Min. Jl., vol. 108, no. 12, Sept. 20, 1919, pp. 513-515, 5 figs. Sequence of operations and arrangement of equipment specially noted as factors which are said to have contributed to obtaining high drilling efficiency aud low maintenance cost.

LAMPS, SAFETY. Height of the Gas Cap in a Safety Lamp, C. M. Young. Coal Age, vol. 16, no. 12, Sept. 18, 1919, pp. 486-487, 2 figs. Experiments claimed to have shown that fairly definite relation between temperature of source of ignition and height of cap formed in mixture of combustible gas and air, height of cap increasing with temperature.

LAWS. *See Apex Law.*

MILLING. Mill Operations at United Eastern During 1917 and 1918, Wheeler O. North. Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1171-1191, 7 figs. Notable features quoted are absence of filters and use of short peb mills loaded with steel balls for fine grinding.

MINING METHODS. Geology and Mining Methods at Pilares Mine, W. Rogers Wade, Alfred Wandtke and Pilares de Nacozari Bul. Am. Inst. Min. & Metallurgical Engrs., no. 152, Aug. 1919, pp. 1143-1169, 14 figs. Mine is of pyrite-chalcopyrite type occurring in latite and andesite breccias of early Tertiary age.

ORE CALCULATION. Calculation and Valuation of Ore in Newly Opened up Mines (Ueber die Berechnung und Bewertung der durch Aufschlussarbeiten in Erzgruben festgestellten Erzmengen), Wilhelm Venator. Metall und Erz. vol. 7, no. 8, Apr. 22, 1919, pp. 167-170. Checking up calculations.

POWER SELECTION. Selection of Power for Mine Service, E. Steck. Coal Age, vol. 16, no. 13, Sept. 25, 1919, pp. 534-535. Effectiveness of mine power system as affected by method of distribution selected. Combination of direct and alternating current preferred to all-direct.

SAMPLING. Application of Air Drills to Mine Sampling, John H. Eggers. Eng. & Min. Jl., vol. 108, no. 9, Aug. 30, 1919, pp. 358-360. Making narrow, deep channels by drilling row of shallow holes and cutting out intervening ribs siad to result in saving of both labor and time.

SIBERIA. Siberian Mines, C. W. Purington. Min. & Sci. Press, vol. 119, no. 10, Sept. 6, 1919, pp. 335-338, 3 figs. Development of gold and base-metal deposits under auspices of British capital and technical control of American engineers. Also abstracted in Eng. & Min. Jl., vol 108, no. 10, Sept. 6, 1919, pp. 403-405.

STOPPING. Economy of Machine Stopping, S. A. Min. Eng. Jl., vol. 28, no. 1454, Aug. 9, 1919, pp. 639. Figures relative to operations on narrow tin lode.

TIMBERING. The Preservation of Mine Timber, N. T. Williams. Trans. Instn. Min. Engrs., vol. 57, no. 3, July 1919, pp. 125-133, 4 figs., partly on supplement plate. Survey of various methods of treatment.

MINOR INDUSTRIAL MATERIALS

TUNGSTEN-BEARING ORES. Tungsten-Bearing Ores. U. S. Tariff Commission, Washington, 1919, 47 pp. Prepared for use of Committee on Ways and Means, House of Representatives.

WULFENITE. Notes on the Metallurgy of Wulfenite, J. P. Bonardi. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919. pp. 364-369. Source and importance of wulfenite; description of its metallurgical treatment, acid leach, alkaline leach, and fusion methods; comparison of these methods; costs of treatment; tabulated results.

OIL AND GAS

ALSACE. Oil in Alsace. (Le pétrole d'Alsace), Aimé Witz. Revue Générale de l'Electricité, vol. 6, no. 8, Aug. 23, 1919, pp. 244-250, 1 fig. Survey of various deposits indicating quality of oil found in each; also economical study of their exploitation.

California. Third Annual Report of the State Oil and Gas Supervisor of California for the Fiscal Year 1917-1918, R. P. McLaughlin, California State Min. Bur. Bul., no. 84, 1918, 617 pp., 28 figs. Covering operations of the Department of Petroleum and Gas of the State Mining Bureau.

Application of Law of Equal Expectations to Oil Production in California, Carl H. Beal and E. D. Nolan. Bul. Am. Inst. Min. & Metallurgical Engrs.. no. 152, Aug. 1919, pp. 1237-1245, 3 figs. Method used in demonstrating truth of law is explained, and in addition several methods by which curves constructed in accordance with this law can be used in a practical way are described.

Farnham Anticline, Carbon County, Utah. The Farnham Anticline, Carbon County, Utah, Frank R. Clark, Dept. of Interior, U. S. Geological Survey, Bulletin 711-A, 1919, 13 pp., 7 figs. Oil Possibilities.

Great Britain. Petroleum and Its Occurrence, John Cadman. Trans. Instn. Min. Engrs., vol. 57, no. 3, July 1919, pp. 118-124. Theory advanced in support of existence of petroleum in Great Britain.

Lamp Oils. Investigation of the Adaptability of a Roumanian Naval Fuel Oil as Lamp Oil, R. von Walther. Petroleum World, vol. 16, no. 227, Aug. 1919, p. 344. Results of distillation tests.

Liquid Fuel. Liquid Fuel for Domestic Purposes, E. Bowden-Smith. Petroleum World, vol. 16, no. 227, Aug. 1919, pp. 326-333, I fig. Apparatus in which heavy oil, with aid of tiny stream of compressed air makes fan-shaped flame. Designed for use in kitchen range or for industrial operations. (To be continued.)

Photomicrographs of Petroleum. Petroleum Under the Microscope, James Scott. Petroleum World, vol. 16, no. 227, Aug. 1919, pp. 342-343, 3 figs. Photomicrographs of emulsions of oil and water.

Storage. The Prevention of Evaporation of Petrol in Storage Tanks and Recovery of Waste Vapour in Oil Depots, T. D. Parr. Petroleum World, vol. 16, no. 227, Aug. 1919, pp. 334-335, 1 fig. Method consists in erecting near storage tank a gas holder the bell of which, to be counter-weighted, produces vacuum of from ½ in. to 1 in. of water. Top of storage tank is connected to interior of holder by pipe.

PRECIOUS MINERALS

Alaska. Mining in Chistochina Basin, Prince William Sound Region. and Kenai Peninsula, Alaska, Theodore Chapin and Bertrand L. Johnson. Dept. of Interior, U. S. Geological Survey, Bulletin 692-C, 1919, pp. 137-176, 3 figs. Including notes on geology of platinum-bearing auriferous gravels.

See also Platinum.

Platinum. Geology of Platinum Deposits—I and II, W. L. Uglow. Eng. & Min. Jl., vol. 108, nos. 9 and 10, Aug. 30 and Sept. 6, 1919, pp. 352-355 and 390-393. Aug. 30: Formations and occurrences; Sept. 6: Occurrences in accosiation with other minerals; production of various districts.

TRANSPORTATION

Cables, Stresses. Stresses in Mine Cables (Sur les efforts dans les Cables) M. E. Dessalles. Annales des Mines de Belgique, vol. 20, no. 3, 1919, pp. 1079-1087, 4 figs. Result of experiment to determine coefficient elasticity and velocity of propagation of stress suddenly applied.

Haulage, Undergound. Efficiency in Underground Haulage, C. E. Bowron. Coal Age, vol. 16, no. 9, Aug. 28, 1919, pp. 360-361. Suggests making someone responsible for each operation or for each department.

VARIA

Research, Non-Metallic Materials. The Need for Research in the Non-Metallic Mineral Field, Raymond B. Ladoc. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 348-352. 11 figs. It is pointed out that mining and milling problems in non-metallics are different from those in metallics and often are not appreciated by metal mining engineers; it is, therefore, suggested that a comparatively untrodden field lies open for consulting mining engineers and industrial chemists.

MUNITIONS AND MILITARY ENGINEERING

Anti-Aircraft Guns. Mounts for Naval Anti-Aircraft Guns—II, Fred H. Colvin. Am. Mach., vol. 51, no. 10, Sept. 4, 1919, pp. 457-461, 17 figs. Making of slide and recoil cylinders, with reference to special fixtures and tools used.

Military Value of Guns Used for Defence against Airplanes (La D.C.A., sa place dans la bataille aérienne), Pierre de la Blanchardière. Aéronautique, vol. 1, no. 2, July1919, pp. 53-62, 18 figs. From records of their operation during the war.

The Technique of Anti-Aircraft Artillery, Glenn F. Anderson. Jl. U. S. Artillery, vol. 51, no. 3, Sept. 1919, pp. 277-284, 7 figs. Concerning determination of altitude, deflection, time of burning of fuse, super-elevation and ballistic corrections.

The Defence of Paris Against Aeroplanes During the War, E. Villaret. Jl. U. S. Artillery, vol. 51, no. 3, Sept. 1919, pp. 330-342. General organization of anti-aircraft defence, with notes on enemy tactics and means of defence developed to meet them. Translated from Illustration, March 22, 1919.

Anti-Submarine Devices. Science and its Application to Marine Problems, J. C. McLennan. Engineer, vol. 128, no. 3316, July 18, 1919, pp. 67-68. Development of anti-submarine measures and devices. Paper presented before North-East Coast Instn. of Engrs. & Shipbuilders.

Ballistics. The Use of Adjoint Systems in the Problem of Differential Corrections for Trajectories, Gilbert Ames Bliss. Jl. U. S. Artillery, vol. 51, no. 3, Sept. 1919, pp. 296-311, 4 figs. Method of computing for known trajectory corrections which do not attain values exceeding three per cent of range.

Camouflage. The Dazzle Painting of Ships. Norman Wilkinson. Trans. North-East Coast Inst. Engrs. & Shipbuilders, vol. 35, no. 6, Aug. 1919, pp. 237-255 and (discussion), pp. 255-267, 5 figs. Origin and development, and reasons for its adoption.

Chemical Warfare. The Research Chemist and the War, Allen Abrams. Chem. Engr., vol. 27, no. 9, Sept. 1919, pp. 233-238, 2 figs. Types of gas masks evolved by Chemical Warfare Service; also account of their experiments to camouflage bleaching powder by introduction of some inert pigment.

Preparedness and Chemical Warfare, William L. Sibert. Chem. Engr., vol. 27, no. 9, Sept. 1919, pp. 205-207. Points out that chemical means of offense and defence will be of great importance in future wars, and calls attention to necessity of taking adequate steps to have U. S. adequately prepared when the next war comes.

Coast Artillery. The Coast Artillery and the Reserve Officers' Training Corps, Harrison Tilghman. Jl. U. S. Artillery, vol. 51, no. 3, Sept. 1919, pp. 262-268. Concerning military training in engineering schools.

Commerce Destruction. "Unrestricted Commerce Destroying, Lyman A. Cotten. U. S. Naval Inst. Proc., vol. 45, no. 199, Sept. 1919, pp. 1494-1516 and 1517-1527. Its military effectiveness discussed from historical viewpoint of efforts made in last war and preceding wars to overcome enemy by destroying its commerce.

Destroyers. The Evolution of the Destroyer, S. M. Robinson. Int. Mar. Eng., vol. 24, no. 9, Sept. 1919, pp. 577-584, 20 figs. Noting specially advances in boiler and turbine construction.

Flame. *See Gas Warfare.*

Gas Warefare. An Artillery Gas Attack, B. C. Goss. Jl. Indus. & Eng. Chem., vol. 11, no. 9, Sept. 1919, pp. 829-836, 10 figs. Comparative study of Allied and German tactics and particulars of various types of German gas shells.

Gas, Smoke and Flame in this War and the Next, William H. Walker. Proc. Engrs. Soc. Western Pa., vol. 35, no. 4, May 1919, pp. 195-214, 11 figs. That gas warfare is particularly humane argued because of 30 per cent of total casualties caused by it only 5 per cent were fatal, while of remaining 70 per cent caused by machine gun and rifle fire, shrapnel and high explosives between 20 and 25 per cent resulted in death. Writer believes that gas warfare has come to stay and advises making adequate provision for it. Gases used in last war are classified and their effects described.

Gas Warfare at the Front, B. C. Goss. Proc. Engrs. Soc. Western Pa., vol. 35, no. 4, May 1919, pp. 181-194, 4 figs. Its practical significance.

Guns. "Berthas," E. M. Blake, J. U. S. Artillery, vol. 51, no. 3, Sept. 1919, pp. 269-276, 2 figs. Notes on bombardment of Paris from Mont de Joie. Gun used was a 380-mm. Krupp Naval re-tubed down to a 22-mm. and firing from the same type platform as the 380.

Mine Layers. German Submarine Mine-Layers. (Les sous-marins allemands mouilleurs de mines). Journal de la Marine, vol. 37, no. 1901, Aug. 9, 1919, pp. 508-509, 2 figs. General features of UC-16.

Mounts. The Field Mount for the 7-in. Navy Gun, C. L. McCrea. Am. Mach., vol. 51, no. 11, Sept. 11, 1919, pp. 523-527, 7 figs. Gun is mounted on tractor.

Powder Bleaching. *See Chemical Warfare.*

Railways. Military Importance of Railways in Warfare. (Importancia militar de los ferrocarriles en la conduccion de las operaciones de guerra de un pais), Antonio Beingolea. Informacionnes y Memorias de la Sociedad de Ingenieros del Peru, vol. 21, no. 8, Aug. 1919, pp. 258-280. Including descriptive account of railway systems of So. Am.

Range-Finders. Modern Single-Observer Range-Finders. Nature, vol. 103, no. 2595, July 24, 1919, pp. 405-407, 2 figs. Details of British naval range-finder, type F. X., with uniform range scale accessories. Base length, 30 ft.; magnetification, 16, 20 and 28; on certainty of observation under good conditions, 330 yd. at 40,000 yd. range.

Searchlights. How Portable Searchlight Equipment Was Used in the War, W. F. Bradley. Automotive Industries, vol. 41, no. 10, Sept. 4, 1919, pp. 478-480, 3 figs. Crochat field illuminating trucks.

Smoke. *See Gas Warfare.*

ORGANIZATION AND MANAGEMENT

ACCOUNTING

Accounting Methods. Importance of proper Accounting in the Maintenance of Way Department in General, I. A. May. Street Ry. Bul., vol. 19, no. 9, Sept, 1919, pp. 329-335, 5 figs. Details as to reports, timeslips, data cards, etc.. used by The Connecticut Co., New Haven, Conn.

Appraisals. Practice in Making Electric Utility Appraisals, Charles W. McKay. Elec. Rev., vol. 75, no. 11, Sept. 13, 1919, pp. 428-433. Discussion of value of unit costs and necessity for care in their preparation.

Unit Costs for Use in Public Utility Appraisals, R. L. Baldwin. Eng. News-Rec., vol. 83, no 11, Sept. 11, 1919, pp. 514-515, 1 fig. Method at present employed by many commissions described as combination of "reproduction cost with unit prices based upon average prices," and "actual cost from records."

Classification of Expenses. Protection of Owners on Cost-Plus Contracts, F. A. Wells. Can. Engr., vol. 37, no. 13, Sept. 25, 1919, pp. 323-326, 4 figs. Practical use of Dewey Decimal System in keeping books on the job; classification of plant expense and field overhead.

Cost Accounting. Uniform Cost Accounting in Shipbuilding—II, J. L. Jacobs, Int. Mar. Eng., vol. 24, no. 9, Sept. 1919, pp. 638-640. Plan adopted by Atlantic Coast Shipbuilders' Assn. for uniform method of cost accounting in steel shipbuilding.

A Cost System for Shipyards—III, Creighton Churchill. Int. Mar. Eng., vol. 24, no. 9, Sept. 1919, pp. 641-642, 1 fig. How the system is operated; practical application in the case of a hull under construction or under contract.

COSTING. Costing in Relation to Scientific Management, J. H. Boyd. Elecn., vol. 83, no. 2152. Aug. 28, 1919, pp. 171-172. Results obtained of various works.

The Necessity of Knowing Manufacturing Costs, Roland H. Zinn. Am. Industries, vol. 20, no. 2, Sept. 1919, pp. 20-21. Points out that unless exact cost of each department is known, waste of materials, inefficient help, or careless supervision in buying will not be reported.

The Philosophy of Costs, C. E. Knoeppel. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 179-183. Importance of determining hourly performance of labor illustrated by various instances in which efficiency was increased by recording it regularly, notably experience of one company in which efficiency in one department increased production 60 per cent by displaying graphically from day to day actual hourly production against predetermined hourly production.

Do you know exactly what your Product Costs? Can. Machy., vol. 22, no. 5, July 31, 1919, pp. 101-106, 5 figs. Illustrating how planning costs showed up; comparison chart for engines built during 1917-1918.

COST FACTORS. Summarizing All Cost Factors, M. H. Potter. Iron Trade Rev., vol. 65, no. 10, Sept. 4, 1919, pp. 630-631, 6 figs. Suggested method for determining basis for fixing of selling price.

INVENTORIES. Inventorying Materials and Supplies, B. J. Yungbluth. Elec. Ry. Jl., vol. 54, no. 11, Sept. 13, 1919, pp. 518-520, 2 figs. How Pittsburgh Railways Co. inventoried in two days, at cost of $239.85, 8613 different kinds of materials valued at $916,317, without special help of overtime of employees.

EDUCATION

ARMY TRADE TESTS. The Army Trade Tests, William T. Bawden. Dept. of Interior Bur. of Education, Circular no. 4. Apr. 1919, 28 pp., 8 figs. Report of a conference of specialists in industrial education, called by the U. S. Commissioner of Education.

FACTORY SCHOOL. The Factory School as an Americanizing Force, T. A. Levy. Am. Industries, vol. 20, no. 2, Sept. 1919, pp. 23-24. From address at Americanization Congress under auspices of Assn. Industries of Mass.

TRAINING FACTORY HELP. Possibilities in Training Factory Help, James F. Johnson. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 221-224, 2 figs. Has remedy for labor shortage.

EXPORT

BRITISH MACHINE TOOL AND METAL INDUSTRIES. British Machine Tool and Metal Industries, Alexander Luchars. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 19-24, Report of U. S. Trade Commissioner to Great Britain and Continental Europe appointed by U. S. Dept. of Commerce, for purpose of studying conditions affecting sale and use of American machine tools and accessories in European market. Also in Am. Mach., vol. 51, no. 10, Sept. 4, 1919. pp. 478-480.

CEMENT. International Trade in Cement. Cement, Mill & Quarry, vol. 15, no. 5, Sept. 5, 1919, pp. 19-23. Statistics of imports into other countries. Export opportunities for American producers. Third article

CHINA. China as Market for Railway Materials, Frank Rhea. Ry Rev., vol. 65, nos 9, and 11, Aug. 30 and Sept. 13, 1919, pp 289-294 and 371-376, 23 figs. Aug 30. From Far Eastern markets for Railway Materials, Equipment and Supplies, Special Agents' Series no. 180, published by Dept of Commerce, Bureau of Foreign and Domestic Commerce. Sept. 13: Operating methods; track materials and maintenance; general characteristics of rolling stock.

EAST INDIES, DUTCH. Dutch East Indies Offer Many Construction Opportunities, J. W. Evans. Eng. News-Rec., vol. 83 no. 11, Sept. 11, 1919, pp. 497-498. Developments now under way or in prospect in Sumatra and Java include port works, railroads and water-power.

SIGNALLING APPARATUS. Opportunities for American Signalling in Far East, Frank Rhea. Ry. Age., vol. 67, no. 12, Sept. 19, 1919, pp. 557-558. Urges that American firms must recognize differences in operating methods to compete successfully.

FACTORY MANAGEMENT

BAR STEEL, IDENTIFICATION. Identification of Bar Steel. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 36-38. Method employed by Rockford Drilling Machine Co., which consists in painting streaks of different colors laterally and transversely on side of bars.

CONSTRUCTION WORK, CHART. A Useful Progress Chart for Construction Work. Power Plant Eng., vol. 23, no. 17, Sept. 1, 1919, p. 769, 1 fig. Employed during construction of Edgewarer power station for determining percentage of work already done on any particular job as well as percentage of work remaining unfinished, and estimated length of time required to complete work.

CONTROLLING PRODUCTION. A System for Controlling Production, Robert H. Wadsworth. Am. Mach., vol. 51, no. 10, Sept. 4, 1919, pp. 451-455, 12 figs. Forms used are illustrated and their functions discussed.

DRAWING OFFICE. Drawing Office and Workshop Organization, N. Gerard Smith. Eng. & Indus. Management, vol. 2, no. 9, Aug. 28, 1919, pp. 259-263, 11 figs. Concerning filing of technical data and routine for tool supply.

EMPLOYMENT DEPARTMENT. Adjusting the Employment Department to the Rest of the Plant, Dwight T. Farnham. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 201-205, 3 figs. Suggested standard-practice-instructions for employment determined.

FOLLOW-UP PLANTS FOR PRODUCTION. Keeping Production on Schedule, S. P. Keator. Factory, vol. 23, no. 3, Sept. 1919, pp. 510-511, (figs. Suggested follow-up plan for small plants.

FOREMAN. The Foreman in Relation to Workshop Organization, A. Robert Stelling. Eng. & Indus. Management, vol. 2, no. 10, Sept. 4, 1919, pp. 294-295. Comparison of American and English practice in management of workshops.

FOUNDRY. *See Production Methods.*

INDUSTRIAL RELATIONSHIPS. Industrial Relationship, Bass Smith. Am. Mach., vol. 51, no. 10, Sept. 4, 1919, pp. 471-472. Qualifications of industrial management.

Industrial Welfare, Edgar L. Collis. Eng. & Indus. Management, vol. 2, no. 10, Sept. 4, 1919, pp. 309-311. Welfare is considered as "an inevitable development of modern industry, necessary to enable it to do its duty by its employees," and it is pointed out that welfare work must cover outside activities, such as recreation, transport and housing questions."

INSPECTION, ELECTRICAL. Organizing Electrical Inspectiou and Mainteuance, C. A. Cowdery. Elec. World, vol. 74, no. 12, Sept. 20, 1919, pp. 645-649, 4 figs. Method carried out in one of large industrial plants in New England while factory was employed on war work exclusively and operated twenty-four hours daily excepting Sundays.

MACHINE TOOL PLANT. Organization and Management of a Machine Tool Plant—III. Machy. (Lond.), vol. 14, no. 358, Aug. 7, 1919, pp. 565-569, 9 figs. Manufacturing departments and systems recommended for medium size machine tool manufacturing plant making a single line of machines.

MOTOR TRANSPORT BUSINESS. Starting in the Motor Transport Business. Motor Traction, vol. 29, no. 758, Sept. 10, 1919, pp. 219-222. What it costs and what it brings in.

MOTION ANALYSIS. Graphic Methods of Analysing Motions. Eng. & Indus. Management, vol. 2, no. 8, Aug. 21, 1919, pp. 229-232, 2 figs. Charts illustrating simultaneous cycle motiou of lowering pig iron upon a railway truck and action of workman in leaving his work.

PLANNING. The Production Planning System of the Heald Machine Company—II W. S. Pratt. Am. Mach., vol. 51, no. 11, Sept. 11, 1919, pp. 501-508, 11 figs. Planning Board and method of following work.

A Planning Department System in Use in a Machine Shop, John H. Black. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 225-229, 2 figs. Viewpoint around which planning department is said to be built is necessity of knowing at all times "what is still needed" and how to make up actual or impending shortage.

Planning the Industrial Plant—IV, Hugh M. Wharton. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 237-241, 5 figs. Material handling, fire protection, toilets and lavatories, power transmission, heating, ventilation and illumination. (Concluded.)

PRODUCTION METHODS. Continuous Movement in the Essex Production Line, J. Edward Schipper. Automotive Industries, vol. 41, no. 9, Aug. 28, 1919, pp. 416-421, 10 figs. partly on supplement plate. Engine, chassis, and body treated as separate units until delivered complete at final assemhly line.

Increased Output with Reduced Hours of Work? Chas. S. Myers. Eng. & Indus. Management, vol. 2, no. 8, Aug. 21, 1919, pp. 227-229, Study of improved methods in an iron foundry.

Installing Management Methods in the Woodworking Industry, Carle M. Bigelow. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 185-195, 24 figs. Preparing orders, determining upon stock and material, laying out progress of work, making out production orders, preparing standard instructions, using control board, handling job cards and inspection records and computing labor efficiency, are described and illustrated by drawings and forms.

Machinery Versus Trained Brains, Lazarovich-Hrebelianovich. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 198-200. War experience of company which after losing its trained workers failed to increase its production efficiency even after having spent $200,000 in important machinery for use of new employees.

Factory Management in Garment Trades, Mack Gordon. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 230-235, 4 figs. Advising acceptance of democratic principle in training and follow-up functions.

Need of Personal Responsibility in Industry, Harry Tipper. Automotive Industries, vol. 41, no. 11. Sept. 11, 1919. pp. 534-535. Points out that employer can do much to solve his labor troubles if he will educate his workers as to their part of whole and himself realizes responsibility to workers.

Getting Ready for the Shop Emergency. Can. Machy., vol. 22, no. 5. July 31, 1919, pp. 118-121, 6 figs. It is said that every well-appointed plant must have the means to deal quickly and efficiently with any mishap that may be encountered. How outfits are made up; accident prevention.

Maintenance of Management, Frank B. Gilbreth. Eng. & Indus. Management, vol. 2, no. 10, Sept. 4, 1919, pp. 296-298, 1 fig. Proposed form for standing orders.

Scientific Management—IV, Henry Atkinson. Eng. & Indus. Management, vol. 2, no. 10, Sept. 4, 1919, pp. 300-304. Points out that in order to establish successfully scientific management in any plant, "It is essential to take the broad view of industry and its relation to the general welfare," without any spirit of trying to "see if there is anything in it."

The Application of Industrial Efficiency, Charles E. Bedaux. Eng. & Contracting, vol. 52, no. 11, Sept. 10, 1919, pp. 311-312. It is important to meet European competition.

Engineering Organization and Routine, George L. McCain. Automotive Industries, vol. 41, no. 12, Sept. 18, 1919, pp. 562-567, 9 figs. Suggested system for keeping all concerned in touch with all of the work and developments at all times.

Eliminating the Stop Watch from Industry, C. E. Knoeppel. Iron Age, vol. 104, no. 12, Sept. 18, 1919, pp. 766-767. Production rates, determined by conferences with workers, and efficient management are essentials.

PRODUCTION RECORDS. Planning and Controlling Production, Ivan R. DeArmond. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 60-66, 18 figs. System used by R. K. LeBlond Machine Tool Co., showing records by means of which information concerning progress of work, stock on hand or required, and location of job at any time may he quickly determined.

PURCHASING. Organization for Purchasing and Stores, Henry B. Spencer. Ry. Age, vol. 67, no. 13. Sept. 26, 1919, pp. 617-619. Executive officer should supervise purchasing, selling, storing, handling, protecting and disbursing.

Restaurants. Installing and Operating an Industrial Cafeteria, E. F. Ross. Iron Trade Rev., vol. 65, no. 11, Sept. 11, 1919, pp. 691-694, 6 figs. Information regarding equipment required, method of operating, system of financing and cost of installing a modern lunch room for employees.

Shop Layout. Efficiency in Industrial Planning Illustrated in a New Forge Shop. Am. Architect, vol. 116, no. 2279, Aug. 27, 1919, pp. 283-287, 6 figs. Illustrating general character of buildings in plant of Central Forge Co., Detroit, Mich., and open space provided on all sides by use of rolling doors, also diagrams showing arrangement of equipment.

Shop Papers. The Shop Paper as an Aid to Morale, Peter F. O'Shea. Factory, vol. 23, no. 3, Sept. 1919, pp. 518-522, 10 figs. Experience of writer as editor of factory house organ of Greenfield Tap and Die Corporation.

Tool Repairs. Make the House Organ a Human Interest Organ with a Punch, Robert E. Park. Automotive Industries, vol. 41, no. 12, Sept. 18, 1919, pp. 572-574. Survey of editorial policies followed by various plant journals.

Woodworking Industry. *See Production Methods.*

INSPECTION

Bureau of Standards, Optical Apparatus. Optical Projection Applied to Inspection, H. C. Bean. Inspector, vol. 1, no. 4, Sept. 15, 1919, pp. 25-30, 7 figs. Description of apparatus developed and used by Bur. of Standards.

LABOR

Bonus System. Bonus System for Boiler Room Employees, Robert June. Power House, vol. 12, no. 13, Aug. 20, 1919, pp. 356-357, 2 figs. Its effect upon economy in operation. From answers received by writer and circular letter he sent to various chief engineers of power plants in Canada.

Bonus systems for Chemical Works, Norman Swindin. Chem. Age, vol. 1, no. 9, Aug. 16, 1919, pp. 240-243, 4 figs. Account of research carried on in large chemical works in regard to application of Rowan system.

Employment System. Placing the Right Man in the Right Job—I. W. D. Stearns Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 30-33. Outline of methods used by Westinghouse Elec. & Mfg. Co., East Pittsburgh.

Health of Man. How to Keep the Human Machine in Working Order, Thomas Darlington. Eng. & Contracting, vol. 52, no. 12, Sept. 17, 1919, pp. 331-332. Noting relation of efficiencies to health.

Labor Unrest. Effect of Labor Unrest on Output and Cost. Eng. & Indus. Management, vol. 2, no. 8, Aug. 21, 1919, p. 250. Report submitted by Industry and Trade Conference to Nat. Assn., outlining result of inquiry as to direct and indirect effects of revolution on conditions of labor and consequently on production and exchange of goods.

One-Man-One-Job System. Fallacy of the One-Man-One-Job System in Industry, Harry Tipper. Automotive Industries, vol. 41, no. 12, Sept. 18, 1919, pp. 580-581. Monotony of system argued as drawback against its effectiveness.

Profit-Sharing. Profit-Sharing and Ownership, Fred. Mills. Eng. & Indus. Management, vol. 2, no. 8, Aug. 21, 1919, pp. 237-239. Memorandum on labor unrest laid by writer before British Coal Commission.

Shop Committees. Labor and the Shop Committee, William Leavitt Stoddard. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 217-220. Organized labor's position.

Recognizing the Human Side of Industry, A. R. Kennedy. Can. Machy., vol. 22, no. 5, July 31, 1919, pp. 92-96, 6 figs. Industrial council and cafeteria among features adopted.

Steel Industry. The Iron and Steel Situation. Manufacturers Rec., vol. 76, no. 11, Sept. 11, 1919, pp. 107-108. Labor question as it effects iron and steel situation.

Wage System. The Piece Work Pay System, J. A. A. Beaudin. Gas. Rec., vol. 16, no. 4, Aug. 27, 1919, pp. 37-38. How it works in Montreal Light, Heat & Power Co., as applied to meter readers, billers, delivery men and collectors. Paper read before Can. Gas. Assn.

Welfare. Industrial Welfare, Edgar L. Collis. Eng. & Indus. Management, vol. 2, nos. 8 and 9, Aug. 21 and Aug. 28, 1919, pp. 246-249 and 266-268, 1 fig. Aug. 21: Welfare in relation to industrial birth, life and death. Aug. 28: Deals with organization of welfare, and refers particularly to a scheme of welfare supervision for boys.

Women. Women's Work in Engineering and Shipbuilding During the War, Lady Parsons. Trans. North-East Coast Instn. Engrs. & Shipbuilders, vol. 35, no. 6, Aug. 1919, pp. 227-234. Summary of technical work of skilled nature.

Report on the Metabolism of Female Munition Workers, M. Greenwood, C. Hodson and A. E. Tebb. Proc. Roy. Soc. vol. 91, no. B635, Aug. 6, 1919, pp. 62-82. Following conclusions are arrived at from experimental tests and measurements: For light training and forging about 100 calories per sq. m. of body surface per hr. are needed; for tool setting, heavy turning, stamping, finishing copper bands and shell hoisting, about 125 calories per sq. m. per hr.; for gauging, walking and carrying, about 160 calories per sq. m. per hr.; and for labouring, cleaning and drying, about 180 calories per sq. m. per hr.

A Preliminary Study of the Energy Expenditure and Food Requirements of Woman Workers, O. Rosenheim. Proc. Roy. Soc., vol. 91, no. B635, Aug. 6, 1919, pp. 44-61, 1 fig. As results of experiments in which it was intended to measure actual energy of average woman worker during twenty-four hours, it is quoted that an average of 2400-2800 calories may be assumed as a standard for women, the corresponding figure for men being 3000-3500 calories.

LEGAL

Infection Liability. The Liability of Infections, Chesla C. Sherlock. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp. 252-253. Court interpretations of problems brought by workmen's compensation acts.

Resale Price Fixing. The Fixing of Resale Prices—I, Chesla C. Sherlock. Am. Mach., vol. 51, no. 11, Sept. 11, 1919, pp. 521-522, Legal aspect of question.

LIGHTING

Daylight Measurements. Some Practical Daylight Measurements in Modern Factory Buildings, Emile G. Perrot and Frank C. Vogan. Tran. Illum. Eng. Soc., vol. 14, no. 6, Aug. 30, 1919, pp. 257-277, 10 figs. Photometric readings taken in several buildings.

Industrial Lighting. What Better Industrial Lighting Can Do to Stimulate Production, F. H. Bernhard. Elec. Rev., vol. 75, no. 10, Sept. 6, 1919, pp. 381-384, 2 figs. Based on records of increased production due to efficient lighting at time of war.

The Science of Efficient Shop Illumination, A. W. Swan. Can. Machy., vol. 22, no. 5, July 31, 1919, p. 97, 1 fig. Subject of shop lighting considered as a very vital one, for without proper illumination workmen cannot be expected to produce results either from quality or quantity standpoint.

How Better Industrial Lighting Can Improve Working Conditions, F. H. Bernhard. Elec. Rev., vol. 75, no. 12, Sept. 20, 1919, pp. 469-472, 3 figs. Because, it is said, it adds to welfare of employees and reduces labor turnover and labor disputes.

Shipyards. Shipyard Lighting, H. A. Horner. Tran. Illum. Eng. Soc., vol. 14, no. 6, Aug. 30, 1919, pp. 278-282 and discussion, pp. 282-285. Notes deficiency in present methods and suggests improvement.

Shops. *See Industrial Lighting.*

Windows. What it Pays to Know about Factory Lighting—VII, C. E. Clewell. Factory, vol. 23, no. 3, Sept. 1919, pp. 496-499, 5 figs. Concerning location of windows and selection of sash and glazing.

RECONSTRUCTION

Alsace. Textile Industries of Alsace. (Les industries textiles de l'Alsace.), Alfred Renouard. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 131, no. 4, July and Aug. 1919, pp. 32-63. History of their development and remarks on their present economic significance.

France. Present Position and the Future of French Industry. (La situation et L'Avenir de l'Industrie Française.), Ch. Vallet. Industrie Electrique, vol. 28, no. 652, Aug. 25, 1919, pp. 301-302. Economical situation in coal industry. (Concluded.)

Germany. Germany's Industrial Position, Richard D. Lucker. Jl. Indus. & Eng. Chem., vol. 11, no. 8, Aug. 1, 1919, pp. 777-780. From before the war to the present time. Compiled from writer's personal observations.

War-Time Activities of Dye Plants in Germany. Chem. & Metallurgical Eng., vol. 21, no. 5, Sept. 1, 1919, pp. 224-225. From report of British mission appointed to visit enemy chemical factories in occupied zone, introduced at Dyestuffs Hearings before House Committee on Ways and Means.

The German Machine-Tool Industry During and After the War. Am. Mach., vol. 51, no. 11, Sept. 11, 1919, pp. 537-539. Writer sees "German national front of business" broken and believes in eventual internationalization of German industry.

Machine Tool Trade. Conditions in the Machine Tool Trade. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 75-76, 1 fig. Containing Government price-fixing chart for determining selling price of standard machine tools.

Plant Conversion to Peace Work. Adapting Munitions Plant to Peace-Time Work. Elec. World, vol. 74, no. 12, Sept. 20, 1919, pp. 620-626, 9 figs. Particularly in reference to method employed of making distribution system more flexible.

Trans-Missouri Region. Industrial Development in the Trans-Missouri Region, P. F. Walker. Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 821-823. Statistical figures relative to agricultural and mineral products, accomplishments in manufacturing and transportation and freight adjustments.

SAFETY ENGINEERING

Accident Statistics. Accident Statistics of German Reinforced Concrete Construction for 1911 to 1918 (Unfallstatistik des Deutschen Ausschusses für Eisenbeton 1911 bis 1918), W. Petry. Beton u. Eisen, vol. 18, no. 7 and 8, May 5, 1919, pp. 73-76. Compiled by German Committee on Reinforced Concrete Construction, appointed by Secretary of Public Works.

Boiler Explosion. The Boiler Explosion at Mobile, Ala. Locomotive Hartford Steam Boiler Inspection & Insurance Co., vol. 32, no. 6, April 1919, pp. 162-165, 2 figs. Suggested explanation for explosion of two water-tube boilers, one Heine and one Stirling.

Dust Explosions. Dust and Dust Explosions (Staub und Staubexplosionen). Rauch u. Staub, vol. 9, no. 7, Apr. 1919, pp. 53-54. Considers best means to prevent explosions ventilation and sprinkler system which has been in use in German mines since 1898.

Cause and Prevention of Dust Explosions. Contract Rec., vol. 33, no. 37, Sept. 10, 1919, pp. 858-859. Recommendations made by Ontario Fire Prevention League.

Fires, Mine. Mine Fires, and the Inert Gas Method by Which They May be Extinguished, Joseph J. Walsh. Jl. Am. Soc. Heat & Vent. Engrs., vol. 25, no. 3, July 1919, pp. 329-331, 1 fig. Arrangement consists of ordinary boiler furnace; gases produced by combustion are conducted through cooling tubes, immersed in water,and then forced into mine. Gasesused are carbon divide and nitrogen.

Fire Protection. Fire Protection for Oil Tanks. Eng. & Min. Jl., vol. 108, no. 9, Aug. 30, 1919, pp. 350-351, 3 figs. Method for extinguishing fires by using bubbles containing carbonic-acid gas to form blanket covering on surface.

Fire Protection for Schools, H. W. Forster. Construction, vol. 9, no. 1, July 1919, pp. 11-21. Importance of providing for it and essential features to secure it. From Nat. Fire Protection Assn. Quarterly.

Water Departments and Private Fire Lines, Dow R. Gwinn. Can. Engr., vol. 37, no. 13, Sept. 25, 1919, pp. 335-337. Proper regulation governing private fire protection lines; contamination of water supply; suggestions for compensations.

Industrial Safety. Industrial Safety—II, C. W. Price. Power Plant Eng., vol. 23, no. 17, Sept. 1, 1919, pp. 784-785. Suggestions in regard to plant conditions, arrangement, order and lighting in and around industrial plants.

Steam Prime Movers. Methods of Guarding Engines and Turbines. Power House, vol. 12, no. 12, Aug. 5, 1919, pp. 330-333, 4 figs. Different forms of safety apparatus as applied to governors, fly wheels and rotors.

SALVAGE

Goodrich Rubber Company. Salvage and Reclamation Department of The B. F. Goodrich Rubber Company, George W. Sherman. Indus. Management, vol. 58, no. 3, Sept. 1919, pp. 176-178, 4 figs. Particularly in reference to organization features of department.

Liberty Engine Materials. Application of Liberty Engine Materials to the Automotive Industry, Harold F. Wood. Am. Mach., vol. 51, no. 12, Sept. 18, 1919, pp. 557-562. Author states reasons for use of certain materials and certain treatments for each part and gives recommendations for their application to problems of automotive industry.

TRANSPORTATION

Automobile Factory Transportation System. Automobile Factory Transportation Systems, Edward K. Hammond. Machy. (N.Y.), vol. 26, no. 1, Sept. 1919, pp. 1-7, 11 figs. Types of equipment used for transporting raw materials and parts of product through plant Willys-Overland Company in Toledo, Ohio.

Motor Trucks at Marine Freight Terminals. Motor Trucks and the Problem of Efficient Marine Freight Terminal Operation—II, III, Merrill C. Horine Int. Marine Eng., vol. 24, nos. 9 and 10, Sept. and Oct. 1919, pp. 632-637 and 696-703, 15 figs. Sept.: Comparison of horse dray with motor carriers; also discussion of value of store-door delivery. Oct.: Emphasizes that weak link of our transportation facilities as applied to overseas commerce is not in railroads or ocean carriers, but in methods and facilities employed for handling freight at marine terminals.

Truck Routing. Routing Trucks by Capacity. Commercial Vehicle, vol. 21, no. 3, Sept. 1, 1919, pp. 99-101, 2 figs. Brooklyn soap manufacturer claims to obtain greatest truck efficiency by this method.

Trucks, Electric. Use of Industrial Electric Trucks and Tractors in Warehouses, Bernard J. Dillon. Elec. Rev., vol. 75, no. 9, Aug. 30, 1919, pp. 345-348, 5 figs. Application of such equipment to handling problems of warehouses and storage places of all types.

Trucks, Garaging. How the American Railway Express Co. Secures Greater Service from Its Motor Trucks. Eng. & Contracting, vol. 52, no. 12, Sept. 17, 1919, pp. 340-341. Features of garaging and maintaining 3,313 motor vehicles.

VARIA

Chicago District. Industrial Resources of the Chicago District, H. B. Pulsifer, Procter Thomson and Ernest Edgar Thum. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 310-319, 7 figs. Metallurgically, Chicago is described as ranking second only to Pittsburg as producing center, while in non-ferrous operations, refining and alloying are represented extensively. Statistics are quoted to show that in Lake County, Ind., and Cook County, Ill., value of stone, lime, sand and gravel, clay products, mineral paint, pigments, cement, coke and steel reached $300,000,000 market in 1917.

Indiana. Natural and Industrial Resources of Indiana, W. N. Logan and F. O. Anderegg. Chem. & Metallurgical Eng., vol 21, no. 6, Sept. 15, 1919, pp. 320-325, 5 figs. Noting specially research work being done in chemical plants.

Michigan. Natural and Industrial Resources of Michigan, R. A. Smith and W. L. Badger. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 326-334, 2 figs. Leading products include; Iron, copper, salt, alkalis, halogens, lime, gypsum, cement, abrasives, silica, sugar, paper, dyes and organic chemicals.

Wisconsin. Natural and Industrial Resources of Wisconsin, W. O. Hotchkiss, O. L. Kowalke and A. M. Plumb. Chem. & Metallurgical Eng., vol. 21, no. 6, Sept. 15, 1919, pp. 335-341, 11 figs. Raw material resources consist of zinc ores, iron ores, granite and mineral waters. Leather and paper industries among most important of state on basis of value of product and number of men employed.

World Trade. The Economics and World Markets. Raw Material, vol. 1, no. 6, Aug. 1919, pp. 282-289, 9 figs. Reviews status of producing centers of the world, traces shipping routes, outlines smelting conditions and indicates present tendencies of market.

RAILROAD ENGINEERING

FOREIGN

England. A New Railway in South Yorkshire. Engineer, vol. 128, no. 3321, Aug. 22, 1919, pp. 171-173, 5 figs. Profile of railway and details of lifting bridge built over Knottingley and Goole Canal.

Sahara Railroad. The Sahara Railroad (Die Sahara-Esienbahn), F. Baltzer. Archiv f. Eisenbahnwesen, no. 3, May-June 1919, pp. 443-453. Its development and present status.

Train Speeds. European Train Speeds. Ry. Gaz., vol. 31, nos. 8 and 9, Aug. 22 and 29, 1919, pp. 235-236 and 263-266, 5 figs. Aug. 22: Fatest non-stop runs in Scandinavia. Aug. 29: Great Britain and Ireland.

CONSTRUCTION

Track Elevation. Elevation of Tracks at Aurora, W. T. Christine. Engr. World, vol. 15, no. 5, Sept. 1, 1919, pp. 17-21, 11 figs. Plans and details of construction.

Train Shed Raising. Raising a Large Train Shed under Traffic. Ry. Age, vol. 67m, no. 13, Sept. 26, 1919, pp. 609-612, 8 figs. Lackawanna lifts entire structure at Hoboken to overcome settlement and restore original clearance.

Large Train-Shed Raised without Traffic Interruption. Eng. News-Rec., vol. 83, no. 10, Sept. 4, 1919, pp. 460-462, 4 figs. Work done in consequence of subsidence of pile foundations of Lackawanna Railroad structure at Hoboken, N.J.

ELECTRIC RAILROADS

Free Wire System. Continuous Current Overhead Systems for Suburban Railway Electrification, E. Goolding. Tramway & Ry. World, vol. 46, no. 8, Aug. 14, 1919, pp. 72-74, 3 figs. Three-wire system using low pressure continuous-current machines in series.

Freight Traffic. Mineral and Goods Traffic Electrically Operated, Theodore Stevens. Electrical Rev., vol. 85, no. 2178, Aug. 22, 1919, pp. 249-251. Comparison between British steam locomotive mineral railway and American electrified mineral railway. (To be continued.)

Locomotives. Electric Freigbt Locomotive of the Pennsylvania Railroad Designed for Use on Heavy Grades. Ry. & Locomotive Eng., vol. 32, no. 9, Sept. 1919, pp. 260-261, 1 fig. One of interesting features is jackshaft gear which is so constructed and rim so connected to center by springs, that the whole power is transmitted through them, while design is such that up to an exertion of 25 per cent of its horsepower gear acts practically as a solid gear.

See also Regenerative Brakes.

New Electric Locomotives for the Hydro-Electric Power Commission, F. A. Gary. Elec. Traction, vol. 15, no. 9, Sept. 1919, 563-567, 2 figs. Description of six new 100,000 lb. electric locomot ives being built for use on Niagara Construction Railway.

Regenerative Brakes. TrialTrips of Alternating Current Locomotive with Electric Regenerative Brakes (Veruschsfahrten einer Wechselstromlokomotive mit elektrischer Nutzbremsung), Hans Behn-Eschenburg. Schweizerische Bauzeitung, vol. 74, no. 7, Aug. 16, 1919, pp. 84-89, 5 figs., partly on suppl. plate. Refers to article published in latter part of 1918 in Schweiz. Bauzeitung concerning new regenerative brake for a.c. locomotives. Present article supplements former and gives data in regard to practical tests, curves, wiring diagram of motor, etc.

West Penn System. The West Penn System. Elec. Traction, vol. 15, no. 9, Sept. 1919, pp. 531-542, 14 figs. Vast system of electric railways, light and power companys serves territory of 2,500 square miles.

ELECTRIFICATION

Current, Types. Single Phase Versus Continuous Current in Railway Electrification, E. Goolding. Tramway & Ry. World, vol. 46, no. 12, Sept. 11, 1919, pp. 137-139. Summary of relative merits and possibilities of different systems.

Europe. Electrification of Railways (Electrificacion de ferrocarriles), D. José Luis Valenti y Dorda. Revista de Obras Publicas, vol. 67, nos. 2288 and 2291, July 31 and Aug. 21, 1919, pp. 365-373 and 419-422. July 31: Notes on development in England, Switzerland, France, Italy and Germany. Aug. 21: Cost figures. (Concluded.)

France. Progress on the Midi Railway Pyrenean Electrification, Lucien A. H. Pahin. Elec. Ry. Jl., vol. 54, no. 10, Sept. 6, 1919, pp. 475-477, 3 figs. Ultimate

France. Progress on the Midi Railway Pyrenean Electrification, Lucien A. H. Pahin. Elec. Ry. Jl., vol. 54, no. 10, Sept. 6, 1919, pp. 475-477, 3 figs. Ultimate electrical mileage of more than 500 involved in development.

Switches. Railroad Electrification Facts and Factors, A. J. Manson. Ry. Elec. Engr., vol. 10, no. 9, Sept. 1919, pp. 311-314, 7 figs. Details of controlling apparatus and construction of electro-pneumatic unit switches.

LABOR

Track Labor. Improving Efficiency of Track Labor. Ry. Rev., vol. 65, no. 12, Sept. 20, 1919, pp. 409-412. Urges construction of good, clean, commodius, comfortable and sanitary quarters for track laborers as means for improving their working efficiency. Paper read before Roadmasters & Maintenance of Way Assn.

LOCOMOTIVE

British Locomotives. The Metamorphosis of the Locomotive, H. Holcroft. Engineer, vol. 128, no. 3320, Aug. 15, 1919, pp. 153-154, 1 fig. Recent innovations to British locomotive design, such as use of three high-pressure cylinders, and carrying circular smoke boxes in saddles. Fourth article.

Carbonization. Carbonization in Valve Chambers and Cylinders of Superheated Steam Locomotives; Its Cause, Effect on Lubrication and Maintenance, and Proper Measures to Overcome it, F. P. Roesch. Can. Ry. & Mar. World, no. 259, Sept. 1919, pp. 475-477, 4 figs. From anlyses of deposits of foreign matter which collect in valve chambers, passages, etc.

Feedwater Heaters. A New Departure in Locomotive Feedwater Heaters. Ry. Age, vol. 67, no. 10, Sept. 5, 1919, pp. 475-476, 3 figs. Combined feed-pump and feedwater heater of open type capable of handling 60,000 lb. of feedwater per hour.

Preheating of Feed Water in Locomotives (Vorwärmung des Speisewassers bei Lockomotiven), H. Igel. Zeitschrift für Dampfkessel u, Maschinenbetrieb, vol. 42, no. 18, May 2, 1919, pp. 130-133, 18 figs. Rieger preheater; flat shaped preheated for locomotive produced by Atlas Works, Bremen; types constructed by Schichau and Vulcan Works; Knorr one-chamber type.

Firebox Repairs. Locomotive Fire-Box Repairs, J. F. Springer. Ry. & Locomotive Engr., vol. 32, no. 9, Sept. 1919, pp. 270-271, 1 fig. By ocy-acetylene welding.

Mallet. Penn Lines Mallet Locomotive. Ry. Mech. Engr., vol. 93, no. 9, Sept. 1919, pp. 513-515, 4 figs. For pusher and hump yard service; 51-in. wheels and 28-in. stroke; 100,000 lb. tractive effort.

Powdered Fuel Equipment. A Pulverized Fue. Equipment for Locomotives. Ry. Age, vol. 67, no. 11, Sept. 12, 1919, pp. 519-520, 3 figs. Consists of fuel tank on tender, fuel-feeding apparatus, special arrangement of combustion chamber, slag or ash pans and smokebox.

Three-Cylinder Engines. Governing of Triple-Cylinder Locomotives (Die Steuerungen der Dreizylinderlokomotiven), F. Meinecke. Zeitschrift des Vereines deutscher Ingenieure, vol. 63, no. 18, May 3, 1919, pp. 409-411, 10 figs. According to writer three-cylinder engines have many advantages over four-cylinder engines, notably that two governing devices are sufficient for them. New simple governing device for triple-cylinder engine is described.

Valve Gear. Types of Valve Gear on French Locomotives, W. G. Landon. Ry. Mech. Engr., vol. 93, no. 9, Sept. 1919, pp. 523, 4 figs. Arrangements of Walschaert valve gear.

Valve Setting. Lame Engines and Their Effect on Fuel Consumption, J. W. Hardy. Ry. Mech. Engr., vol. 93, no. 9, Sept. 1919, pp. 515-516, 1 fig. Chart showing relation of fuel consumption to valve setting.

MAINTENANCE

Brakes, Freight. Maintenance of Freight Brakes, Mark Purcell. Ry. Mech. Engr., vol. 93, no. 9, Sept. 1919, pp. 531-532. Summary of instructions to be published for distribution by Air Brake Assn.

Bunk Cars. Some New Ideas in Bunk Car Facilities, H. F. Haag. Ry. Maintenance Engr., vol. 15, no. 9, Sept. 1919, pp. 305-307, 3 figs. Portable quarters provided for small gangs.

Upkeep of Railways. The "Upkeep" of the Railways under Federal Control. Eng. News-Rec., vol. 83, no. 10, Sept. 4, 1919, pp. 457-459. Analysis of conditions of railway properties now as compared with Jan. 1, 1918, when they were taken over by U. S. Government.

Tank Cars. The Tank Car Maintenance Problem, Paul Bateman. Mech. Eng., vol. 41, no. 10, Oct. 1919, pp. 817-819, 3 figs. Concerning particularly repairing of friction draft gear.

OPERATION AND MANAGEMENT

Explosives, Transportation. The Safe Movement of Explosives, D. J. O'Dea. Ry. Mech. Engr., vol. 93, no.9, Sept. 1919, pp. 533-537. Duties of carinspectors and repairers in respect to shipments of explosives and imflammables.

Fares, Australia. The Graduated Fare at Brisbane, Australia, J. S. Badger. Elec. Ry. Jl., vol. 54, no. 10, Sept. 6, 1919, pp. 481-484, 5 figs. Writer claims that in 1918 collections were 45.15 cents per car-mile with 60 per cent of riders paying only two cents each.

Freight Handling. Freight Handling at Brooklyn Army Base. Eng. News-Rec., vol. 83, no. 12, Sept. 18, 1919, pp. 555-560, 5 figs. Principles and prospective methods which controlled design of huge terminal intended to care for army overseas business at port of New York.

Loading of Cars. The Heavier Loading of Cars and Its Importance to the Transportation and Industrial Life of the Nation, M. J. Wise. Railroad Herald, vol. 34, no. 10, Sept. 1919, pp. 15-17. Concerning manner of conducting campaign for making ships load cars to maximum capacity.

Logarithmic Charts. The Logarithmic Chart in the Analysis of Railroad Operations, F. J. Deesen. Ry. Age, vol. 67, no. 12, Sept. 19, 1919, pp. 570-571, 6 figs. Illustrating uses of logarithmic chart.

Telegraphs and Telephones. I.C.C. Statistics on Telegraph and Telephone. Ry. Signal Engr., vol. 12, no. 9, Sept. 1919, pp. 305-309. Including table showing miles of telegraph and telephone lines being operated by American railways.

The Railway Telegraph, E. L. King. Proc. Pac. Ry. Club, vol. 2, no. 4, July 1919, pp. 3-9. Handling of railroad telegraph business; use and abuse of the telephone.

PUBLIC REGULATION

Good Will. Acquiring Good Will. Elec. Traction, vol. 15, no. 9, Sept. 1919, pp. 548-552, 14 figs. Springfield (Ohio) railways begin all over after granting of new franchise and have succeeded in giving real service that is highly appreciated by public.

Japan. Railway Nationalization in Japan. Ry. Engr., vol. 40, no. 476, Sept. 1919, pp. 196-199. Account of operation under state management from 1907-1917.

Municipal Ownership. Elements of the Cost of Service, Replacements Valuation and Rate of Return, Mortimer E. Cooley. Aera, vol. 8, no. 1, Aug. 1919, pp. 15-18. Arguments against municipal ownership of street railways.

The Advantages of Municipal Ownership and Operation of Street Railways, Glenn E. Hoover. Elec. Traction, vol. 15, no. 9, Sept. 1919, pp. 544-545. Enumerates advantages accruing from municipal ownership and points out that to his knowledge, no city ever reverted from municipal ownership of street railways to private ownership.

Railroad Operation. A plan for Private Operation of Federalized Railways, William J. Wilgus. Eng. News-Rec., vol. 83, no. 11, Sept. 11, 1919, pp. 496-497. Employees would have voice in management and share surplus with operators and public.

Track Supports. Concrete for Railway Track Support. Contract Rec., vol. 33, no. 36, Sept. 3, 1919, pp. 827-831, 2 figs. Four year's experience claimed to show lower maintenance though higher first cost.

Concrete Railway Track Supports. Engr. World, vol. 15, no. 5, Sept. 1, 1919, pp. 25-28, 9 figs. Illustrating various types in operation and suggested designs. Paper read before Am. Concrete Inst.

Track Welding. Track Welding by the Metallic Arc, Cyril J. Hopkins. Electrical Rev., vol. 83, no. 2180, Sept. 5, 1919, pp. 292-293, 5 figs. Current is obtained from motor-generator installed on covered wagon, taking supply from trolley wire. Details of fish-plate welding.

Turn Tables. Recent Examples of Turntable Design. Ry. Maintenance Engr., vol. 15, no. 9, Sept. 1919, pp. 312-314, 6 figs. Two designs illustrated, one with disc bearing center built by N. Y. Central, and one of continuous girder design built by Penn. R.R.

RAILS

Corrugations. Corrugations in Rails (Note sur l'usure ondulatoire des rails et leur fabrication), M. Ch. Thonet. Revue Universelle des Mines de la Métallurgie, vol. 2, no. 1, Mar.-Apr. 1919, pp. 501-539, 8 figs. Summarizing investigations undertaken by various experimenters, writer concludes that these undulations are due to presence of impurities in steel, and that in order to prevent their formation, steel used for rails should possess a high elasticity and prevent homogeneity.

Failures. Maintenance of Permanent Way—III. Ry. Engr., vol. 40, no. 476, Sept. 1919, pp. 188-193. Causes of rail failures.

Selection. Selection of Rails for Electric Railway Service, R. C. Cram. Elec. Ry. Jl., vol. 54, no. 12, Sept. 20, 1919, pp. 556-559, 6 figs. Data required and implements of manufacturing details as factors in determining proper form for a rail. For determining weight of rail rule developed by Baldwin Locomotive Works is recommended.

ROLLING STOCK

All-Metal Cars. Multiple Unit Equipment for English Railway. Ry. Age. vol. 67, no. 13, Sept. 26, 1919, pp. 625-628, 4 figs. Description of all-metal cars offers opportunity for interesting comparison with similar American rolling stock.

Box Cars. Box Cars Built by C. M. and St. P. Ry. Mech. Engr., vol. 93, no. 9, Sept. 1919, pp. 529-531, 5 figs. Underframe has steel center sill and wooden side sills; wooden frame body with steel ends.

Caboose. United States Standard Caboose Cars. Ry. Rev., vol. 65, no. 11, Sept. 13, 1919, pp. 379-380, 6 figs. Designs prepared for both steel and composite construction by Railroad Administration's Equipment Standards Committee.

Grain Elevators, Portable. Portable Pneumatic Grain Elevator, George F. Zimmer. Eng. World, vol. 15, no. 6, Sept. 15, 1919, pp. 36-38, 8 figs. Mounted iron railway rolling stock. Front end is supported on 8-wheel bogie, and rear pair of wheels being of ordinary type, while center pair can be coupled to engine so that truck can travel on its own power at rate of 5 miles per hour.

Lighting. New Developments in Car Lighting Save Money, E. Wanamaker. Ry. Age, vol. 67, no. 12, Sept. 19, 1919, pp. 567-569. Historical review of progress made from 1825 to present time, with notes on reasoned investigations. From paper read before Western Ry. Club.

Mail Cars. Specifications for Steel Full Mail Cars for Canadian Railway Mail Service. Can. Ry. & Mar. World, no. 259, Sept. 1919, pp. 472, 1 fig. Approved by Board of Railway Commissioners.

SAFETY AND SIGNALLING SYSTEMS

Block Signal Working Model. Southern Pacific Builds Instruction Car. Ry. Signal Engr., vol. 12, no. 9, Sept. 1919, pp. 309-311, 3 figs. Automobile Block signal working model installed with other apparatus for presenting operating problems,

Blue Lights, New York Subways. Blue Lights and Their Significance in the New York Subways, Edward A. Poor. Elec. Ry. Jl., vol. 54, no. 12, Sept. 20, 1919, pp. 579-581, 6 figs. Emergency precautions that have been taken to provide for the cutting off of power, the turning in of alarms and the automatic changing over to an emergency source of power for lighting.

Inspectors. Power-Saving Instruments a Long-Standing Success in Great Britain and Ireland. Elec. Ry. Jl., vol. 54, no. 11, Sept. 13, 1919, pp. 521-526, 6 figs. Value of follow-up recognized by maintaining motorman's inspector as permanent official.

Lightning Protection, Telegraph and Telephone. Telegraph and Telephone Lightning Protection. Ry. Signal Engr., vol. 12, no. 9, Sept. 1919, pp. 317-319, 18 figs. Purpose, scope and requirements briefly outlined with rules for applying protector principles.

SIGNALMEN'S CAR. Improved Outfit Cars Produce Good Results, H. F. Haag. Ry. Signal Engr., vol. 12, no. 9, Sept. 1919, pp. 302-304, 4 figs. Layout of four-car outfit designed by Kansas City Southern for use of signalmen.

TRAIN CONTROL SYSTEM. Test of Automatic Train Control System. Ry. Signal Engr., vol. 12, no. 9, Sept. 1919, pp. 312-316, 8 figs. Magnetic-inductive type installed on Western Pacific and Southern Pacific in California.

SHOPS

CYLINDERS, WELDING. Welding Locomotive Cylinders, J. B. Tynan. Ry. Mech. Engr., vol. 93, no. 9, Sept. 1919, pp. 540, 2 figs. Cylinder casting having large section of barrel broken off repaired by gas welding.

ELECTRICAL EQUIPMENT. Electrical Equipment of B. & O. Glenwood Shops. Ry. Elec. Engr., vol. 10, no. 9, Sept. 1919, pp. 297-304, 16 figs. With special reference to facilities for lighting, power and electric arc welding.

ROUND-HOUSE DESIGN. Modern Tendencies in Round-House Design, Exum M. Haas. Ry. Mech. Engr., vol. 93, no. 9, Sept. 1919, pp. 521-522. Modern types divided into three classes—brick wall, wood frame and roof; reinforced-concrete frame and roof; and combination of steel frame and reinforced-concrete structure. From paper presented before Western. Soc. of Engrs.

TIE TREATING PLANT. Pennsylvania Has Novel Treating Plant. Ry. Maintenance Engr., vol. 15, no. 9, Sept. 1919, pp. 315-317, 4 figs. Portable tie treating plant.

WOOD PRESERVING PLANT, PORTABLE. A Complete Wood Preserving Plant Mounted on Cars. Ry. Age, vol. 67, no. 10, Sept. 5, 1919, pp. 453-455, 4 figs. Portable equipment used by Penn. R.R

STREET RAILWAYS

CINCINNATI. Cost of Service in Cincinnati, W. C. Culkins. Elec. Traction, vol. 15, no. 9, Sept. 1919, pp. 570-572, 2 figs. Service-at-cost franchise adopted for solving street railroad problem.

COUPLING MECHANISM, AUTOMATIC. Automatic Coupling Mechanism for Tramways (Autocoupleur pour tramways). Bulletin Technique de la Suisse Romande, vol. 45, no. 17, Aug. 23, 1919, pp. 171-174, 5 figs. Projecting bar operates mechanism which drops weight and engages vertical rod in hole of bar. There are two similar mechanisms, one in each tramway.

DUNDEE. Dundee Municipal Tramways. Tramway & Ry. World, vol. 46, no. 12, Sept. 11, 1919, pp. 131-135, 8 figs. Progressive system with prospects of extensive development.

ECONOMIC FUTURE. Economic Future of Transportation Utilities. Elec. Ry. Jl., vol. 54, no. 11, Sept. 13, 1919, pp. 529-531. Symposium presented at Western Society of Engineers' meeting.

ELECTRIC RAILWAY SITUATION. The Electric Railway Situation of the United States Summarized. Aera, vol. 8, no. 1, Aug. 1919, pp. 8-11. Facts which have been brought out before U. S. Federal Elec. Ry. Commission appointed by the President to investigate urban transportation and its needs.

FARE COLLECTION. The Collection of Odd Street Railway Fares, R. T. Sullivan. Elec. Ry. Jl., vol. 54, no. 13, Sept. 27, 1919, pp. 653-656, 4 figs. Illustrating how design of car facilitates collection.

FARE SYSTEMS. Zones Fares in Springfield. Elec. Ry. Jl., vol. 54, no. 13, Sept. 27, 1919, pp. 628-636, 12 figs. Based on central city zone with outer zone belts and two reduced-rate tickets to points in first outside zone.

Zone System in Portland. Elec. Ry. Jl., vol. 54, no. 13, Sept. 27. 1919, pp. 621-627, 11 figs. System in Portland, Maine, comprises slightly more than 100 miles of track, the population served approximately 100,000 except during summer months when it is increased to 175,000.

The Net Result of the 5-Cent Fare, James R. Bibbins. Elec. Ry. Jl., vol. 54, no. 12, Sept. 20, 1919, pp. 570-571, 1 fig. Instance of large company in which 5-cent fare is said to have produced instability. Paper presented at Western Soc. of Engrs.

Zone Fares have been found Satisfactory in Milwaukee. Elec. Ry. Jl., vol. 54, no. 13, Sept. 27, 1919, pp. 613-620, 11 figs. Present system has been in existence since January 18, 1914.

Discussion of Fare Systems. Elec. Ry. Jl., vol. 5, no. 13, Sept. 27, 1919, pp. 610-612. Present fare systems classified and compared. Fundamentals of scientific system outlined.

SPEEDS. Advantage of Higher Schedule Speeds, John A. Beeler. Elec. Ry. Jl., vol. 54, no. 13, Sept. 27, 1919, pp. 657-660. Claimed to be of benefit to both the company and the public.

TERMINALS

EAST ST. LOUIS. Terminal Improvements in East St. Louis. Ry. Rev., vol. 65, no. 12, Sept. 20, 1919, pp. 405-407, 7 figs. Arrangement to route traffic along water front instead of through to junction points.

MARKHAM YARDS. Markham Yards of Illinois Central, W. T. Christine. Eng. World, vol. 15, no. 6, Sept. 15, 1919, pp. 25-28, 8 figs. For classifying freight, making up trains composed of various commodities and for various industries and destinations to bring freight so classified into Chicago for distribution and to handle outbound freight in an equal manner.

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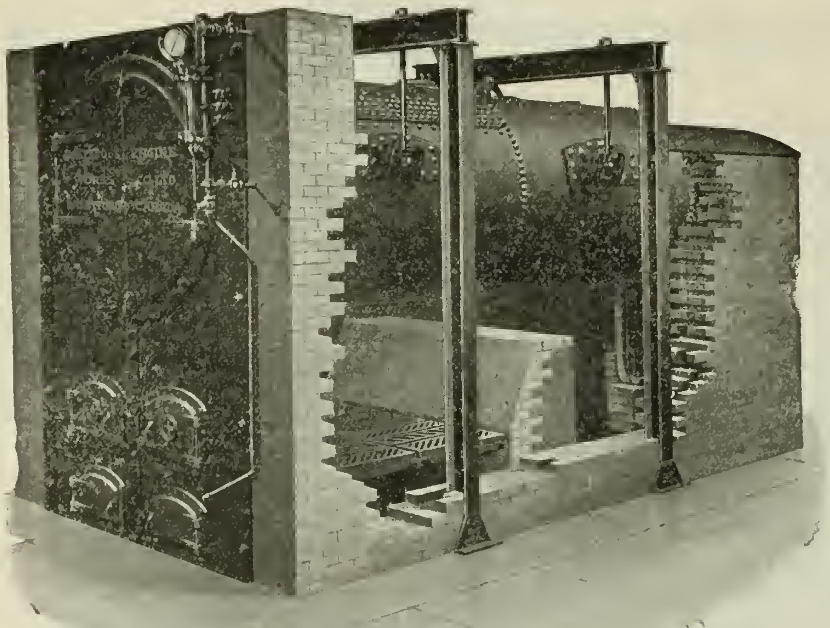

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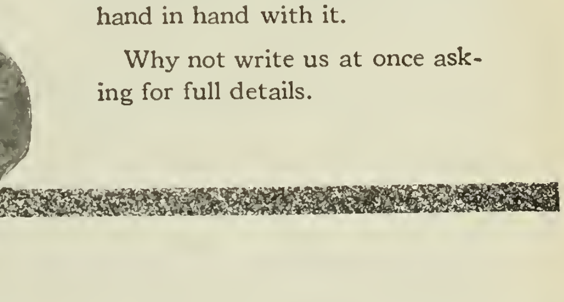

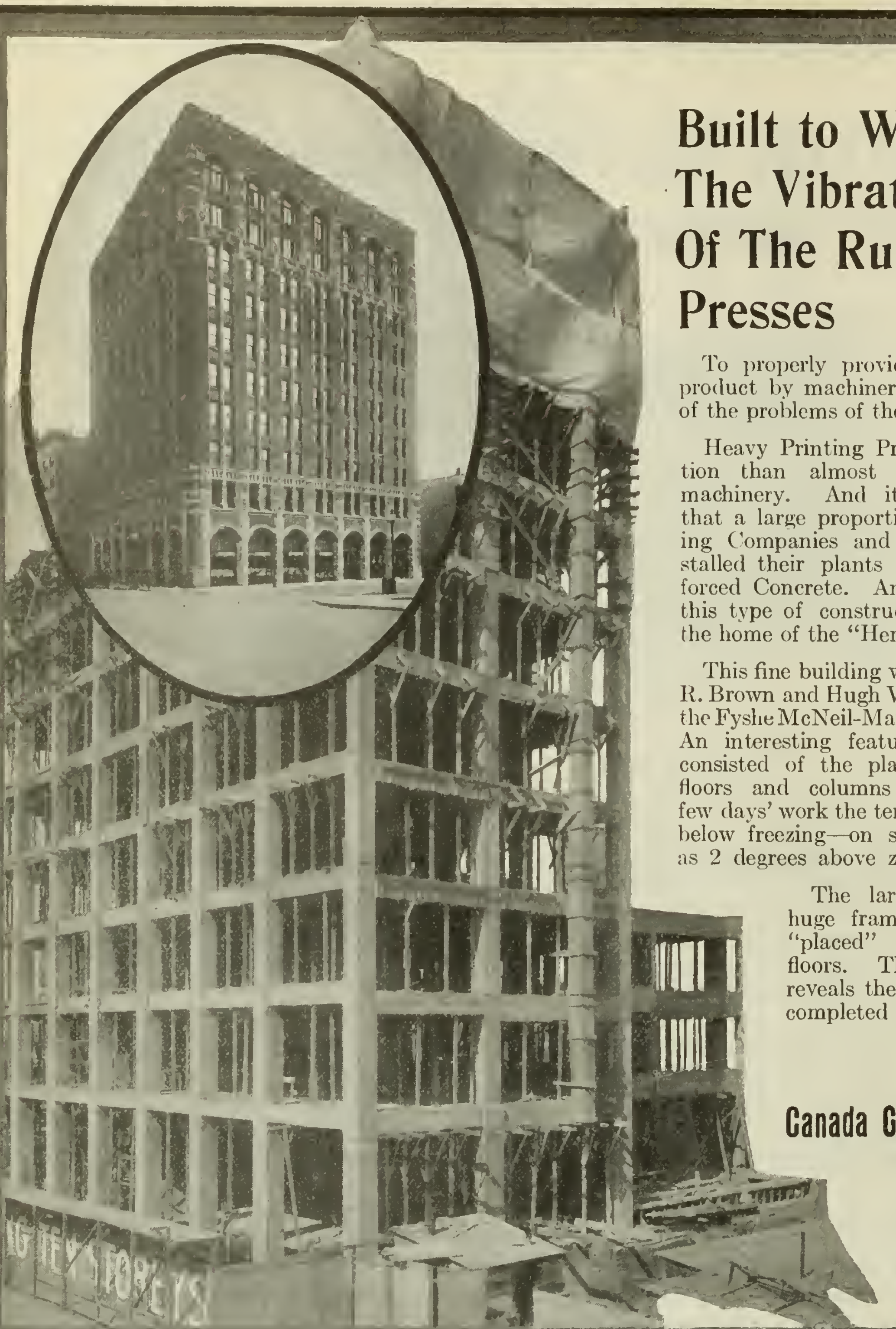

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The Economy of Treating Railroad Ties

By S. B. Wass, A.M.E.I.C.

History of Treatment, Most Suitable Woods, Principal Methods of Treatment, Treatment in Canada, Advantages of Treatment.

Up to the present time wood for all purposes in Canada has been available in such quantities, and at such prices, that very little thought has been given, or care taken to extend the period of its life, or to conserve its use. No accurate estimate is available of the total quantity of timber in Canada, but Senator W. C. Edwards said, while presiding at the tenth annual meeting of Commission of Conservation recently: "The lumber east of the Rocky Mountains is almost exhausted, and every Province overestimates its lumber resources." It is generally conceded that the annual cut of lumber with destruction from forest fires exceeds greatly the annual growth, so that with the greater development of our country during the re-construction period, no greater depletion of our forest reserves must take place unless some prompt action is taken to counteract it.

Several methods at once suggest themselves: Reforestration, Fire Protection, Chemical Preservation, and others. As railway ties form a very large proportion of the requirements for wood it is proposed to deal in this paper with Chemical Preservation as applied to railway ties.

Chemical Preservation of wood is not a new industry. In very early days oil was used to preserve timber, and as far back as 1782 creosote was used in Europe to preserve ship timbers and timbers for dykes.

Chemical Preservation consists of impregnating the pores of the wood with a toxic antiseptic, which poisons the fungi or bacteria which consume and destroy the fibres of the wood. The best and most economical substances are creosote, or dead oil of tar, and zinc chloride solution, or combination of these.

History of the Treatment

Treatment of ties has been carried on in Europe for a great many years. Great care has been exercised in the selection of the timber and seasoning before treatment. Of eighty-seven railroads reporting to the International Railway Congress in 1900, fifty-nine were using treated ties almost entirely and twenty-eight only were using untreated ties, and these latter were of the smaller roads.

In Great Britain the larger portion of ties are of baltic pine imported from Norway, Sweden and Northern Russia, the average life of which, untreated, is eight years. When properly treated the average life is fifteen or sixteen years, thus the life of the tie is doubled. The treatment used is creosote, or zinc chloride and creosote.

In Continental Europe, a great variety of woods has been used, but oak, pine, and beech are the most uniformly distributed and are available in largest quantities. The Report of the International Railway Congress states that from data of fifty-four railways the average life of ties is as follows:—

Oak, untreated, 13.5 years, creosoted, 25 years. Inc. in life, 85%.

Pine, untreated, 7 to 8 years, creosoted, 20 years. Inc. in life, 150%.

Beech, untreated, 2½ to 3 years, creosoted, 30 years. Inc. in life, 900%.

The report goes on to say, "Of all wood in Europe sound beech is the most thoroughly susceptible of impregnation, this fact is due to the circumstance that beech is mostly sap wood, and consequently all the pores, which in their natural condition serve to transmit water, remain permanently open; whereas in the case of oak and pine the creosote penetrates only through the sap portion of the wood, while the heart wood absorbs very little or none. Results reported by certain of the French roads show that Creosoted Beech ties harden with age or service, and eventually surpass oak ties in durability and hardness, so that they are preferably used on lines of heavy traffic. In consideration of the foregoing qualities, and the fact that the first cost of beech is less than that of oak and pine, it is considered by far the most suitable timber for ties."

In the United States experimental work was carried on as far back as 1880, but the first tie-treating plant was constructed by the Atchison, Topeka and Santa Fe Railroad in 1885, followed by one for the Union Pacific, one for the Chicago Rock Island and Pacific in 1886, and one for the Southern Pacific in 1887. For the next ten years during the period of financial depression the development was slow, but commencing in 1897 twelve plants were constructed in very rapid succession for or by American roads in the West and Middle West, where timber is less plentiful than in the Eastern States and the long haul on ties led to greater care and treatment of ties. From that time development has been rapid until 1914, during which year ninety-five tie treating plants treated 43,847,000 ties or 34.26% of the 128,064.000 ties used by railroads in the United States. Since 1914 the production has fallen off owing to extremely high prices of preservative and to other abnormal conditions due to the war.

Types of Wood Suitable for Treatment

In the United States all kinds of wood have been subject to treatment with varying results. The records are not so complete as in case of European roads as the majority of the most successful examples of treatment are still in the track, and their life can only be estimated. Enough is known, however, to prove beyond a doubt that the life of the average first class tie can be increased by 200% to 300% by chemical treatment, that the increase will be proportional, within certain limits, to the amounts and quality of preservative used, that the greatest advantage can be gained by treatment of the harder and more porous woods as red oak, beech, birch, maple and similar species. These species absorb the preservative more readily and uniformly, are stronger to withstand mechanical wear, and provide greater strength to the track generally and great strength is a necessity on account of the heavy loads imposed by up-to-date rolling stock.

Treatment Processes

In general four processes of treatment have been used:

1st. Creosote only.

2nd. Mixture of Creosote and Zinc Chloride.

3rd. Mixture of Zinc Chloride, glue, and tannin.

4th. Zinc Chloride only.

The most economical process for any particular case depends very largely on local conditions such as the price of ties, price of preservative, length of haul, labor conditions, etc. Generally the creosote process gives most permanent results, but since the war the price of creosote has been almost prohibitive and the supply limited. The mixture of creosote and zinc chloride gives good results for timber not exposed to the action of the salt water and is very much cheaper than Creosote alone, the third and fourth processes are cheaper, but the results are less satisfactory due to the antiseptic being dissolved by moisture; also less resistance to electric current is offered by ties treated by the zinc chloride process.

Some difficulty has been experienced on account of the fact that these ties transmit the current in automatic signal territory. This does not occur with creosoted ties. If, however, the price of creosote does not come down these processes will be more largely used, especially by the roads of the Middle West, where the climate is dry.

The combined committee of the American Railroad Engineering Association and the American Wood Preservers Association, after a lengthy report and discussion on processes at their convention in Chicago in last March arrived at the following conclusions:—

I. Creosote is the finest timber preserving agent known for all purposes; its composition is not affected by either rainfall or temperature. it has a lubricating effect on the wood which diminishes the injury due to mechanical wear, which combination of qualities places it at the head of all treating preservatives.

2. Where for economic reasons creosote oil is not available, or other conditions of maintenance will not justify the expense of creosote treatment, the adoption of zinc chloride is without question justified in the treatment of ties. Climatic conditions will go further in determining the economy of this treatment than in any other. One can unquestionably figure on doubling the life of the untreated timber by its use in dry climates.

3. In localities where the rainfall is excessive and the atmosphere is humid the Zinc Chloride treatment is unfavourably influenced by leaching, and in any climate where leaching of the timber is likely to be excessive, and the mechanical abuse of the fibre is extreme it is not considered possible to secure a straight Creosote treatment. The introduction of some lubricating agent with Zinc Chloride has a beneficial effect in retarding the destruction of the timber from the above causes.

In Canada the industry is in its infancy; up to 1910 practically no treated ties were used; since that time the following growth has taken place:—

In 1911, 206,000 ties; in 1912, 1,818,000 ties were treated, the maximum was reached in 1915, with 3,915,000 ties, after which the number decreased to 2,732,000 ties, due to abnormal conditions and prices. This development has taken place principally in the West, and practically no treated ties are being used in the East of Canada. Only the creosote process has been used in Canada, and the treatment in many cases for experimental purposes has been thorough. Judging by present conditions and from estimates of the life of ties made by the Railway Maintenance Engineers, it would seem that the results of treatment will be highly satisfactory, and that the Canadian railways should encourage and develop the tie treating industry.

Advantage of Treatment

From the railroad point of view the advantage to be gained is two fold:—First, Indirect; Second, Direct.

The indirect effect of treating railroad ties would be to reduce the requirements of the railroads to at least 50% of what they would be for untreated ties. Hence the treatment of railroad ties would be an important factor in conserving our forest reserves, the railways are among the heaviest users of timber for up to the present no satisfactory substitute has been found for wood ties. It has been estimated by A. Gibson, Superintendent of the Timber Preservation & Tie Treating plants of the Northern Pacific Railroad, that if untreated ties were used throughout the United States the railroads would require 191,000,000 ties annually for renewals; this would be reduced by 113,000,000, were all ties treated. Hence in Canada we would effect a saving of about 12,000,000 ties annually on our 30,000 miles of railroads by using treated ties. Hardwood is highly suitable for treatment, and hence if the use of treated ties becomes more general, a vast amount of hardwood would be used which is at present, either used for fuel or left standing, becoming frequently a prey to forest fires. The use of hardwood ties would also release a large amount of more valuable soft woods for other purposes.

The principal direct advantages from the use of treated ties are as follows:—

Greater strength of track is afforded by hardwood ties, which are stronger to hold track to gauge, and resist better the mechanical wear of the rail.

The surface is improved as the material under the ties is not disturbed so frequently for renewals. With reference to this, W. M. Camp, says, "Any preservative process which will double the natural life of the tie, at a total cost for the handling and treatment not exceeding the cost of an untreated tie is a paying proposition for any railroad."

The third direct result of treating is seen in reduction of annual cost of ties. The annual cost of maintaining a tie in the track consists of three items: 1st, the interest of the first cost of the tie, 2nd, a sinking fund which will be sufficient to replace the tie when it becomes worn out. 3rd, the annual labor charge for surfacing. A comparison of treated and untreated ties on this basis is interesting. The third item varies greatly under different conditions, and an accurate estimate cannot be made. It is quite safe to assume, however, that the difference if any, will be in favor of the treated tie, we shall, therefore, only consider the first two items.

Untreated Ties

Cost of tie	90c.
Placing in track	35c.
Total	$1.25
Annual Cost:	
Interest on $1.25 @ 5.5% per annum	6.875 cts.
Sinking fund to replace tie after 7 years	15.123 "
Total	21.998 "

Treated Tie

Cost of tie	$1.00
Seasoning and creosoting	.53
Placing in track	.35
Total	$1.88
Annual cost:	
Interest on $1.88 @ 5.5% per Annum	10.340 cts.
Sinking fund to replace tie after 15 years	8,393 "
Total	18.733 "

These tables show an annual reduction of 3.265 cts. per tie or in other words an annual saving in maintenance of $68.20 per mile of railroad by the use of the treated ties.

This saving, like most good things, cannot be had without some expenditure of energy and capital on the part of those interested. The railways and the producers must co-operate in order to replace the present wasteful method of supplying ties with the more methodical, scientific and economic process required for treated ties. This change cannot be affected at once but will require some years to be developed; but the saving will amply repay the expenditure; and it would seem that a start should be made in Eastern Canada.

Editorial Note

The comparison showing costs of treated or untreated ties depends largely on the rate chosen for the sinking fund. The author of the paper has chosen 5½%, and it is possible that this rate is too low for present conditions. It is obvious that the method of calculating sinking fund and the interest charged for the whole amount of money involved has a very important bearing on the subject and a relatively slight change in interest would make the whole difference between whether the treated tie or untreated tie was the proper one to use.

Duty of Water Investigations in Alberta*

By F. H. Peters, M.E.I.C.

"Duty of Water" means the quantity of water required to irrigate one acre of land in each irrigation season; the author describes experiments on duty of water conducted by the Irrigation Branch of the Department of the Interior, and gives tables showing results obtained for different crops.

All surface water in the provinces of Alberta and Saskatchewan belongs to the Crown, and the use of this water for irrigation and every other purpose except for water power, is controlled by the Dominion Irrigation Act. In accordance with the requirements of this Act, the duty of water is fixed by the Minister of the Interior, and this has created the necessity for practical experimental work to determine what the proper duty of water is in Western Canada.

The duty of water means the quantity of water that is required to irrigate one acre of land in each irrigation season, which includes the annual period from May to September, both inclusive, and in certain districts the annual period from April to September, both inclusive. The duty of water fixes the *quantity* that is to be supplied during the irrigation season, but it has nothing whatever to do with the rate at which the water is to be supplied during the season. It is assumed that the total duty is to be supplied throughout the irrigation season at such rates of flow as will make field irrigation a practical success.

It is obvious that the proper duty of water depends on a number of different factors and that it will vary in different localities. The factors which mainly affect the duty of water are the climatic conditions and the soil conditions, and in the same locality different crops will require different quantities of water. The Irrigation Branch of the Department of the Interior has carried on the only investigations to determine the duty of water in Western Canada. It is possible that investigations along this line have been made by other parties, but if so they have never been published and made available for general information. In carrying on these duty of water investigations the Canadian Pacific Railway have assisted by providing land and water to work with, and the Canada Land and Irrigation Company have co-operated by carrying on experimental work under the supervision of government officials at their demonstration farm at Ronalane, Alberta. The two principal duty of water experiment stations are now at Brooks, and Ronalane, Alberta. An experiment station was previously operated at Strathmore, Alberta, and similar work is also being done at the present time in the Coaldale irrigated district near Lethbridge. The work which has been done at these stations gives general results which are typical for the larger irrigated blocks which have already been developed, or are proposed to be developed in the future. Up to the present there has been no opportunity to study very closely the question of local variations.

*To be read before the Western Professional Meeting of the Institute at Edmonton.

The method of carrying on these experiments is such as to give definite and positive results. A piece of land is selected which has consistent characteristics throughout and this is then divided up into a number of smaller plots. To determine the duty of water for wheat for example, perhaps ten of these plots are sown to wheat. They are then all treated exactly alike except that varying depths of water are applied. The first plot is left dry; the next receives four inches; the next eight inches; the next twelve inches, and so on up to a point where so much water is applied that the yield is actually decreased. This method definitely fixes the quantity of water which produces the maximum yield of all the different crops which are experimented with. This work is all checked by determining from soil moisture investigations the quantity of available water in the soils, both in the spring and in the fall of the year. Sometimes with the deeper rooted plants, the plots which do not receive sufficient irrigation water draw on the available moisture which was in the soil in the spring, and conversely with some of the plots that receive large quantities of water, the plants cannot use all of the water supplied and some of it is stored up in the soil. By determining the quantity of water available in the soil in the spring and again in the fall, we can determine definitely just what quantity of water has actually been used by the plants during the growing season.

The experimental work referred to above shows just what results are gained from the different crops by applying different depths of water, and finally shows the depth of water which produces the maximum yield. It does not follow, however, that the quantity which produces the maximum yield should be adopted in fixing the duty of water. In fixing the legal duty of water there are practical considerations which have to be taken into account. It may not pay under practical conditions to supply the quantity of water which will produce the maximum crop yields. It may be much better to fix a duty which can be readily applied and at the same time give a large increase in crop yield. After a certain quantity of water has been applied, it usually takes a comparatively very large quantity of water to produce additional gains in the crop. Another practical point which has to be considered is the desirability of conserving the water supply which is available in our streams. Particularly with low priced dry lands, the value of a certain quantity of water may be much greater if spread over a larger area. That is to say, one and one-half acre-feet of water spread over one acre of land might produce fifty bushels of wheat, while three-quarters of an acre-foot spread over one acre might produce thirty-five bushels. Thus if one and one-half acre-feet were spread over two acres of land, it could be made to produce seventy bushels.

Any full discussion of the definite duty of water in Western Canada requires a mass of detailed information, and anybody who is particularly interested in this question can get all this information by reference to the reports which have been published by the Irrigation Branch. The original duty of water in Western Canada was fixed by requiring a continuous flow throughout the irrigation season of one cubic foot per second for each one hundred acres of land. This figures out to a duty of three acre-feet, giving a depth of three feet of water all over the land. Later the duty was changed requiring a continuous flow of one cubic foot per second for one hundred and fifty acres of land, which is equal to two acre-feet or a depth of twenty-four inches over the land. On March 25th of the present year, the duty was again changed and fixed at one and one-half acre feet for each acre of land, which equals a depth of eighteen inches. The investigations which have been made by the department indicate that with a system constructed so as to give a delivery of water at proper rates for practical use, that one and one-half acre-feet is sufficient under our general conditions in Western Canada, and is a proper general duty of water.

The diagram which is printed below shows at a glance the kind of information that is gained in carrying on the duty of water experimental work. The diagram shows the results actually gained at Ronalane during the season of 1917. The diagram is divided off, to show the various crops on which experiments were made. Above the central horizontal line the columns represent the crop yield, and similar columns plotted underneath the central line show the depths of water which produced the crops. The column below the line representing the depth of water which produced the maximum yield is shown cross hatched with a view to bringirg it more prominently before the eye. It is very evident from this diagram just how the crops increase as the depth of water applied is increased, until one reaches a point where too much water keeps the land wet and cold, and the crop yield begins to fall off again. As an exception, the greatest depth of water applied produced the greatest yield of wheat, but this particular experiment was not carried far enough to prove that an increased quantity would have decreased the yield. It will be noted that in the alfalfa crop the first group of columns shows the application of four inch irrigations, while the second group shows the results from the application of six inch irrigations. Similarly for the wheat, oats, barley and peas, the main group of columns shows four inch irrigations, while the last two in each case show six inch irrigations.

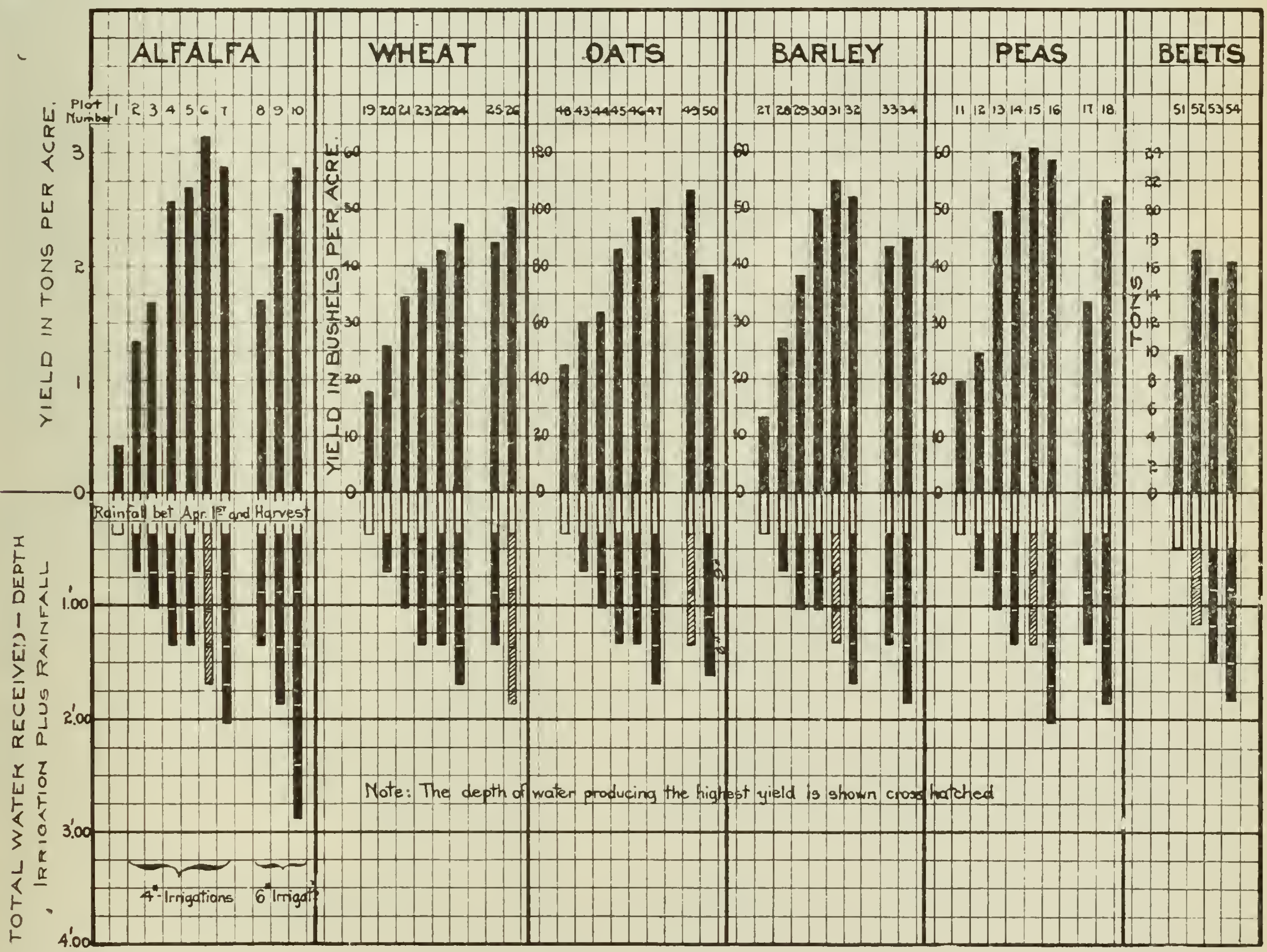


Diagram Showing Yields Produced in Comparison with Irrigation Water Applied, Ronalane, Alberta, 1917.

Coal Briquetting and Conservation

By P. A. N. Seurot, M.E.I.C.

Advantages of Briquetting—Briquette Binders—Description of Presses—Layout of Briquetting Plant.

Coal Shortage and Utilization of Waste.

The high cost of coal is due to several causes, chiefly to trusts, transportation, local and climatic conditions; the shortage of coal may be due to lack of, or to poor, mining resources, to strikes, blockade, etc.

There is another phase of the problem which, so far, in Canada, has not been seriously considered, and that is the waste of coal and by this is meant the waste or non-utilization of the refuse or dust left in barges, in cars, in coal yards, in power plants, in gas plants, the waste of "run-of-mine," dust, or slack left in mines and collieries.

In regard to coal production, Canada was before 1914, very much in the same position as France. This latter country, whose natural coal resources were not sufficient to supply her needs depended on England, getting coal from Newcastle and Cardiff just as Canada depends partly on the Lehigh and Lackawanna fields, on Pennsylvania and on West Virginia.

The production of coal for the years 1912 and 1913 was as follows:—

In 1912:—14,512,829 tons representing a value of	$36,019,044
In 1913:—15,115,089 tons representing a value of	36,250,311
For the two years, a value of	$72,269,355

The imports of coal from the United States into Canada for the same two years amounted to :—

Anthracite Coal.	
In 1912:—4,118,379 tons representing a value of	$19,306,639
In 1913:—4,237,310 tons representing a value of	20,399,279
Bituminous Coal.	
In 1912:—10,500,662 tons representing a value of	20,333,268
In 1913:—11,060,910 tons representing a value of	20,447,587
For the two years, a value of	$80,486,773

It may be seen, therefore, that while the production of coal in Canada amounted to $72,269,355 for the years 1912-1913, the imports of coal amounted for the same years to $80,486,773, i.e., an excess of imports over home production of $8,217,418.

While it is not claimed that the imports of coal could be dispensed with, there is no reason why the manufacture and use of briquettes for commercial and domestic purposes, utilizing run-of-mine slack, breeze, coal dust and waste could not more than redeem this difference of over $8,000,000.

The scarcity of coal and the high cost, particularly during 1917 and 1918 emphasize still more forcibly the necessity of utilizing all wasted coal, slack, and dust to make up in a mesure for lack of adequate supply and to keep prices down.

The Committee on Conservation of our own *Engineering Institute*, the then *Canadian Society of Civil Engineers*, in its report of 1915 quoting W. J. Dick, Mining Engineer to the Commission on Conservation, stated that:—"At our coal mines, from the Atlantic to the Pacific, the waste of coal, and so of potential power, is simply appalling. In Saskatchewan, Alberta and British Columbia, from 10% to 35% of the whole output of coal brought to the surface is waste slack. Some of it is burnt on the prairies; in British Columbia much is thrown into the sea. There is no doubt but that the waste in Eastern Canada is correspondingly great and some attempt to inculcate a little economy on the part of coal mine operators would be in the direct line of the efforts and functions of the Commission.

Mr. Dick states further that there are four briquetting plants in Canada. The limiting output of these 4 plants is only about 1100 tons per day, say 350,000 tons per annum, which is a very small proportion of the total slack coal produced, the rest being sheer waste.

In Germany alone, the manufacture of briquettes amounted to over 20,000,000 tons per annum.

In France, the railway companies, the gas companies, the mine owners, the coal dealers, all manufacture briquettes out of coal breeze and dust and even owners of canal coal barges install on each barge small compact briquetting plants to redeem any waste dust left in the hull of their boats.

Even Newcastle and Cardiff, so rich in coal fields, have briquetting plants to salvage any waste.

As pointed out by Mr. Dick:—

"A large proportion of Germany's briquetting is made from lignite, but as there immense deposits of lignite in Canada, the value of Germany's example is but enhanced.

Revenue from Briquette Manufacture

The following estimate will show what revenue could be derived from the manufacture of briquettes in a yard capable of manufacturing 30 tons per day:

Estimate of coal briquetting for a production of three tons per hour.

Area necessary for plant:—810 square feet, Installation comprises:—

1 Coal feeding screw and hopper.
1 pitch feeding screw and hopper.
1 pitch breaker and pulverizer.
1 steam jacketted mixer.
1 conveyer elevator.
1 cooling table.
1 briquette press.
1 motor using steam for mixer.

Cost of above installation	$8,000.00
Shed, piping and incidental installation	2,000.00
Total	$10,000.00

Interest on equipment at 6%
Amortization........ 6%
Repairs............ 3%

15% on $10,000.00
per year —$1,500.00

Assuming 300 days' work, carrying charges per day are.......... $\frac{1500}{300}$ — $5.00

Cost of manufacturing per diem of 10 hours equivalent to a production of 30 tons per day:—

Carrying charges		$ 5.00
Pitch binder, say 8% on 30 tons:—2.40 tons at $10.00		24.00
Labor, 1 foreman	$ 4.00	
" 6 men at $3.00	18.00	
	$22.00	22.00
Fuel for power and steam mixer 250 H.P.H. at 2 cts		5.00
Waste, oil, etc		.50
Office work		1.50
Total for 30 tons		$58.00

Cost of manufacturing per ton 50÷30=$1.93.

The cost of manufacture would, therefore be $1.93 for briquettes which could easily be sold at $5.00 per ton and be still cheaper than coke to the consumers. If we assume that instead of throwing or giving away the coal screenings the coal dealer had found a buyer for them and could get say $1.00 per ton, it would bring the cost to him to $2.93, still leaving a large margin for profit.

An Actual Example of Saving

One other example will show what saving can be realized by using coal screenings.

In the Hudson and Manhattan tunnels Power House, the amount of coal dust averages 7.5 tons per day. The removal of this coal waste required handling costing the company $10.50 per day for labor of 10 hours, that is $1.40 per ton of coal dust removed. It was decided, a few years ago, to see if this coal dust could be utilized and made into briquettes.

Owing to the fineness of this breeze, it was found that it would require not less than 10% of binder and the following estimate was made:—

200 lbs. of pitch, per ton of coal dust, @ 0.0045.		$0.90
Using a 12 H.P. eggett machine of 1,500 lbs. hourly capacity, running 10 hours per day:—		
Fuel for power		0.05
Oil and Waste		0.02
Labor:—Loading and handling coal dust, running pitch breaker, mixer and press, loading and handling briquettes		1.53
Cost of press, engine and accessories	$3,200	
Interest and amortization per year at 10%—	$320	
Maintenance on part of plant, 3% on $2,300, say	70	
	$390	
cost per ton $\frac{390}{2,475}$ tons per year		.15
Total cost per ton		$2.65

If we deduct from this amount the cost $1.40 per ton of removing the coal dust as given above, it leaves $1.25 to be charged to the manufacture of briquettes which could be used instead of coal. The saving amounted then to the difference between the price per ton of coal and of the cost of briquette manufacturing, multiplied by 8.25 tons, the weight of briquettes obtained every day.

Reasons for Failures

Aside from the selfish motive which may influence some mine owners or coal dealers in Canada to look upon coal briquetting as a competition, the knowledge of the failures suffered in the United-States by some briquetting enterprises may be taken as an excuse.

C. L. Wright in his report to the Washington Bureau of Mines, on Fuel Briquetting Investigations states that the failures were, in a large measure, due to the following causes:—

1st.—"Many of the "plants" represented promoters' schemes, no attempt being made to build the plants.

2nd.—Attempts were made to develope a new binding material or a new press, without proper appreciation of the principles of briquetting.

3rd.—Plants were poorly situated for marketing the briquettes.

4th.—The briquettes produced were inferior.

5th.—Poor salesmanship has been responsible for other failures of briquetting ventures.

6th.—Uncertainty in the supply of raw fuel or binder has caused the failure of many briquetting plants.

7th.—Lack of technical supervision has in some instances been the direct cause of failure.

Advantages of Briquettes

Quoting from articles by Charles L. Wright and from bulletins Nos. 363, 403 and 412, published by the U.S. Bureau of Mines, the briquettes, when properly made and with a suitable binder, possess the following advantages over raw fuel:—

1.—The even size of the briquettes permits of a more regular and thorough combustion in the firebox or furnace as the spaces that exist between adjacent blocks allow of even distribution of air through the fire and the pressure drop through the fire is also less.

2.—A good briquette holds its shape in the fire, so that even when coking coals are used they do not coke together sufficiently to cut off the air for combustion and the gases are burned as fast as distilled off, so that:—

3.—Practically no smoke should be obtained from the combustion of good briquettes.

4.—Briquettes generally burn to a fine ash rather than a clinker, as in the briquetting process the mixing and grinding thoroughly distribute the ash material, which in the raw fuel exists in spots and layers and is fused into clinker instead of falling through the grate.

5. The characteristic fineness of the ash from briquettes allows of keeping a better fire with less attention and poking than is possible with raw fuel under the same conditions.

6.—The evaporation per pound of fuel is greater for the briquette than for the same coal in its natural state. This advantage is maintained at all rates of evaporation.

7.—The capacity of a boiler is considerably increased by the use of briquetted fuel.

8.—The weather-resisting qualities of many coals, and especially lignites, are greatly improved by briquetting.

9.—Briquettes apparently give a longer flame than run-of-mine coal.

10.—It is much easier to raise and to keep up steam with briquettes than with run-of-mine coal.

11.—Higher rates of combustion are possible with briquettes and consequently higher power.

12.—When properly made, there is less loss from breakage during transportation of briquettes than of run-of-mine coal.

13.—The danger of spontaneous combustion in storage piles is eliminated if the fuel is stored in the briquetted form, and this characteristic of briquettes has made briquetted fuel favored for storage by European countries.

14.—The block-shaped briquettes may be piled in regular piles and occupy less space than the run-of-mine or slack from which they were made.

15.—Briquettes, especially those made from lignite, have a higher heat value than the raw fuel from which they were made, this improvement resulting from the higher heat values of the binder being added to bituminous and anthracite coal, and from the evaporation of water from the raw lignite.

Binders

At first it was intended to manufacture briquettes without any binder by a process of physical reconstruction, applying simultaneously heat and pressure to pulverized coal. These briquettes, however, lacked cohesion, disintegrated easily and were expensive to manufacture.

However, the experiments that were made were essentially laboratory tests and could not be applied practically to any advantage; it was also necessary that only the highest grade of soft coal be used. Such coal, however, is used to better advantage in the manufacture of gas and coke and very seldom for manufacturing briquettes. In any case the cost of the machinery would be such as to be prohibitive.

Practically the only fuel used in the manufacture of briquettes without the admixture of binder is peat.

Briquettes have been made in which clay was used as binder. Such briquettes are still manufactured in the Northern part of France. These briquettes, generally called "economical fuel," are sold chiefly for domestic use about $2.80 per ton; they burn slowly and evenly, they have a high radiating power and are very satisfactory.

Pitch

Pitch is really the best and most practical binder used in the manufacture of briquettes. Its use gives a high degree of cohesion to the briquettes, while the high calorific power of pitch lessens the percentage of ash.

Pitch is the residuum of the distillation of coal tar. If the distillation is stopped when the temperature reaches 390° to 430° Fahr., the residuum still contains the anthracene oils and is called soft pitch; it melts at about 122° Fahr. and its specific gravity is 1.18, whilst the specific gravity of tar is 1.17. Soft pitch can only be transported in special tanks and is used for manufacturing briquettes only in plants such as gas plants, where both distillation of coal and manufacture of briquettes are carried on simultaneously.

When the distillation is continued after the temperature reached 430° Fahr. the anthracene oils are then separated and the residuum is the dry pitch. However, in order that this pitch be of good quality not more than 5% of anthracene oil should be extracted. The dry pitch left in the vat should then be about 65% of the tar, in weight. This dry pitch softens at about 158° Fahr., melts between 200° and 250° Fahr. and its specific gravity is 1.19.

In the manufacture of briquettes, the quality of the dry pitch is a very important item. When using soft pitch, the quality of the briquettes merely depends on the percentage of tar in the mixture. When using dry pitch, however, it is necessary that it should answer to certain specifications.

It should remain dry and solid at ordinary temperatures and should be easily transported in cars, waggons or barrows, softening only when exposed to the sun for a long time. When broken, the surface ought to be conchoidal, shiny, and perfectly black. It should not stick to, nor grease, the fingers; its odor ought to be the odor of coal tar. Put in water at a temperature of 167° Fahr. it ought to pull in long, thin, threads without breaking; if such threads are not more than from 12 to 20 inches long the quality of the pitch is poor. When burned, it should give from 45 to 52% of swollen and very solid coke. Incinerated, it should not give more than 0.5% of ash.

It must be the product of the distillation of tar and must not contain any residuum of either petroleum or mineral oil.

A very simple way to test the quality of pitch is to place in the mouth a small piece, about one-eighth of an inch on each side; if the pitch is too dry, it will crumble under the teeth while good quality pitch will soften and become plastic without breaking.

The quality of the pitch to be used necessarily depends on the kind of manufacture, on the machinery, on the method of heating and on the quality of coal. It is advisable that the inspection of pitch be entrusted to the same employee who may thus acquire the necessary practice and judgment as to the requirements under various conditions.

Other Binders

Binders other than pitch have been used in Germany and in the United States.

Köppern, at Hattingen, succeeded in making briquettes from coke breeze and pitch with an admixture of naphthane, the latter apparently giving more consistency to the briquette and making it smokeless. The proportions used being 93% of coke breeze, 6 to 7% of pitch and 0.5. to 1% of naphthane.

In 1909, the United States Consul at Barmen, Germany, in the Daily Consular Reports No. 3361, states that bituminous coals which require from 7 to 10% of pitch for briquetting can be made into briquettes by the use of only 5% of sulphite pitch and that some kinds of coal require only 2 to 3%.

Inasmuch as sulphite pitch burns without smoke or odor, it makes an ideal fuel for household and industrial purposes. This sulphite pitch is said to give excellent results when briquetted with coke breeze. Heretofore experiments for the manufacture of briquettes made of coke breeze and tar pitch had failed. This failure according to the writer's investigation was due to the highly abrasive property of coke breeze which no briquette press could stand for any length of time.

Manufacturing Process—Briquettes with Pitch Binders

The tonnage of briquettes manufactured with pitch binder being far in excess of all other kinds of briquettes containing other binders, this paper will deal specially with the briquette made of coal with admixture of pitch.

The principal points to consider in a briquette are:—the cohesion, the quality and amount of binder, the pressure used in manufacturing the briquette, the amount of water held in the mixture and its bearing on the density of the briquette.

In regard to cohesion, the specifications of the French Navy call for a cohesion of 52% for general use and 58% for torpedo boat use; they also must not soften at 60° Cent. (140° Fahr.)

The manufacture using soft pitch is preferable because the preliminary melting process permits of a more intimate and homogenous mixture. Generally speaking, plants using soft pitch employ about 6% of pitch in their mixture, whereas plants using dry pitch usually employ about 7.5 or 8% of pitch. The use of dry, instead of soft pitch is generally governed by local conditions and quality of coal; it requires greater pressure on the briquette and is said to give less smoke.

The quality of dry pitch may be improved by the admixture of either heavy oil, naphthane or preferably coal tar.

Experiments on Cohesion

Henry de Graffigny, C.E., conducted various tests at Anzin, France, and found that the briquettes have a greater cohesion than both coal and pitch.

He found that dry pitch at 10° C. (60° F.) has a cohesion from 28 to 29.5%. The Anzin coal has a cohesion varying from 20 to 35% and yet the briquettes made with this coal pulverized and 9% of the same dry pitch had a cohesion equal to 52%. Mr. de Graffigny explains this phenomenon by the fact that the cubes of coal tested in the drum have cracks or seams which are really lines of cleavage along which the coal breaks up while the grains of pulverized coal have a greater resistance. The cohesion depends, therefore, on the coal, while the resistance to crushing depends on the pitch. The crushing strength of a briquette was found to be about 42 kilogrammes (597 lbs. per square inch), while the crushing strength of the Anzin coal was 25 kilogrammes (356 lbs. per sq. inch.)and the crushing strength of dry pitch was 75 kilogrammes (1068 lbs. per sq. inch).

The resistance or strength of the briquette increases, up to a certain limit, with the proportion of pitch; there is, therefore, a time when the strength of the briquette is maximum for a certain amount of pitch, but in practice, the percentage of pitch used in the mixture is less than the amount which would give the briquette its maximum strength; this percentage is governed more by the burning qualities it imparts to the briquette than by the additional, and not absolutely necessary strength a greater percentage of pitch would ensure to the briquette.

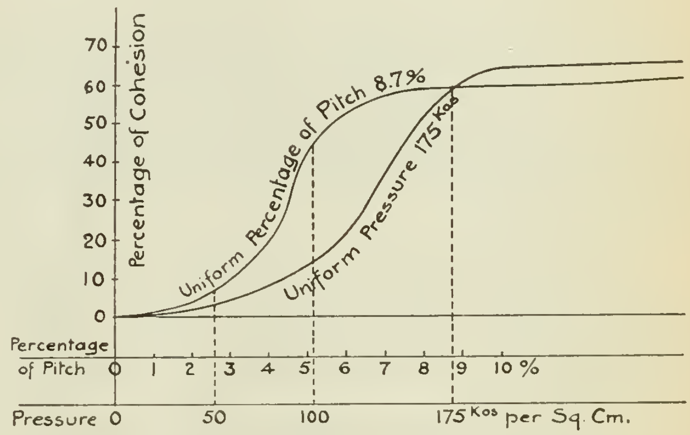


Diagram No. 1.

Diagram No. 1 shows the cohesion obtained by de Graffigny in the tests made by him at the Portes and Sénéchas Mines with briquettes manufactured with a Révollier Press. Diagram No. 2 shows the cohesion obtained with briquettes manufactured with the same press and made of Anzin coal mixed with varying proportions of pitch. With this coal, the cohesion is practically nil if the percentage of pitch is not at least 4 %. It must be noticed that in Diagram No. 1 beyond 7% of pitch, the cohesion increases very little.

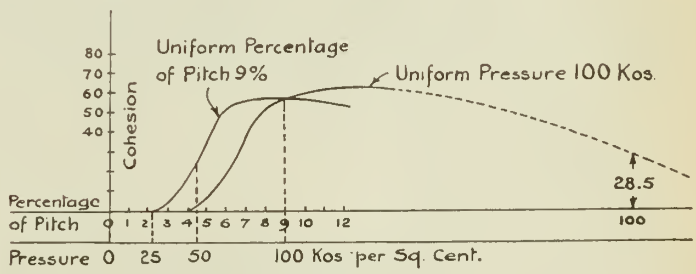


Diagram No. 2.

In Diagram No. 2, after passing 9 % of pitch, the cohesion increases very little; it reaches its maximum at 72% and then decreases to 28.5%, which is the cohesion of the pitch itself.

To quote James E. Mills in his report to the United States Geological Survey on "Binders for Coal Briquettes," the office of the binder is, "to coat the grains, fill up the void spaces between the grains, and by its adhesive and cohesive properties hold the briquette together."

The amount of binder depends, therefore, on the amount of surface to be coated and this surface depends on the size of the grains of coal and on the density of the dry coal.

The surface to be coated varies inversely with the density of the coal and the diameter of the grains. It follows that coals with a low density require a greater amount of binder than coals having a higher density. It follows, also, that the degree of fineness of the coal slack has a great influence on the amount of binder required.

It appears then that crushing coal too fine is not good practice; fine crushing gives the briquette a smoother surface with greater weather resistance, but it increases the amount of binder and therefore, the cost. Moreover, the cohesion of the briquette increases very little after the amount of binder reaches 9%, it is, therefore, useless to go beyond that limit. Voids between large grains of coal should then be filled with coal dust or finer coal rather than with binder.

Theoretically the amount of void space between grains of uniform size is independent of their size. In practice, however, grains of uniform size do not pack so closely as theory tends to show. Experiments made by Clifford Richardson indicate that with shot the percentage of voids reaches 32.

In practice the best results are obtained by breaking the coal to a maximum of 5/16 of of an inch in diameter, or 7 to 8 millimeters, according to French practice; the voids being filled with finer coal and coal dust and the binder.

Coke Breeze Briquettes

At the Paris Gas Company's plant and at the Lyons Gas plant, briquettes made of coke breeze were manufactured for several years and were quite satisfactory, except that the wear on the moulds was rather excessive, the coke breeze acting very much like fine emery.

At the Paris plant, the proportion was 90% of coke breeze and 10% of pitch. The maximum cost of coke breeze was frs. 6.44 per metric ton and the maximum cost of pitch 40 frs. per metric ton. The tons of mixture was then frs. 9.80 per ton made up as follows:—

900 kilos of coke breeze	frs.	5.80
100 kilos of pitch	"	4.00
1000 kilos of mixture	"	9.80

Including delays, 44 tons of briquettes were manufactured per 10 hour day. The labour amounted to frs. 2.55 per ton. The fuel consumed for power to run the press and incidental machinery amounted to 240 kilos of coke per hour, and it took 5 kilos of coke per ton to heat the mixture in the feeding screw, making 2620 kilos of coke per day at a cost of 65 frs. for 44 tons of briquettes or fr. 1.48 per ton. The maintenance amounted to fr. 1.28 per ton and tools to fr. 0.03 per ton. The grand total cost was, therefore frs 15.14 (about $2.91) per ton of coke breeze briquettes, exclusive of interest on capital, amortization and transportation to customers. The above, however, is a maximum price as the prices of coke and pitch are maximum; labour was all hand labour and could be reduced by the use of mechanical appliances. The amount of water in the coke breeze was 18% in weight.

The briquettes were rectangular, measuring $9\frac{7}{16}''$ x $5\frac{1}{8}''$ x $4\frac{1}{8}''$. They weighed 4.639 kilos when leaving the mould and 4.154 kilos one month after being stored, a loss of 0.485 kilos. The pressure used to manufacture these briquettes was 80 kilos per sq. centimeter (1143 lbs. per sq. inch.).

At the Lyons plant the coke breeze was mixed with 7% of pitch and 2.5% of tar. The briquettes weighed 4.3 kilos each and the cost of manufacture frs. 16.27 ($3.12) per ton or, with maintenance and amortization, frs. 17.02 ($3.27) per ton. As stated above, the great difficulty was due to the unusual wear on the metal parts of the machinery coming in contact with the coke breeze which obliged the manufacturers to change the design of several parts of the machines. For instance, the moulds and plungers which had been of wrought iron were made of hard cast iron. The mixer itself, which is ordinarily made of light iron plates, was made of cast iron.

However, the addition of naphthalene to the coke breeze and to the pitch, or the use of sulphite pitch instead of tar pitch as binder is said to do away with this trouble and to give excellent results.

The Pollacsek process consists in mixing coal screenings with a dry powder or a thick syrup obtained, by evaporation, from the waste sulphite liquor of the pulp mills which, previously, was allowed to be discharged in the streams and was a cause of pollution.

Down in Louisiana, sugar factory residues, such as thick molasses or black strap which are thrown away have been used in the manufacture of briquettes as well as starch.

The briquettes are fairly good but do not stand exposure to weather and easily disintegrate.

It is well to mention also the manufacture of briquettes made by Pflieger of Dambach near Schlestadt in Alsace in which coke breeze is mixed with sawdust, tar pitch being used as binder.

Experiments have been made in which crude petroleum, asphaltic petroleums, wax tailings and asphalt tar were used as binders; the results were not very satisfactory.

Correct Use of Binder

The various tests made so far, as well as practice, seem to show that pitch binder is preferable to all others. The choice of any particular binder depends, however, on local conditions, quality and kind of coal available, use for which the briquettes are intended. For instance it is quite possible that a gas plant having coal screenings to briquet would use tar pitch, while a coal yard or a colliery near a pulp mill might use sulphite pitch but generally the binder chosen ought to be the one which will give to the briquette cohesion, retention of shape, and weathering quality.

The briquette should be fairly hard but not so hard as to become brittle. When tar pitch is used dry, brittle pitch makes a hard briquette which can only be brought down to the desired degree of hardness by an additional amount of pitch. The French Navy Specifications require that the briquette should not soften at 140° Fahrenheit.

A good briquette should stand long exposure to weather without deteriorating. If the coal has been imperfectly ground and poorly mixed with the binder, or insufficiently pressed, the briquette will lack homogeneity and cohesion; cracks will appear letting the moisture in and causing deterioration. Briquettes made of lignite do not weather well because of the tendency of the lignite to absorb moisture. Consequently binders which are soluble in water cannot be successfully used except in very dry climates; this precludes to some extent the use of starch, molasses and sulphite pitch as binders unless the briquettes are waterproofed by a baking, or coking process, or by some other method; this waterproofing, however, considerably increases the cost of the briquettes.

The cost of binders seems to be the main factor in determining whether briquettes can advantageously be manufactured in different parts of the United States.

The average of investigations made in France by the writer gave 36 cents per ton of briquettes, exclusive of cost of coal and pitch. J. E. Mills, in his report on binders for coal briquettes estimates that the cost of manufacture per ton of briquettes in the United States, exclusive of binder and of coal, and apparently exclusive also of interest, amortization and overhead charges, amounts to 27 cents in the Western States and to 49 cents in the Eastern States. J. E Mills then states that "considering 30 to 50 cents per ton, therefore, as being approximately the cost of manufacture, it appears that when the difference in price between the slack coal and the first-class lump coal is $1.00, the binder must cost less than 50 to 70 cents per ton."

This, of course, is to assume that slack coal has to be purchased. In case of coal slack, dust or screenings, which in collieries, in coal yards and barges are, or have been, a total waste and loss, bir der may be used even if its cost is much higher than stated above. and yet the manufacture of briquettes in this case, will be an attractive business proposition to the mine owner and the coal dealer and a great help to many consumers.

Pressure

Next to the quality and amount of binder, the pressure exerted in the manufacture of the briquette is an important factor in giving to the briquette its maximum cohesion. There are two things to consider in the pressure; its intensity and the length of the period during which it is applied.

As a rule, the coal used for briquetting has been washed and is more or less wet when used. When it contains more than 5% of water, the excess of water offers a certain resistance to the compression; this excess of water must then be expelled, otherwise the briquettes will crack and have little strength.

With powerful presses in which the pressure is applied to the mixtures for a relatively long time, the mixture may contain a higher percentage of moisture, even as high as 10% as in the case of the Révollier press; there is enough time during the period of uniform and slow comression for the excess water to be expelled when the maximum pressure is reached, in order to obtain a perfect briquette.

In other presses, the Biétrix, for instance, in which the maximum pressure is reached almost instantaneously, the briquettes are perfect also, provided that the percentage of moisture is low; there is not sufficient time in this case during the period of compression to allow the excess water to be expelled. It is necessary, in such cases, to dry the mixture by heating; this is why some plants include as optional equipment dryer-heaters in which the coal is treated before being mixed with the binder.

Effect of Moisture

But all the water must not be expelled and it is usual, in practice, to allow from 1½ to 3% of moisture in the mixture. This moisture renders the mixture more pliable and acts as a lubricant, lessening the friction of the particles passing over one another during the compression. If the mixture be thoroughly dry, the briquettes will have a low degree of cohesion and will crack. The moisture retained in the mixture must increase the cohesion of the briquette when hot and leaving the mould, and must assist in forcing out any air bubbles contained in the mixture.

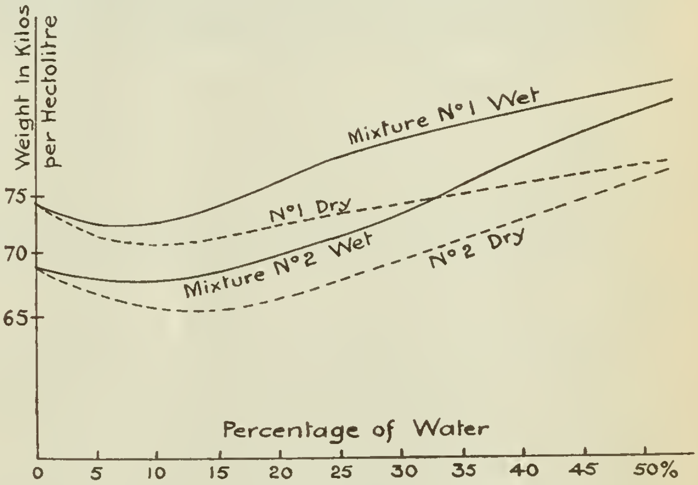


Diagram No. 3.

No matter how high a pressure be applied, there are always some minute voids between the grains. If the mixture is thoroughly dry, these voids contain some compressed air which expands when the pressure stops and the briquette leaves the mould. This expansion impairs the solidity and the strength of the briquette; a small amount of moisture fills these voids and expels the air. The same trouble takes place when the temperature of the mixture is too high during the compression if, for instance, the mixture is compressed when over 194° Fahr., some vapor is formed within the briquette which by expansion, when the briquette leaves the mould, causes surface cracks and irregularities.

Therefore the duration of the compression has not a very great influence on the results, as long as the mixture contains the proper percentage of moisture. Its intensity is more important, because the greater the pressure and the better is the even distribution of binder in the mixture, the better are the air and the excess of water expelled and the closer are the grains to one another.

Diagram No. 1 giving results obtained with Portes & Sénéchas Coal shows that beyond 175 kilos per sq. centimeter, the cohesion increases very little and is very low when the pressure is under 50 kilos.

Diagram No. 2, giving the results of tests made with Anzin coal which is softer than the coal of Portes and Sénéchas, shows that the cohesion does not increase when the pressure reaches 100 kilos.

In plants where the coal is perfectly dry, the proper amount of moisture 2 or 3% necessary in manufacturing the briquette is introduced in the mixture by means of a steam jet.

Another drawback to the larger percentage of moisture is that the specific gravity of the coal screenings is decreased.

Diagram No. 3 shows results of tests made by Henry de Graffigny with two different mixtures.

Mixture No. 1 consisted of coal containing 24% of volatile matters and of coal with 10% volatile matters pulverized in a Carr pulverizer 1 meter in diameter and making 400 revolutions per minute. The hectolitre was weighed after being filled, the filling up being done by hand shovel from an uniform height of 1.30 metre.

Mixture No. 2 consisted of coal containing 10% of volatile matters, passed through a 2 millimeter mesh screen and dropped in the measure from a height of 20 centimeters. The minimum weight of wet mixture No. 1 is 72 kilograms and corresponds to 7% of water. It is only when the percentage of water is over 17% that the wet coal is heavier than dry coal.

Taking the weight of the coal, exclusive of water, the minimum corresponds to 8½% and it is only after 37% that the presence of water begins to increase the density.

With the second mixture, the minimum corresponds to 8½ with wet coal and 11% for dry coal; it is necessary to go beyond 19% and 33% of water, respectively, before the weight of the hectolitre be increased.

From the above it appears that with a mixture containing 6% of water, as is the case with many briquette presses, the mixture is about at its lowest density; with this percentage of moisture the mould is not so well filled up as it would be if the amount of moisture were only 2%. The stroke of the plunger must, therefore be longer before the required pressure is obtained and the weight of the briquette is less than it ought to be.

The Briquette Press

There are two general types of briquette press:—The double compression or plunger type press and the tangential roller press. The first type is used for the manufacture of the large rectangular, prismoidal or cylindrical briquettes, the second one is used for the manufacture of the so-called ovoids or egget briquettes.

Among the plunger or double compression presses are the Révollier press and the Evrard press. The Roux-Veillon press is a double compression machine generally working at a pressure of 2000 to 2850 lbs. per sq. inch; with this pressure a cohesion of 65% to 70% is generally obtained.

In this machine a simultaneous compression is obtained on each side of the briquette by hydraulic power

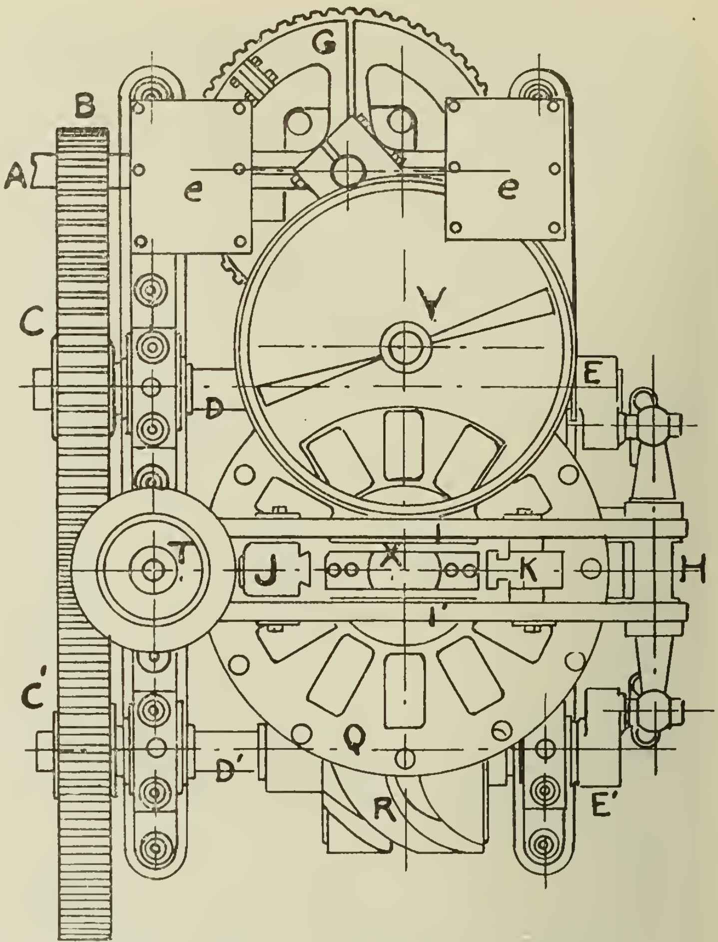


Plate 4.—Biétrix-Couffinhal Press Top View.

which gives a great elasticity to the system. At each turn of a shaft, the moulding table revolves one division, so that a new cell comes in front of the distributor or feeding screw and is filled up; the cells already filled come, one at a time, opposite two compressing plungers; at the end of each compression these plungers are released, the table moves on another division, and the finished briquette comes under another plunger which strikes it out of the mould.

The Mazeline machine which consists of a horizontal circular table turning about its axis, on which are moulds each of which is fitted with a plunger for compressing the mixture and has at the lower face a piston to force the briquette out of the mould. This machine can develop a compression of about 4300 lbs. per sq. inch, and manufactures briquettes weighing 20 lbs. each, measuring 8¾″ x 11¾″ x 4 ⅜″, at the rate of 20 briquettes per minute or 40 for the double tabled press. There are also the Crozet press and the Middleton Press, with a capacity per minute of twelve briquettes, each weighing 14 lbs.

Among the tangential roller machines or egget presses, the best known types are the Dupuy Press and the Horme Press.

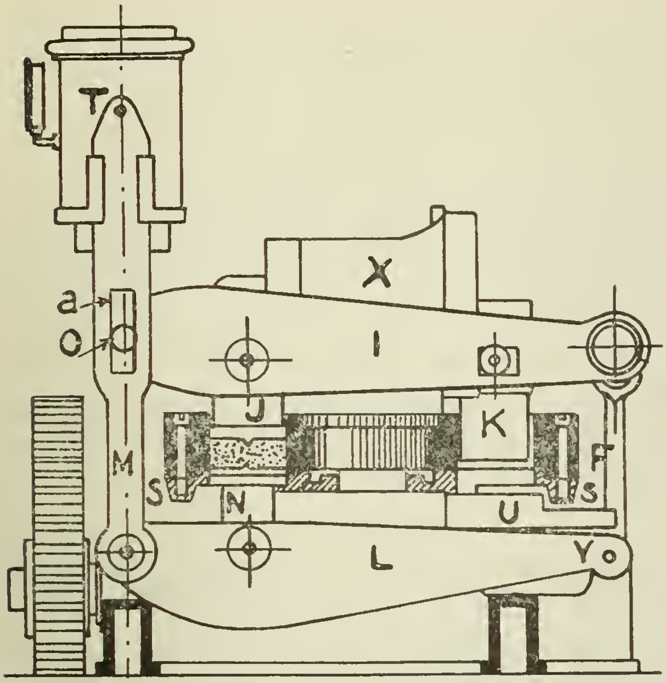


Plate 5.—Biétrix-Couffinhal Press Vert. Cross Section.

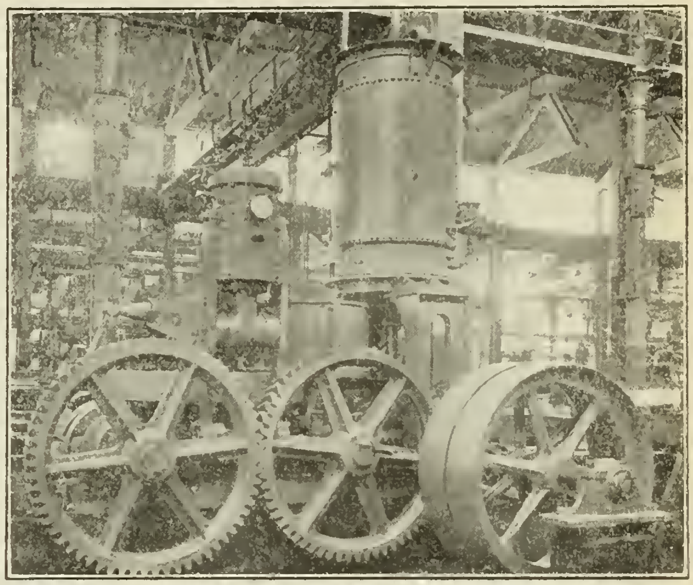


Plate 6.—Leflaive's Couffinhal Press.

Description of the Bietrix-Couffinhal Press

The various double compression presses used in the manufacture of large briquettes are based on the same principle and differ only in minor details or improvements; it will, therefore, be sufficient to describe one of the most widely used machines of this type.

Plates 4 and 5 show, respectively, a vertical cross section and a top view of a Biétrix-Couffinhal Press, manufactured by Leflaive & Cie, of St. Etienne, and which are fully illustrated in plate 6. Referring to Plates 4 and 5, shaft A controls the geared wheels C C′ which in turn control cranks E and E′ and also the connecting rod F. The plunger J compresses the briquette and plunger K forces it out of the moulding table. The compression takes place when the upper lever controlling plunger J is lowered; when the upper face of the briquette reaches its maximum pressure, that is when the upper pressure is equivalent to the pressure of the lower plunger N plus the resistance due to the friction of the briquette against the walls of the mould, then the lower plunger N, connected to the lever L and controlled by the connecting rods M begins to rise until the pressure is equal on both faces of the briquette.

A Hydraulic cylinder T controls the connecting rods M; the axle 0 of the upper beam is free to move in a slot in the connecting rods M. This axle O is connected to the plunger of the hydraulic cylinder T.

The moulding table is controlled by a drum R on which are specially cut grooves engaging bronze cones S turning about steel axles and set under the moulding table; these grooves are so arranged as to cause the moulding table to revolve with a speed which increases uniformly from the start of the movement to a maximum speed and to decrease at the same rate. During the period of compression, the rollers S are engaged in a part of the groove which is in a plane perpendicular to the axis of the drum R, when the moulding table is stationary.

G is a gear controlled by pinion B operating the shaft of the mixer. The briquette is forced downward by plunger K and falls on a tipping scale which throws the briquette on a belt conveyor.

The pressure may reach 4270 lbs. per sq. inch. The moulding table has from 12 to 14 cells. The walls of these cells wear out owing to the friction; when these walls have been worn a thickness of 0.12 inch, at the end of 3 or 4 years, the cells are reamed and bronze linings set in.

This press is made in different sizes with a capacity of 18, 50, 90 and 150 tons per 12 hour-day. The briquettes manufactured with this press weigh as much as 22 lbs.; the usual weight, however is 13 lbs.

Description of a Typical Tangential Roller Press

The Dupuy tangential roller press is manufactured by Dupuy Frères of Paris, consists of a cylindrical distributor receiving the hot mixture and feeding it in the shape of a ribbon between two sets of tangential rollers, on the circumference of which are a certain number of recesses or cells each of the shape and size of half an ovoid or egget briquette. These rollers are so operated as to turn in opposite directions at the same speed; the cells are so placed as always to coincide and cover one another; the hot mixture is then compressed between these cells and formed into eggets which fall on a shaking grate which acts as a chute as well as a screen through which passes the small thin webb formed by the mixture pressed between the eggets. This mahine is made in 4 sizes having

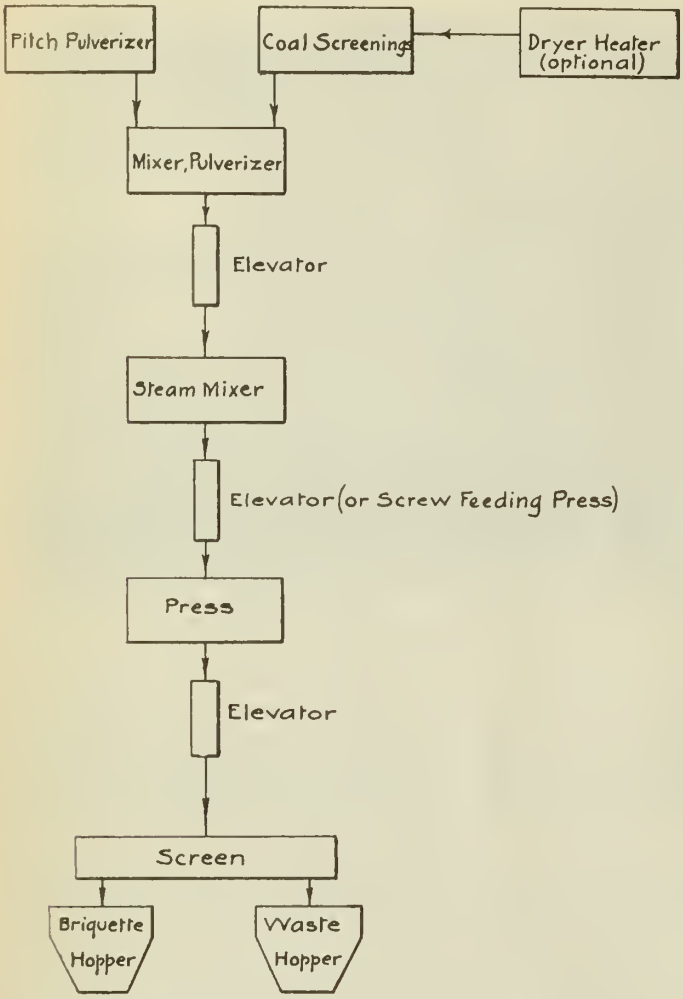


Plate 7.—Flow Sheet of Typical Briquette Plant.

respectively a capacity of three quarters of a ton, two and a half, five and ten tons per hour. The briquettes manu factured weighing 1 ounce, 1½ and 3 ounces. The machine may be fitted with 2 different sets of rollers to manufacture simultaneously briquettes of two different sizes. The rollers wear under the abrasion of the hard particles of coal. This wear and tear is a function of the size and of the quality of the coal. These rollers are made of best quality soft steel; they are milled and machined and then hardened and tempered. For very hard coal, and coke breeze, the tires of the rollers may have to be renewed after manufacturing 8000 tons of briquettes. The rollers of the Dupuy Press are 20 inches in diameter.

Flow Sheet

Plate No. 7 is a flow sheet showing in their sequence the various steps of briquette manufacturing. The pitch pulverized to a proper size is fed by either a feeding screw or a belt to the mixer where it is mixed in the proper amount to the coal screenings. These coal screenings which have been washed are usually passed first through a dryer heater which takes the excess moisture; this however is optional and in many cases the coal after being cleaned and washed is allowed to dry sufficiently to retain from 2 to 5% of moisture before being mixed with the binder. In some plants the mixing of binder and coal, instead of being done by a mechanical mixer, is done by hand, the respective amounts of coal and binder being measured in boxes. The mixture is then brought up by conveyor, elevator or feeding screw to a steam jacketed mixer where the mixture is thoroughly mixed while steam softens it to a required plasticity so that its temperature, when reaching the moulding press, will not be higher than 122° Fahr. From the press the briquettes are elevated to a screen through which all waste falls into a hopper, from which it is brought back to the steam mixer; the briquettes are unloaded into another hopper, ready to be loaded in cars.

Plates 8 and 9 show respectively the elevation and the plan of a typical briquetting plant to which applies the flow sheet shown on plate 7.

Secondary Plant

Under this heading may be classed all that part of the equipment which is independent of the type of press used and some of which is not indispensable.

A briquetting plant aside from the briquette press may include, substantially, the following equipment:—

1st.—Steam generator. 2nd.—Motor. 3rd.—Coal breaker or pulverizer which in some cases is not necessary. 4th.—Dryer heater, optional. 5th.—Pitch breaker or pulverizer or a pitch melting tank. 6th.—Feeding and measuring apparatus. 7th.—Steam mixer. 8th.—Cooling table or cooling and loading endless belt or elevator. 9th.—Baking oven, optional and necessary only to produce smokeless briquettes manufactured with binders which are themselves a cause of smoke.

Steam Equipment

In providing for the steam equipment of a briquette manufacturing plant, it is safe, generally, to figure on a heating surface equivalent to 165 square feet per ton of briquettes to be manufactured in one hour. If the steam used for heating the mixture is taken directly from the boilers it is safer to figure on a maximum heating surface which may reach 270 square feet per ton of briquettes to be manufactured per hour.

The consumption of fuel is generally figured at 100 lbs. per ton of briquettes, although it may be as low as 40 lbs.

The motor or steam engine may be of any convenient design; it is recommended, however, that it be fitted with some automatic safety device and that it be belt driven to insure a certain amount of resilience in case any solid body should happen to find its way in to any part of the machinery.

Coal Breaker

The coal breaker or pulverizer may be of the coffee mill grinder type or, preferably, of the cylinder type, fitted with teeth which break the coal to the required dimension by causing the coal to be projected by a rapid revolution of the cylinder against the steel teeth. One of the best known coal pulverizers is the Carr pulverizer in which 2 rollers of a comparatively large diameter grind between them the coal which is fed by a distributing hopper. The Carr pulverizers used at the Saint-Waast mines have rollers which measure 4 feet in diameter and 12 inches in width; they make 300 revolutions per minute, using 25 H.P. and pulverizing 15 tons of coal per hour.

Coal Dryer

In some installations, the coal after being washed is thoroughly dried in ovens or dry heaters before being fed to the mixer where the mixture of coal and pitch, when dry pitch is used, is made sufficiently plastic and moist by heating and by jets of steam. A type of dryer commonly used is the Hanrez dryer; it consists of a cylinder 4 feet in diameter and 2 feet 6 inches long, turning about an axis, either vertically or horizontally. It is covered with a copper plate three millimeters thick and perforated with holes ½ millimeter in diameter. Inside is a screw having a relative speed of 5 turns per minute. The wet coal is fed at one end and leaves at the other end under the action of the screw. The cylinder revolves at a speed of 350 turns per minute, the water being expelled by the action of the centrifugal force. The power necessary is equivalent to 6 H.P. and the capacity is 50 tons per 12 hour-day.

This drying process while more rapid, is not more effective than the dripping process which consists in loading high vertical towers, generally built of wood, with wet coal which is allowed to drip and to dry naturally.

The dryers are generally cylindrical measuring from 4½ to 5 feet in diameter and 22 to 25 feet in length. A helicoidal gear turns on the axis of this cylinder displacing the coal which moves in a direction opposite to the flames. Wings, 4 inches wide, are placed on the revolving cylinder in order to turn the coal over and bring different layers in contact with the heated surface. The speed is so regulated that the coal remains about 10 minutes in the cylinder losing from 5 to 6% of water; the machine makes from 3 to 4 turns per minute and has a capacity of about 70 tons per hour.

The Leflaive dryer consists mainly of a turning table whose motion is dependent on the operation of the briquette

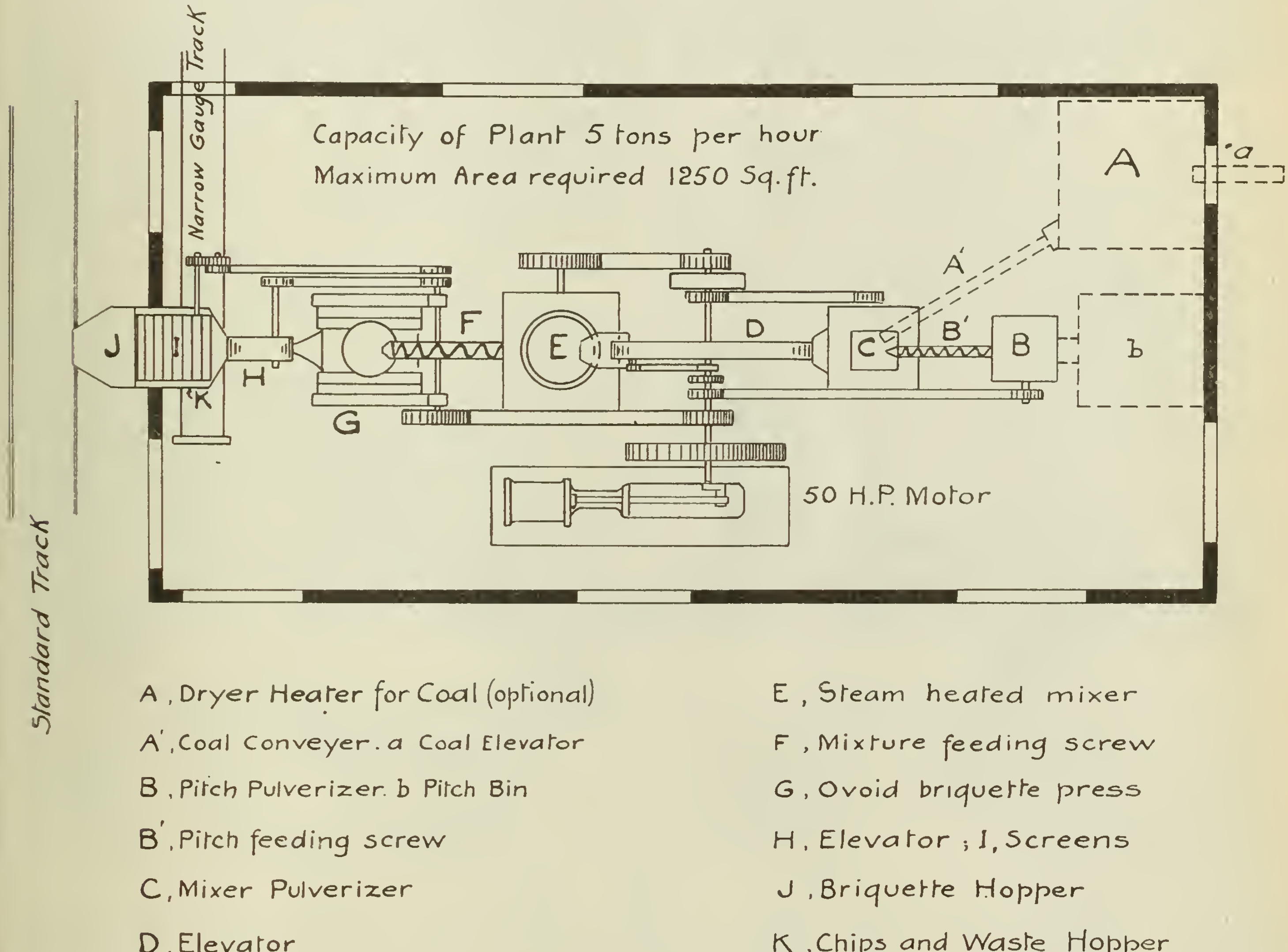


Plate 8.

press. This table is built in masonry which is itself encased in sheet iron and on which rests a spherical hood or cupola in the centre of which passes a cast iron cylinder firted with a vertical axle and paddles.

A lateral firebox with two openings opposite one another control the temperature in the dryer. The flames after licking the upper part of the coal, heat the cupola, which concentrate the heat by reflection, then pass under the table and into the chimney. Around the dryer are six openings; through the four first openings are set radial iron bars with teeth or claws which scrape the coal, turn it over and let it be heated uniformly and throughout. Opposite the fifth opening are two bars which by means of articulated slats regulate the thickness of the layer of coal, and consequently the time the coal will remain on the table, and at the same time slowly shake it, turn it over and bring it from the centre of the table to its circumference, passing thence outside through the sixth opening. The power necessary to operate this dryer is low. It is possible with it to vaporize from 11 to 13 lbs. of water per every 2 lbs. of fuel consumed. When the quantity of water to vaporize is over 10%, the capacity of the dryer is increased by using two tables, one above the other, each working as explained above.

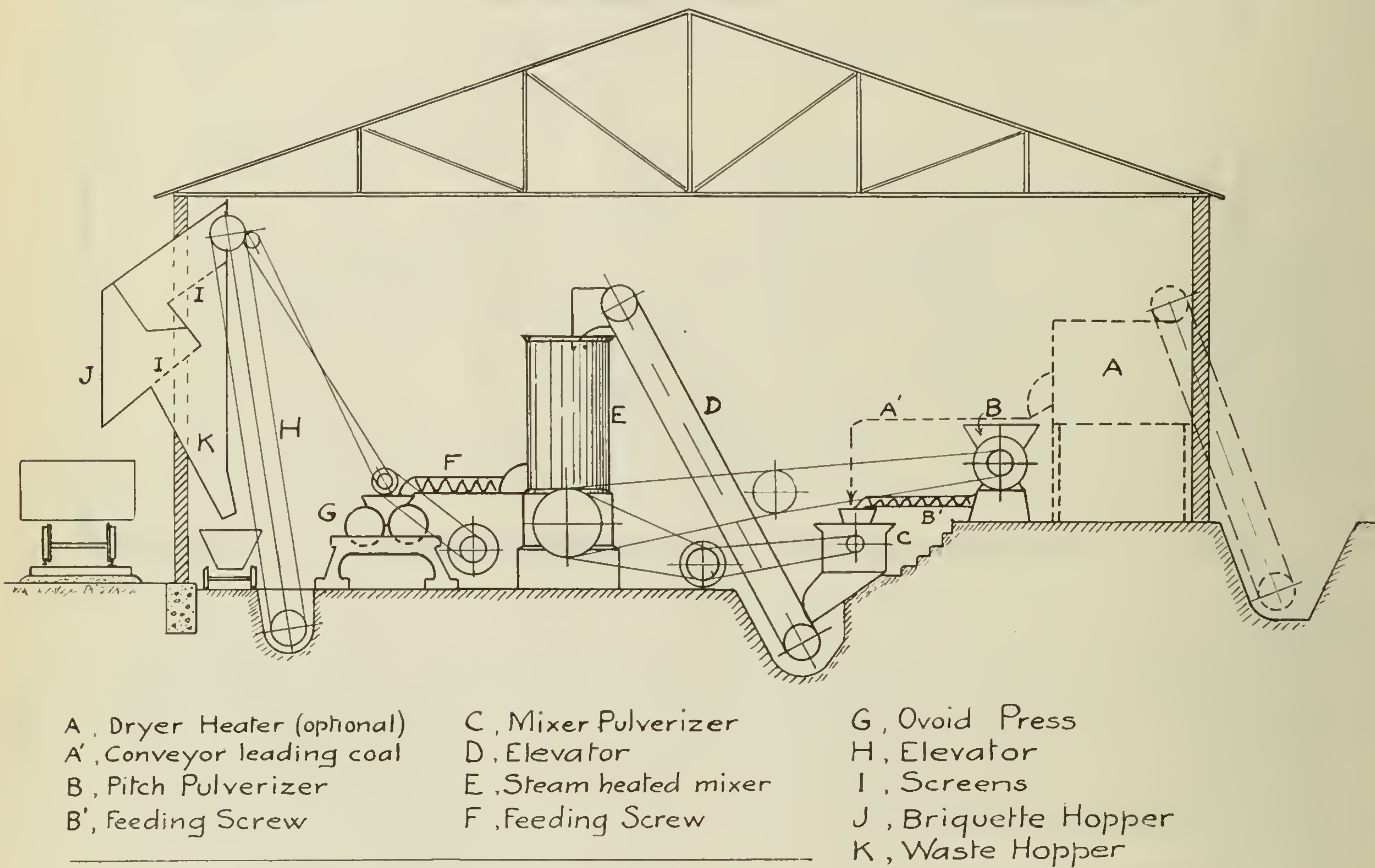


Plate 9.

Pitch Pulverizer

The pitch pulverizer is preferably of the CARR type already described. Care must be taken to keep the supply of dry pitch at as low a temperature as possible, and, in summer, under a water sprinkler, otherwise the pitch becomes soft and is compressed without being broken and pulverized; when too soft it may even stop the pulverizer unless the pitch is mixed, before being pulverized, with 25 or 50% of coal.

The use of melted pitch is, therefore less troublesome; however, to get the best grade of briquettes and particularly smokeless briquettes for domestic use, dry pitch should be used instead of melted pitch.

The melting is done usually in iron tanks heated directly by soft coal. These tanks are about 3½ feet wide, 6 feet deep and 20 feet long, the bottom is slightly sloped towards the gate; the full charge is about 9 tons, it takes about 12 hours to melt and requires 600 lbs. of coal. In the majority of plants using melted pitch, it is customary to mix a certain amount of tar with the pitch in the proportion of 12 to 20%.

Feeding and Mixing

The mixing or proportioning of pitch and coal making the paste or mixture to briquette is better done by hand with shovels, wheelbarrows or hand cars but is practicable only in small plants. In more important installations, this proper mixing of both coal and pitch is done by means of feeding screws or by bucket conveyers which are filled from chutes or hoppers so inclined or so opened as to let the exact quantity of coal and pitch fall in the required time and in the proper volume.

Usually this feeding and mixing apparatus and the briquette press are synchronously operated by the same motor in order that their movements be interdependent. When melted pitch is used, it is necessary that the feeding screw or transporter be heated to keep the pitch from solidifying.

The steam mixer or "Malaxeur" is preferably vertical. It usually consists of a sheet iron cylinder 32 to 48 inches in diameter and 9 or 10 feet high. A central axle revolves at the rate of 20 to 25 revolutions per minute. Arms set on this axle beat the mixture and drive it downwards. The lower arm must be reinforced and very rigidly connected to the axle as it is intended to scrape the bottom of the mixer upon which the mixture has a tendency to stick and harden. The heat is supplied by steam let in through apertures located either in the bottom of the cylinder or at various points on the outer surface. This steam comes either from the engines or from the boilers; in the latter case when it enters into the cylinder there is a sudden expansion and the temperature falls down to 212°F. This expansion is accompanied by a certain condensation which increases the moisture of the mixture by 2 or 4%.

Steam Consumption

Theoretically 8 to 10 lbs. of steam at a temperature of 212° F. are sufficient to heat one ton of mixture to 212° F. In practice, however, if only this quantity of steam were used, it would be entirely condensed and would increase the percentage of moisture by ½%. Inasmuch as the contact of the steam and mixture is not very intimate, it is necessary to let in the mixer a much greater quantity of steam, about 100 lbs. per ton of mixture; therefore, but 10% of the heat contained in the steam is utilized while the moisture is increased from 2 to 4%.

In some plants, superheated steam is used at a temperature of 392° Fahr. It is usual to figure for superheating on 21 square feet of heating surface per ton of briquettes manufactured per hour and on 1% of fuel.

The two principal types of briquettes are the ovoid or egget, specially made in two sizes for domestic use and the typical briquette manufactured for industrial purposes, particularly for firing railway and marine boilers.

Price Comparison

As a basis of comparison, it might be mentioned that in 1910, in Paris, the price of egget briquettes for domestic use, as shown on plate 14, was 52 francs ($10.00) per gross ton, delivered in sealed bags of 100 lbs. whilst the price of Welsh anthracite was 80 francs ($15.40) per gross ton.

Miscellaneous Data

The following table compiled from the catalogue of Messrs. Dupuy Frères gives the capacity in tons per hour in large briquettes from 6 to 20 lbs., and in ovoid or egget briquettes, as well as the force required in H.P., the area occupied by the plant, the number of men necessary to operate the entire plant, as well as the approximate cost of the briquetting equipment and motor, this equipment includes generally shafting, bearings and pulleys, one coal feeding screw and hopper, one pitch pulverizer, one pitch feeding screw and hopper, one dry mixer, one elevator, one steam jacketed mixer, one cooling belt or table, and one or two presses according to plant capacity. The prices are pre-war prices in France. To these prices should be added from 10 to 15% for crating and shipping, ocean rates based on normal prices.

Briquette presses are admitted free of duty in Canada; they are patented and could be manufactured here by arrangement with the various patentees; the rest of the equipment, such as motors, feeding screws, pulverizers, conveyors, elevators is easily available in Canada.

TABLE GIVING DETAILS OF BRIQUETTE MANUFACTURING PLANTS.

Capacity per hour in 6 lb. briquettes.	Capacity per hour in 10 to 12 lb. briquettes.	Capacity per hour in 16 to 20 lb. briquettes	Capacity per hour in egget briquettes.	Force required in H.P.	Area of plant in sq. feet.	Number of men required.	Approximate cost of briquetting equipment	Approximate cost of Motor.
....	....	....	1500 lbs.	10–12	540	4	$1,500.00	$1,500.00
....	....	....	2½ tons	15–21	800	6	3,700.00	2,200.00
....	....	....	5 tons	25–35	800	8	4,600.00	2,800.00
....	....	....	10 tons	40–50	1100	14	7,000.00	3,400.00
2½ tons	....	....	....	15–21	800	7	4,700.00	2,800.00
5 tons	....	....	....	25–32	1100	12	7,000.00	2,200.00
....	5 tons	....	....	20–25	800	8	5,300.00	3,200.00
....	10 tons	....	....	30–40	1100	16	8,500.00	3,200.00
....	....	7½ tons	....	30–40	1100	10	6,500.00	3,200.00
....	....	15 tons	....	55–70	1100	20	10,400.00	4,500.00
2½ tons	....	....	2½ tons	25–33	1100	11	6,000.00	2,800.00
....	5 tons	....	2½ tons	30–40	1100	13	7,100.00	3,200.00
....	....	7½ tons	2½ tons	40–50	1100	16	8,000.00	3,400.00
2½ tons	....	....	5 tons	40–50	1100	14	7,100.00	3,400.00
....	5 tons	....	5 tons	40–50	1100	15	8,000.00	3,400.00
....	....	7½ tons	5 tons	50–60	1100	18	8,600.00	4,300.00
....	....	10 tons	....	50–60	1100	20	8,000.00	5,200.00

Report of the International Alaska-Yukon Boundary Commission.

A Summary

By J. J. McArthur, M.E.I.C.

The Joint Report of the Commissioners, appointed under the Convention of 1906, for the demarcation of that part of the 141st Meridian of West Longitude, which forms the boundary between Alaska and the Yukon Territory from Mt. St. Elias to the Arctic Ocean, has been transmitted to His Majesty's Government by the Minister of the Interior, and certified copies have been laid before Parliament.

This report, which is illustrated with many fine views, forms a record of a very interesting survey which was carried out under unusual difficulties and called for the highest degree of organizing and technical skill.

Historical

The 141st Meridian became part of the boundary between Russian America and the British possessions in North America by virtue of the Treaty of 1825.

The United States acquired the Russian possessions in 1867, by purchase, and the Territory became known as Alaska.

No effort was made to locate the Boundary along the 141st Meridian until 1887, when the late Wm. Ogilvie, D.L.S., of the Department of the Interior, Canada, was instructed to descend the Yukon, and determine by astronomic observations the location of the Meridian at the crossing of that river. Incidentally he made a micrometer survey from the Coast and Geodetic station at Pyramid Island, up the head of Lynn Canal and over the divide to the Yukon waters which he followed to a point in the vicinity of the boundary, which he reached on September 14; the trip from salt water having occupied one hundred and eight days.

He established his observatory on the north bank, about three miles above the present boundary; his transit stand being the stump of a spruce tree 18 inches in diameter; round which he built his transit house; and a living camp and magnetic observatory were erected close by.

There was no telegraph line, and the journey was too long and too rough to permit of carrying the time by chronometers, and the alternative was the adoption of the methods of moon culminations and the occultations of stars by the moon.

His observations continued during the winter, the temperature seldom rising above thirty below zero; yet notwithstanding the difficulties and inconveniences, he was able to give a location for the boundary which compared most favorably with the final determination made in 1906; until which time his work stood as the accepted boundary. Corresponding observations had been made at Kamloops, B.C., by W. F. King, D. T. S., Astronomer of the Department of the Interior, who later became Chief Astronomer of Canada and His Majesty's Boundary Commissioner.

In 1889, J. E. McGrath of the United States Coast and Geodetic Survey made an independent location of the boundary. He occupied Ogilvie's observatory and also adopted the same method of culminations and occulations The result of his observations so far confirmed the position of the Ogilvie line that it was accepted as the temporary boundary until the final determination in 1906. J. H. Turner of the same staff in this year made a preliminary location of the boundary at the crossing of the Porcupine.

In the Spring of 1895, Wm. Ogilvie was again sent out to produce the 141st Meridian, north and south from the Yukon, in order to furnish a conventional line of jurisdiction, where prospecting and mining operations were being carried on, notably in the vicinity of Forty-mile. Before winter set in the line vista had been opened for a distance of five miles to the north of the river.

During the winter he succeeded in getting ten new determinations of longitude which were later combined with his observations of 1887-88. In February he resumed work on the line and by the middle of April they had reached Sixty Mile river, and work was dicontinued.

In 1902, rumours reached the Department of gold discoveries on the Tanana River, some of whose tributaries were supposed to cross the boundary; and to prevent possible complications J. J. McArthur, D.L.S. was sent to continue the line to the south. He produced it to Scottie creek, sixty miles from where Ogilvie had left off in 1906.

The question of definitely marking the boundary remained "in statu quo" until 1906, when a Convention was signed at Washington, April 26, and ratified August 26 of the same year. It prescribed the use of the telegraph for determining a point on the 141st Meridian, and the extension of a north and south line through the point thus determined.

Use of Telegraph

The refined astronomic observations requisite for the telegraph determinations could not be properly made except during the summer, and the reductions of the observations would require considerable time. O. H. Tittmann and Dr. W. F. King, respectively, the Superintendent of the U. S. Coast and Geodetic Survey, and the Chief Astronomer of Canada, were Commissioners for the Alaska Coast Boundary, and they expected to be, and were later, appointed commissioners under this Convention. In order that full advantage of the season of 1907 could be taken for the running of the line, they, early in 1906, before the ratification of the Convention, decided to make use of the organizations under their direction, namely the Coast and Geodetic Survey, and the Astronomical Branch of the Department of the Interior, to execute the necessary astronomic work during that season.

The point on the meridian at the crossing was in telegraphic communication with Vancouver and Seattle, both by the Canadian Government telegraph line via Dawson and Ashcroft, and the United States land line via Eagle to Valdez, and by cable from Valdez to Sitka and from Sitka to Seattle, thus forming a loop. The difference of longitude between Vancouver and Seattle had been determined by telegraph in 1905, the observers being Assistant Edwin Smith of the Coast and Geodetic Survey, and Dr. Otto J. Klotz of the Chief Astronomer's staff at Ottawa; and later the longitude was carried by assistants Smith and J. E. McGrath by cable to Sitka and Valdez, and thence overland to Fort Egbert. Hence a determination by two telegraphic routes was possible, and Mr. Smith of the Coast and Geodetic Survey was sent to Ft. Egbert, Mr. McDiarmid of the Chief Astronomer's staff to a station near the boundary, and Dr. Klotz of the same staff to Vancouver.

Considerable difficulty was anticipated in obtaining good wire connection between the Boundary and Vancouver. The line in its length of nearly two thousand miles traverses a sparsely settled country; in fact, by far the greater part is wilderness. Through the woods a right of way is cleared, and the wire is supported on trees which have been trimmed and the tops generally sawed off. However, the service proved to be much better than anticipated; the good results being largely due to the solicitous interest of the Superintendent, J. T. Phelan, and of the Chief operator at Vancouver. The correction of 0.0335 between Seattle and the Boundary resulting from the loop closure, was distributed evenly between the stations in the loop.

Two independent computations of the observations were made during the winter, which gave an accurate position for the instrument pier:—9h, 24m. 00.027s, or the pier is 17.62 feet west of the 141st Meridian.

It is interesting to note that this determination of the position of the 141st Meridian, established by the most modern methods under favorable telegraphic conditions, showed that Ogilvie's line of 1887-88 was only 218 feet west of the Meridian, and McGrath's observation 1889-90 gave a position only 477 feet east of the final line. This may be considered a great tribute to the skill of the original observers.

Joint Astronomical Party Expedition in 1907

In 1907, in order to take full advantage of the short working season at this latitude, a small joint astronomical party, with G. C. Baldwin and F. A. McDiarmid, respectively United States and Canadian representatives, were sent out to establish the initial point, and determine the direction of the Meridian. They left towards the latter part of March for Seattle, whence they proceeded by steamer to Skagway, thence by the White Pass and Yukon Railway to White Horse, and by stage line 330 miles to Dawson, where they arrived April 13. From here they travelled by team over the ice to the boundary line which they reached April 20.

Observations were taken by both representatives to determine a true north and south line, which was carefully marked.

The large joint line party arrived June 12, A. J. Brabazon, D.L.S., was in charge for Canada, and G. C. Baldwin assumed charge for the United States. Without delay they proceeded to trace the line to the southward. The first permanent marks placed on the boundary were two large aluminum bronze monuments of pyramidal type, one on either bank of the river.

Duties of the Commissioners

The principal points agreed upon by the Commissioners with regard to the fulfilment of their duties under the Convention were:—

That the final and agreed longitude of the observing pier on the south bank of the Yukon River, as determined by officers of the Coast and Geodetic Survey and officers of the Dominion Observatory, was 9 hours, 24 minutes, 00.027 seconds west of Greenwich, or 17.62 feet west of the true meridian of 141 degrees west from Greenwich, and that the initial point of the boundary line should be located in accordance therewith.

That an accurate azimuth should be observed by a joint party at the initial point, and that a mark should be set determining the direction of the boundary line, which should be produced in this direction north to the Arctic Ocean and south to Mount St. Elias.

That the work should be executed jointly by representatives of the two Governments.

That the boundary line should be produced by the micrometric transit method, representatives of the two Governments observing independently.

That the boundary line should be permanently marked by large and small aluminum-bronze monuments set in rock or concrete foundations at intervals of not more than four miles, and intervisible where practicable, except in the region between Mount Natazhat and Mount St. Elias.

That a vista with a 20-foot sky line should be opened along the boundary through all timber encountered.

That a belt of triangulation should be extended along the boundary line, and the geodetic positions of all monuments determined.

That the computation of the trigonometric determination of the positions of peaks and monuments should be made under the direction of the computing division of the Coast and Geodetic Survey at Washington, and that the results, when obtained, should be submitted to the Commissioners for their final approval and adoption.

That a topographic map, for final drawing on a scale of 1/62,500 with a contour interval of one hundred feet, should be made of the belt of country extending not less than two miles and not more than two and one-half miles on each side of the boundary line; excepting in the region between Mount Natazhat and Mount St. Elias, where it might be made wider if found desirable.

That a line of precise levels should be run from tide water at Skagway, Alaska, to some point on the boundary line for the control of elevations.

That the Alaska Coast Boundary should be drawn from Mount St. Elias to the 141st Meridian on such course parallel to the coast as should be found most equitable in the topographic conditions.

Method of Line Projection

The micrometer transit method adopted in producing the line was with some modifications practically the same as that employed by the U. S. Mexican Boundary Commission of 1893.

The instrument used was a Berger & Sons 6¼ inch repeating theodolite, the telescope being equipped with a micrometer eyepiece magnifying twenty-five diameters. The focal length was 27 cm. and the diameter of the objective, 33 mm. One division of the micrometer head equalled 1″.72 nearly.

Heliotropes of the ordinary pattern mounted on tripods were used as fore- and back-sights and for communication, while the instrument party had a British Army pattern heliograph for communication purposes. A modification of the Morse code was used, together with special code signals relating to various features of the work. The fore-heliotrope party, by reporting on the condition of river crossings, good camping places, available feed and other features of interest, was often able to save considerable time for the parties following.

Points were established on the Meridian at the more or less permanent hills and ridges, seldom less than 10 miles apart, or more than 20 miles. For expeditious work it was necessary that all three heliotropes should be in sunshine at the same time.

The transit having been carefully set over the last point determined on the line, and the rear heliotrope over some other known point on the line, usually the last previously determined point, all was in readiness to determine a new point ahead. Setting the micrometer at collimation, which was easily determined by a short series of direct and reverse readings on the rear heliotrope, and transiting through, the fore-heliotrope man, who was showing his light from the ridge on which the new station was to be set, was instructed by means of the heliograph, which direction, east or west, and about how far, to move so that his light would appear about midway between the two vertical wires of the micrometer. This was usually accomplished in two or three moves, as the first move, though merely an estimate, furnished a scale by which to judge the distance between the heliotrope and the line.

The fore-heliotrope man, on being signalled that he was on approximate line, selected and marked two points

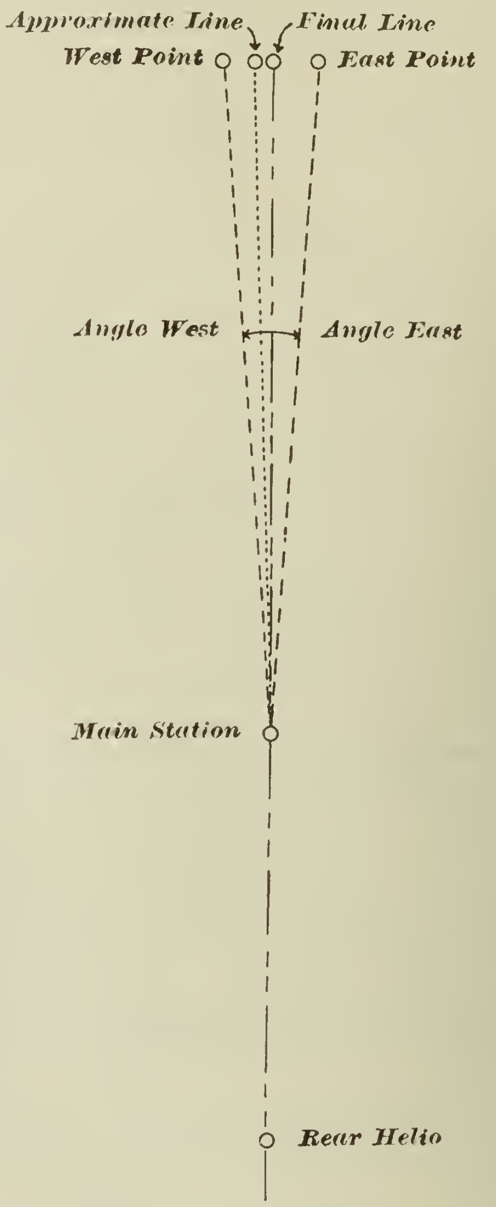


DIAGRAM
ILLUSTRATING
METHOD OF LINE PROJECTION
NOT TO SCALE

about 1.5 meters apart, one on either side of the line, and set his heliotrope over one of them. The readings being completed, the heliotrope was set over the second point which was likewise read on. The distance between the two points had meanwhile been carefully measured by the fore-heliotrope man and was now transmitted to the instrument party and using this as a base and knowing the deflection angles to the two points as read by the micrometer, a simple proportion gave the position of the true line with reference to either point. This position was then communicated to the fore-heliotrope man, who measured the offset to the true line, marked the position and erected a signal in the usual manner.

The observations were made in alternate sets by a United States and Canadian Observer. If the sets did not agree within 5″ (2.8 divisions of the micrometer head) each took another set.

Method used between Mounts Natazhat and St. Elias

The only exception to this method of tracing the line occurred in the region between Mount Natazhat and St. Elias where it was impossible to project the line south in the usual manner, and the only place between these two points where it was found practicable to mark the line was in the vicinity of the Logan and Walsh Glaciers, where the three monuments were set. Here the line was established in accordance with the decision of the Commissioners, who agreed that when a point on the 141st Meridian on Chitina River or Glacier had been determined, the line north and south from that point should be drawn on the azimuth derived from the triangulation. Astronomical observations for azimuth taken at this point or other convenient points were to be used as a check merely.

A base was measured on the south side of the Yukon valley, and a triangulation extended, straddling the boundary line, from which the positions of all measurements were determined. A belt of topography not less than two miles on each side of the line was executed by the plane table, supplemented in places by the photo-topographic method. A 20 foot skyline was opened through timber.

Transport Conditions

Pack-horses, purchased in eastern Washington, and British Columbia, furnished transportation for the parties during the season. The animals, after coming safely through a strenuous season, were to have wintered at Tanana Crossing, Alaska, but all perished in a furious blizzard which overtook them on their way there. The question of wintering the stock used on the survey was a source of much worry and disappointment to those in charge of the work. The horses had to be purchased "outside" and "taken in." The first cost, though comparatively reasonable, was augmented by the heavy freight rates and the cost of feeding while on the long journey to the point where they could be used. As the cost of taking them "outside" again in the fall, wintering them, and returning them again in the spring was prohibitive, they had to be wintered in the country, and, as the survey progressed, the outcome of this plan was found to be more or less uncertain. Some winters all the animals would "come through" looking fit and well in the spring, while again every head perished, and this despite the fact that every likely spot in the whole north district was given a fair trial.

Description of Country Traversed

As conditions met with in 1907 were more or less typical of those throughout the whole work, with the exception of the extreme north and south ends, a short description of them, perhaps, will not be out of place here. The country was undulating to mountainous, generally with deeply eroded stream beds. Heavy timber was usually encountered in the valleys, with the summits bare, or at best covered with a sparse growth of stunted timber or underbrush. Generally, travelling was found to be good along the ridges, except, of course, in the more mountainous portions, where the valleys were found to furnish the best routes of travel, and almost no trail-cutting was necessary except where it was impossible to travel on the ridges, and not always then. The thick moss overlying almost the whole lower country made very tiresome "going" for man and beast, and tended to make the firm, hard ridge-tops the popular lines of communication. The long days of these high latitudes aided the work materially, though at times, particularly on the more northerly portion of the work, many of the men complained that at first they were unable to get their usual quota of sleep owing to the light at night. The majority, however, soon became accustomed to this, and "bed-time" was "bed-time" no matter how light the night.

1908 Expedition

In 1908 a Canadian party under D. H. Nelles, D.L.S., started a line of precise levels at White Horse and carried on by the winter trail to Dawson, and thence west by the Glacier trail to Monument No. 216 of the boundary. Three seasons were occupied in doing this. In 1910, precise levels were brought up from an automatic tide guage at Skagway, by a U. S. party, whence Nelles carried them to White Horse, thus securing a continuous line of precise level from tide water to Mon. No. 216. South of Natazhat the railroad levels of the Copper River and Northwestern Railway from Cordova control the adjustments of all elevations.

The whole survey and demarcation between the Natazhat ridge 15 miles south of White River, and the Yukon a distance of 215 miles was practically completed in the fall of 1909, and a joint party had prolonged the line northward from the Yukon a distance of 40 miles.

1910 Expedition

In 1910 A. J. Brabazon was detailed to conduct the Geodetic Survey of New Brunswick, and J. D. Craig assumed complete charge of the field work, under the British Commissioner, and Thos. Riggs, Jr., under the U. S. Commissioner.

At the close of the season the line tracing had been completed from Mt. Natazhat, the most northerly ridge of the St. Elias Alps, latitude 51° 34, northward to atitude 67° 33, and in 1911 it had reached latitude 69° 20, at which point the Arctic Ocean was plainly visible, but a few miles distant. The triangulation had reached latitude 68° 54′ and the topography latitude 69° 04′.

An epidemic of smallpox had broken out early in the season at Rampart House where the Boundary crosses the Porcupine river, and labor and assistance which had been relied upon, were not available. A small United States party were left to winter at Rampart House to distribute supplies by dog train, and overhaul the launch and take advantage of the spring high water to forward supplies up the Old Crow River.

In 1912 the party reached Dawson May 22, and after a few days delay the outfit of 84 men and 150 horses boarded the steamers "St. Michael" and "Susie" for Circle City, where they transferred to the Steamer "Tanana" and were landed at Rampart House in less than five days from Dawson.

By June 5 all the parties had left for the scene of their summer's work. The fore-heliotrope party arrived at the Arctic Coast on July 12, and found the ice solid except for a narrow lane of water along the shore; but by the 26th the ocean was practically open. Franklin's Demarcation Point proved to be 7 or 8 miles west of the meridian. The topography and triangulation were brought up to the coast, and an area was mapped extending six miles to the east along the coast, and fifteen miles to the west. The triangulation was extended eastward along the coast about twenty-five miles, in an attempt to connect with Herschel Island. Two men had been sent from Rampart House and occupied a heliograph station on the highest point of the island for over a month, but the light was not seen from any of the triangulation stations.

The most northerly monument was set on line, July 18, to the accompaniment of appropriate ceremonies and the unfurling of the standards of the United States and Great Britain. This completed the demarcation of the Boundary from the Yukon river to the Arctic Ocean. The last of the parties left the coast August 6, and on August 30 they boarded the steamer "Delta" at Rampart House en route to Dawson.

Triangulation Work

Also during this season a beginning was made on the section of the boundary between Mt. Natazhat and Mt. St. Elias, a distance of 84 miles, across glaciers and vast ice and snowfields. It was judged practically impossible to project the line directly through this region by the usual method, and it was decided to carry a triangulation from the western end of the White River system of 1909, across the Scolai Pass, south to the Chitini, and up that valley to the line.

As this work would be entirely through United States territory, and would serve other than boundary survey purposes, it was undertaken by the U. S. Commissioner.

In March a party went in from Cordova by railway to McCarthy Station; where they divided into two sections. With horse sleds one section crossed through the Scolai Pass to White River. They recovered four stations of 1909 and carried the triangulation across the pass and down to the Chitini, and effected a junction with the triangulation of the other party which had been working up the valley towards the boundary. They joined forces and measured a base in the Nizina valley and did considerable plane table work on the Chitina and Anderson glaciers. They returned to Cordova about the end of September.

About April 1, 1913, a Canadian triangulation, and photo-topographical party under Fred Lambart, D.L.S., left White Horse over the winter trail to Lake Kluane, and then by pack train to the boundary. They succeeded in extending the triangulation several miles to the south of Mt. Natazhat, and connected with the topography which had been carried up the Anderson Glacier by the United States parties in 1912. Incidentally Mr. Lambart with two assistants succeeded in reaching the summit of Mt. Natazhat.

The general inspection of the work from the Arctic Ocean to Mt. Natazhat, with reference to the alignment, and condition of the monuments was completed this season; Messrs Riggs and Craig the Chief Engineers to the Commission having in person performed the greater part of this task.

Early in March two joint parties had left McCarthy. One completed the triangulation and trigonometrically located the boundary across the Logan Glacier and marked it by the placing of three monuments. A base was measured on a bar below the foot of the Chitina Glacier, and check azimuth observed, which agreed with the computed azimuths brought over the Scolai Pass by triangulation, to within 19″.

The positions of the larger mountains of this region were determined, notably Mt. St. Elias, Mt. King and Mt. Logan. The position of Mt. St. Elias will give a comparison between the Alaska and Yukon datums.

An attempt was made to climb Mt. St. Elias for the purpose of determining the intersection of the 141st Meridian with the line drawn parallel to the coast from the summit of the mountain. After ascending to an elevation of 16,500 feet, a furious storm forced the joint party to abandon the project.

Two hundred and two monuments marked the line from the Arctic Ocean to Mt. St. Elias, a distance of 645 miles, a vista 20 feet wide is opened out through all the timber, triangulation carried north and south from the Yukon controls all positions along the boundary, and a belt averaging 4 miles in width, has been mapped for practically the entire distance.

Thus, the season of 1913 saw the accomplishment of the final acts in connection with the field work of the survey of the 141st Meridian. All the gaps had been filled in, all the "loose ends picked up," and the whole work was complete from the Arctic Ocean to Mount St. Elias, and it was with feelings of genuine regret that all hands from the Chiefs of Party down, said farewell to each other and to the work which had brought them together each season for so many years, and had been productive of such pleasant relationships.

Friendly Relations Between Parties

There can be no doubt that the completion of the work was greatly expedited by the more than friendly relations existing at all times between the parties working under the direction of the Commissioners, and by the remarkable esprit de corps shown by all connected with the work. Everyone, American and Canadian, seemed to successfully grasp the idea that the work was of paramount importance, and it was advanced with the greatest possible speed consistent with good quality, often at the sacrifice of reasonable and legitimate personal comforts on the part of the men, and the disposition of one party to assist ore another in every possible way was quite as apparent between Canadian and United States parties as between parties of the same nationality.

The field work, a great deal of which had to be done in portions of the country hitherto considered practically impassable, was completed under the direction of the original Commissioners, O. H. Tittmann for the United States and Dr. W. F. King for His Britannic Majesty, and constitutes a lasting tribute to their efficient administration and supervision. Practically all the maps had also been prepared under their direction, as sheets 1 to 32, inclusive, had already been signed by them before the resignation of Mr. Tittmann on April 15, 1915, and the death of Dr. King on April 21, 1916.

The work was completed under the direction of E. C. Barnard, appointed Commissioner for the United States, April 30, 1915, and J. J. McArthur, appointed Commissioner for His Britannic Majesty, January 6, 1917; by printing and signing the last six sheets, numbers 33 to 38, preparing and signing the report, and transmitting to their respective Governments, as provided in the Convention, the signed report and duplicate atlases of signed joint maps. The engraved copper plates, original drawings, field sheets, record books and negatives have been stored in a vault of the engraving Division of the United States Geological Survey, Washington, D.C., subject to the order of the Secretary of State.

Thos. Riggs, Jr., having resigned as engineer to the United States Commissioner in May, 1914, the greater part of the work in connection with the preparation of this report devolved upon J. D. Craig, D.L.S., who since 1910 had been in complete charge of the field work under the British Commissioner, and the Commissioners desire to express here their appreciation of the efficient manner in which this arduous task has been accomplished.

Welcome Home

Members of the Saskatchewan branch of th *The Engineering Institute of Canada*, tendered a "welcome home" banquet last night to the members of *The Institute* who have returned from service overseas. Included among the guests were Brigadier-General Alex. Ross, C.M.G., D.S.O., general officer commanding Military District No. 12, and Mrs. Ross; Colonel J. L. R. Parsons, C.M.G., D.S.O., Croix de Guerre, and Mrs. Parsons; Hon. S. J. Latta, minister of highways, and Mrs. Latta; Dr. W. D. Cowan, M.P., Mrs. Cowan and Miss Cowan. The function, which was a very successful one, was held in the Kitchener hotel.

H. S. Carpenter, deputy minister of highways and president of the local branch, acted as toastmaster of the evening. In his address of welcome he referred to the very important role which had been played in the Great War by the engineering fraternity. The members of the Regina organization, he said were proud of the splendid records of the men who had gone from this district, many of whom had acquired fame and honor on the battlefields of France.

Inventions Used

Colonel Parsons in a very interesting address outlined some of the inventions which had been placed at the disposal of the war office by engineers and gave a description of the manner in which these inventions had been utilized by the intelligence branch of the allied armies. As General Staff Officer of the First Canadian Division, Colonel Parsons had a splendid opportunity of learning the history of the plans of the British army chiefs and he gave a graphic account of the Allied advance during the last few weeks of the war.

Major A. P. Linton, O.B.E., gave some reminiscences of the work which had been performed by the bridging company which he commanded in Palestine during the advance of General Allenby against the Turks, resulting in the capture of Jerusalem and the final capitulation of the Moslem empire.

Railway Troops

Lieut.-Colonel A. C. Garner, D.S.O., M.E.I.C., who commanded the 12th Battalion, Canadian Railway Troops in France, explained the organization of the railway troops and the splendid work performed by the corps in France and Flanders. Altogether he said there were thirteen battalions of the Canadian railway troops in France and they constructed thousands of miles of both broad and narrow guage railways. Wherever there was a battery of artillery, the railway builders were to be found laying down their steel and bringing ammunition right up to the gun emplacement. It was only the work of the corps which made the allied advance possible for to it lay the credit of bringing up all the supplies and ammunition necessary to maintain the fight.

During the evening a number of musical items were rendered by local artists and a pleasant evening was brought to a close with a dance.

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOL. II. December 1919 No. 12

Authors Names Omitted

An unfortunate omission occurred in two of the papers published in the General Section of the November issue of *The Journal*, whereby the names of the authors and the meetings where they were read were not included.

The first of these papers: "Heating Problems Produced by some of the Modern Methods of Building Construction," was read by W. B. MacKay, A.M.E.I.C., at the St. John Professional Meeting and attracted a great deal of attention. Reference was made to it in the Report of the St. John meeting and some of the discussion published.

The other paper "Can the Standard Measure of Value be Improved," the author of which is John G. Sullivan, M.E.I.C., was read by the author at a meeting of the Winnipeg Branch and is worthy of close study on the part of other members of *The Institute*.

Discussion received on either of these papers will be published in the succeeding issue of *The Journal*.

Domestic Fuel from Low Grade Lignite—The Present Status.

The writer can speak only in this brief note of the work of the Lignite Utilization Board, with which he happens to be connected, although it is by no means the only organization interested in this problem. The United States Bureau of Mines is about to start experimentation on a large scale, and similar work is proceeding in Australia and New Zealand.

The Board's endeavor is to produce a satisfactory domestic fuel from the poor lignites of the Souris field in south-eastern Saskatchewan. No attempts have been made to treat the coals from any other area, nor to produce anything save a domestic fuel from this particular coal. The industrial possibilities of Souris lignite are not included in the investigation, except as they may be studied in the Board's own power plant, nor has any attention been devoted to by-products, such as tar and ammonia. The present value of these is probably low and their ultimate value problematical.

Souris lignite is probably the lowest grade of any now mined, and it is reasonable to suppose that if it can be satisfactorily treated, better grade coals can be treated with at least as much success, and probably much more. A great deal, therefore, depends upon the results of the Board's labors.

Experimental work conducted since October, 1918, has led to the conclusion that pulverizing, drying, carbonizing and briquetting are the logical steps in the process most promising of commercial feasibility. Pulverizing and drying are comparatively simple processes which can be carried on by the aid of methods already well known and time tried. These present no particular difficulties.

Carbonizing, however, is not so simple. The carbonizer which the Board proposes to use is one developed by its own staff. It utilizes, so far as known, an entirely new principle, and is operated by gravity and at a higher rate than any similar machine. The carbonizer itself has no moving parts, is low in first cost, and it is believed it will be correspondingly low in operating expense. It is flexible and easily controlled, so that the quality of the product may be varied without difficulty. Furthermore, it is hoped, with reason, that sufficient gas will be given off in the process to provide the required heat, thus making it in a sense a "perpetual motion machine."

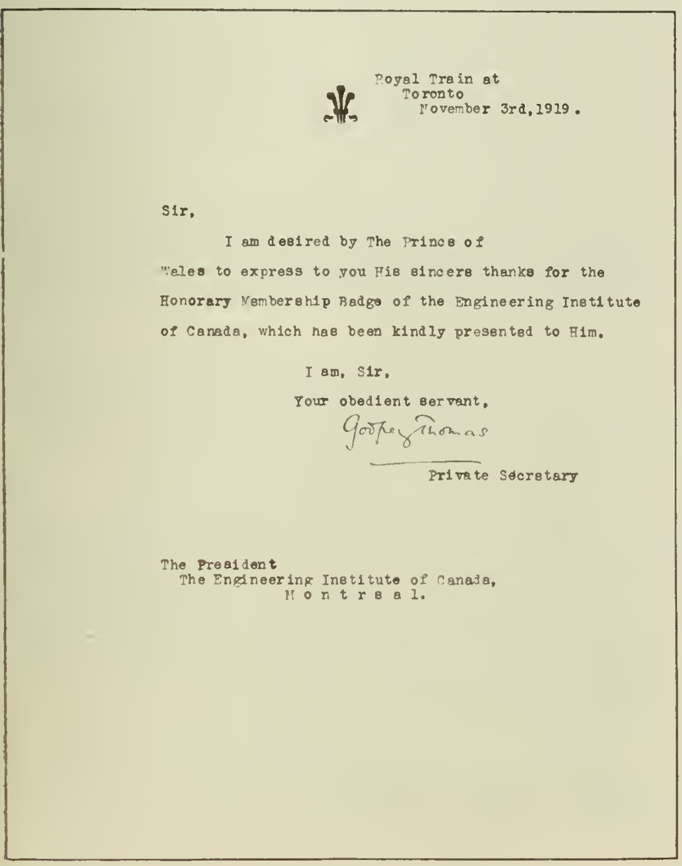
A super-laboratory apparatus, having a capacity of 150 lbs. per hour of product has been in operation for some months with good results. Based on information collected during this period, the designs for an 8000 lb.-per-hour unit are being prepared.

Carbonized lignite is not an easy material to briquette, but the Board feels that its experiments along this line have progressed to the point where ultimate commercial success may be expected. A briquetting plant having a capacity of about 1½ tons per hour has been in operation during the past summer, and a large number of sample briquettes have been made. These have been tested physically and in the fire, and certain of them have proved quite satisfactory. It is now largely a question of dollars and cents, principally with regard to the binder to be used. In addition to the Board's own work, certain commercial briquetting companies are carrying on tests, the results of which are not as yet complete.

The work of the past year has been so encouraging that plans and specifications are being prepared at present for a 100 ton-per-day plant to be erected in the Souris area early in the coming spring. Contracts for the buildings and much of the equipment will probably be placed by January 1st, 1920, and contracts for the balance will follow as rapidly as possible. The requisite "tuning up" may take several months, so that it will probably be the fall of 1920 before the plant is ready to produce on a commercial scale.

Upon the results obtained in this plant, the success or failure of the project can be predicted, since it is of commercial size, and accurate cost records will be an essential part of its operation. If successful, the Board confidently looks for private capital to take up the industry, provide the West with a domestic fuel comparable to Pennsylvania anthractie at less cost, keep more Canadian dollars at home and do a trifle toward reducing the H. C. L.

R. D. L. French.


Royal Train at
Toronto
November 3rd, 1919.

Sir,

I am desired by The Prince of Wales to express to you His sincere thanks for the Honorary Membership Badge of the Engineering Institute of Canada, which has been kindly presented to Him.

I am, Sir,

Your obedient servant,

Private Secretary

The President
The Engineering Institute of Canada,
Montreal.

Research Work in Canada

Two very valuable publications have recently been received by *The Engineering Institute*, the Report of the Special Committee appointed to consider the matter of the Development in Canada of Scientific Research, and Bulletin No. 1 of the School of Engineering Research of the University of Toronto; both of which should be in hands of every member of *The Institute*.

The word research has an unfortunately learned sound, but is very much like calculus to the engineering student. Just when the engineer-to-be is becoming thoroughly convinced that calculus is an invention of the evil one, purely theoretical and of doubtful value, he discovers that it is not merely an instrument of torture in the hands of a professor, but an extremely practical help in the solving of such matter-of-fact problems as the design of steam turbines.

The fact is that research undertaken in connection with purely scientific problems has produced such remarkable results that the larger engineering and chemical firms all over the world have thought it worth while to establish research laboratories and to spend very large sums of money on their upkeep. Canada has lagged behind in this respect to a certain extent, but the Imperial Oil Company spent $240,000.00 annually for research and exploration. The Eastman Kodak Company spend over $2,000,000.00 annually for their research laboratory at Rochester, N.Y., and more than one large industrial Company in the United States spends at least as much.

Now, here in Canada we have a great many problems which can only be solved by concentrated research work. Some of these indicated in the report of the special committee, are:— navigation in fog, the production of a rust resisting wheat, extension of the electro-chemical industry, the utilization of the tar sands of the west, the use of waste liquor from pulp and paper mills, etc. The special committee has recommended the establishment of a central Research Bureau with Government assistance to the extent of $500,000.00 for building purposes, and the fostering of research work in the universities to as great an extent as possible. In this latter connection a curious point emerges from the discussion of the committee. Several of the members were of the opinion that the ordinary university course is not conducive to the atmosphere of pure research, as independence of thought is the outstanding requirement in a research worker, and this is not encouraged in under-graduates. However, it does not follow that independence of thought is so stifled that very effective post graduate work may not be done, and the Bulletin of the School of Engineering Research, of the University of Toronto is strong evidence in support of this. This is a substantial volume of 240 pages and includes a number of investigations in various branches of engineering and chemistry. It is not fair to single out particular papers, but among the longer investigations may be mentioned two, the accounts of which have already been published in this *Journal*, "An investigation on girderless concrete floors," by Peter Gillespie, B.A.Sc., M.Sc., M.E.I.C., and T. D. Mylrea, M.W.S.E., and "Heat Transfer Tests of building materials," by L. M. Arkley, B.A.Sc., M.E.I.C., "A research on a 4" single state turbine pump," by J. H.

Parkin, B.A.Sc., and several investigations on sodium hydroxide and ferric hydroxide, by Maitland C. Boswell, M.A., Ph.D., and J. V. Dickson, B.A.Sc., also a research with a very practical application on "The calculation of transmission line net works," by T. R. Rosebrugh, M.A.

McGill and Queen's are as active in research as Toronto although they have not published results in quite the same form, but without more Government assistance and centralized efforts the work must necessarily be limited in scope. The National Physical Laboratories in England have done a most remarkable work in connection with the war; a great deal of research was done on problems connected with aeroplane design, and relating to anti-submarine problems, and it is only fair to state in this connection that a number of Canadians were called in to help in this work. The British Government founded a Department of Scientific and Industrial Research in 1915 which was granted $5,000,000.00 to begin with. Further, the Admiralty is recommending the British Parliament to provide another $5,000,000.00 for the erection and equipment of a sea experimental station, an engineering laboratory, and a central research bureau, with an appropriation of $1,500,000 per year for the actual conduct of investigations. No one can, therefore, quarrel with the recommendation of the committee that $500,000. be appropriated for similar purposes in Canada, on the score of asking for too much, and the members of *The Engineering Institute of Canada* can do a great deal in spreading the doctrine of efficiency in promoting the furtherance of research in the Dominion.

The Classification of the Civil Service

Readers of *The Journal* are, no doubt, aware that the special committee of Council and the Executive of the Ottawa Branch have taken a deep interest in the classification of the Civil Service and the Act which authorizes it. Their efforts have had a very considerable effect in improving the position of engineers in the service, which in turn will effect engineers throughout the Dominion.

The new classification became law on Nov. 11th last, and will take effect from April 1, 1920. In the meantime the commission will continue to fit the personnel of the service into the various classes.

Patronage in Dominion Government affairs in the past ten years, by two Acts of Parliament has been entirely abolished. The Civil Service Act of 1908 abolished patronage as far as the inside service was concerned and the Civil Service Act of 1918 also brought the outside service under the jurisdiction of the Civil Service Commission. The 1918 Act made it incumbent upon the Civil Service Commission to classify the outside service. To make this classification effective certain amendments to the 1918 Act became necessary, and on November 10th, last, the Civil Service Amendment Act of 1919 received Royal assent. These amendments, together with the 1918 Act, are claimed by those who have studied Civil Service matters to give Canada, if not the best, at least one of the best and most workable Civil Service Acts in any country.

The clause in this 1919 bill which is of most importance is that by which the classification of the Canadian Civil Service is adopted; over 50,000 employees divided into about 1700 classes will receive equal pay for similar duties, responsibilities, and qualification requirements, that is to say, men in Vancouver, Ottawa, and Halifax doing the same work will be placed in the same class and receive the same pay.

It is provided that the Civil Service Commission may prepare new classes, abolish classes no longer necessary, change existing classes as to duties, qualification requirements, lines of promotion, and compensation, provided, however, that changes in compensation must be approved by the Governor-General-in-Council.

Employees are to take the classification of their respective positions, but no temporary employee may be given a permanent position without examination and no permanent employee who has been appointed before the passing of the Act is to have his salary reduced by reason of the classification of his position, and even if the employee is placed in a class where the maximum salary is lower than the maximum salary of the subdivision or grade in which he was before classified, he shall be entitled to go to the maximum of his old subdivision or grade; by this division the Government has recognized a moral obligation that will promote contentment in the service as a result of the adoption of the classification.

Layoffs, an altogether new thing for the Canadian Civil Service, are provided for. When by reason of a completion of any special work or a diminution of work in any branch of the service, those employees who are either temporary or permanent, and are not required, may be laid off, but it is required that their names be placed at the head of the eligible list for the respective class for which they have qualified and they will be appointed to the next vacancy which occurs either in the department from which they were laid off or in any other department in the Government service.

This feature of the bill will be watched with considerable interest, as in the past a man who had a permanent position was considered to have a life job whether there was any work for him or not and was usually only removed when death claimed him.

Working hours for each and all classes and kinds of labour are to be studied and recommendations made by the Commission whereby standard hours will be prescribed for each class and kind of work.

All appointments to the Civil Service are to be made by the Civil Service Commission by competitive examination. The Commission will establish eligible lists for active classes, that is classes from which many appointments are likely to be made. If no eligible lists are in existence for any class, the Commission will hold an examination, and, if the appointment is urgent, fill the position temporarily until a permanent appointee may be selected.

Promotion in the Civil Service is understood to mean a transfer from one class to another class with higher maximum salary. Vacancies are to be filled, as far as is consistent with the best interests of the Civil Service, by promotion, and promotion is to be made for merit upon such examination as the Commission may prescribe. Increases are advances in compensation within a class. They are to be granted for meritorious service rendered and increased usefulness in the Service upon recommendation of the Deputy Head of the department and with the approval of the Civil Service Commission.

In certain cases, for work done outside of prescribed hours, upon the recommendation of the Deputy Head of a department, the Civil Service Commission may grant additional remuneration.

The special committee of Council will closely follow the working of the classification as applied to engineers and will be ready at all times to give their assistance in maintaining and improving the status of the profession.

C. V. PUTMAN.

Engineering Gathering at Peterborough

A Notable Engineering Event. Peterborough Engineers given Charter for the Establishment of a Branch of The Engineering Institute. The Engineers of Peterborough show progressive spirit.

Peterborough, the Electric City, on Thursday, November sixth, distinguished itself in two directions. On that day it reached its Victory Loan objective being the first city in Ontario to win the Prince of Wales' flag and, further, it saw the most important gathering of engineers ever held in the city and the inaugauration of a new era in the engineering life of the community.

When it was decided by the leading engineers there that their progressive city should be placed on the engineering map of Canada, the spirit with which they entered into the proposal and the effective manner in which their plans have been carried out reflects the genius of the men responsible for the new order that has been occasioned. It is also evidence of the spirit of the times when an active body, such as the Engineers' Club of Peterborough, realizes that it is adding prestige to itself and usefulness to its work in becoming a branch of the national organization, which with its eighteen branches is working in harmony in the interest of the engineering profession. It is coming to be more and more realized throughout Canada that the one national organization for the benefit of the profession is the surest means of accomplishing the successful outcome of the requirements of the members thereof.

From the time the Montreal delegation, the first of the out of town guests to arrive, were met at the station at dawn, by G. Reid Munro, A.M.E.I.C., chief engineer of the Wm. Hamilton Co.; Ross L. Dobbin, M.E.I.C., engineer, Public Utilities Commission; Roy H. Parsons, M.E.I.C., city engineer; J. A. G. Goulet, A.M.E.I.C., chief mechanical engineer, Canadian General Electric Co.; James Makintosh, A.M.E.I.C., resident engineer, Hydro-Electric Power Commission; Peter Westbye, vice-president and general manager, Wm. Hamilton Co.; until the last guest departed on the following day, there was no let up to the delightful hospitality which captivated the visitors from start to finish, and which made the non-residents realize more than ever before that Peterborough is an important engineering centre.

At noon an informal luncheon meeting was held for the purpose of becoming better acquainted.

Visits to Engineering Works

About 2 o'clock automobiles kindly supplied by local members took the party to various points of engineering interest in the city; the notable engineering feat, the lift lock of the Trent Canal being the first. After being locked through on board the Government tug following arrangements made by A. L. Killaly, A.M.E.I.C., Supt. of the Trent Canal, the operating mechanism was inspected. The works were familiar to a number of those present, but the lift lock at Peterborough is the source of unfailing interest. It was built from the design made by Walter J. Francis, M.E.I.C.

The Quaker Oats plant which is said to be the finest on the continent was also visited, as well as the pumping station operated by the Peterborough Utilities Commission, the plant of Wm. Hamilton Company, Limited, Peterborough Canoe Company, the Hunter Street Bridge, a superb structure of reinforced concrete now under construction of which Frank Barber, M.E.I.C., is the engineer, attracted considerable attention.

The Dinner

Described by the local papers as one of great importance to the city as a whole, and one that will go down in the chronicles of the history of the city and will for a long time bring pleasant memories to those privileged to be present. It was the inaugural dinner of the Peterborough Branch of *The Engineering Institute of Canada*, and considered from every viewpoint, the large and representative attendance, the enjoyable menu, and the interesting toast list, it was a great success. About one hundred men sat down at this banquet, representing the local engineers, the visitors of the profession and the leading men in the municipal business and professional life in the city.

Formal invitations had been sent out, bearing on the back the names of the officers of the Engineers' Club of Peterborough. Each guest on sitting down found before him a handsome menu card, the cover of which is similar to that of *The Journal*, bearing the words "*The*

Group Photograph of opening meeting of Peterborough Branch, November 6th, 1919.

Key to Group Photograph.

(1) J. Garrow, (2) Jas. Mackintosh, (3) Walter J. Francis, (4) P. P. Westbye (5) E. R. Shirley, (6) A. F. Bookhout, (7) Frank Barber, (8) R. W. Leonard, (9) Alex Richardson, (10) J. A. G. Goulet, (11) H. O. Fisk, (12) R. B. Rogers. (13) P. L. Allison, (14) R. A. Ross, (15) A. W. Fraser, (16) D. W. L. Mayie, (17) A. E. Caddy, (18) C. H. Rogers, (19) R. H. Parsons, (20) W. M. Cruthers, (21) R. L. Dobbin, (22) G. R. Langley, (23) A. L. Killaly, (24) G. Reid Munroe, (25) Fraser S. Keith, (26) W. H. Pretty.

The Engineers' Club of Peterborough

request the pleasure of your company at the

Inaugural Dinner of The Engineering Institute of Canada

Peterborough Branch, to be held in the Empress Hotel,

On Thursday Evening, November the Sixth

Nineteen Hundred and Nineteen

At Seven-thirty o'clock

R. S. V. P.

R. L. Dobbin, M.E.I.C.,
Secretary

Engineering Institute of Canada," the crest and "Inaugural Meeting of the Peterborough Branch, November the sixth, Nineteen hundred and nineteen." The interior of the programme consisted of eight pages containing a list of the members of Council for 1919, the objects of *The Institute*, an aeroplane picture of the Trent Canal and lift lock at Peterborough, the programme, scenes of engineering interest at Peterborough, a list of the officers of the Engineers' Club of Peterborough and a definition of the term "engineer."

Toast List

The King:

R. B. Rogers, M.E.I.C., Chairman.

The City:

Proposed by A. L. Killaly, A.M.E.I.C. Responded to by the Mayor.

The Engineering Institute of Canada:

Proposed by G. Reid Munro, A.M.E.I.C. Responded to by:

Lieut.-Col. R. W. Leonard, M.E.I.C.
Professor H. E. T. Haultain, M.E.I.C.
R. A. Ross, M.E.I.C.
James White, M.E.I.C.
Professor Gillespie, M.E.I.C.
Fraser S. Keith, Secretary.

The Branches of *The Engineering Institute:*

Prosposed by C. E. Sisson. Responded to by:

Walter J. Francis, M.E.I.C.
A. Harkness, M.E.I.C.
J. B. Challies, M.E.I.C.
Frank Barber, A.M.E.I.C.

Sister Professions:

Proposed by Wm. Sangster. Responded to by Dr. Morgan (Medical Society); F. D. Kerr (Law Society).

GOD SAVE THE KING

The chair was occupied by R. B. Rogers, M.E.I.C., who has long been identified with the engineering and business life of Peterborough, who proposed the toast to the King, which was fittingly observed. The toast to the City was proposed by A. L. Killaly, A.M.E.I.C., who predicted a bright future for Peterborough; the city was endowed with great resources and possibilities. Mayor Duncan in responding extended the city's welcome and freedom to the visitors, and referred to the fact that Professor Haultain, R. A. Ross, and Walter J. Francis were old Peterborough boys.

In proposing the toast of *The Engineering Institute* the President of the local Branch G. Reid Munro gave a brief sketch of the history of the Engineers' Club of Peterborough from the time of its inception till the time of the decision to join *The Engineering Institute of Canada*. Lieut. Col. R. W. Leonard, President of *The Engineering Institute* then spoke in reply, and in turn reviewed briefly the history of *The Engineering Institute of Canada* from its early days as the Canadian Society of Civil Engineers to the present day when *The Institute* has eighteen branches and a rapidly growing membership, which is at present close on 4,000. Professor Haultain, of Toronto, then spoke, and brought out the point that the present success of *The Institute* was largely due to the untiring efforts of the Headquarters Executive, R. A. Ross, President-elect of *The Institute* made a plea for the widening of the engineers' influence in public life, urging them to form a brotherhood that would be something which would be of potential good for the whole community. Jas. White, Deputy Chairman, of the Conservation Department of Ottawa followed Mr. Ross with a presentation to the Peterborough Branch of the photographs of Col. W. P. Anderson, T. C. Keefer, C.M.G., and G. A. Mountain, Past Presidents of the Canadian National Association of Engineers from which *The Engineering Institute* has sprung. Professor Peter Gillespie of Toronto gave a brief history of the Trent Valley Canal. He also laid stress on public service and on the fact that one of the principal objects of *The Institute* is to increase the usefulness of the engineering profession to the public. Fraser S. Keith, gave a brief history of general engineering from ancient times to the present day giving an idea of the immense influence of the engineer on present day civilization. J. B. Challies, Chairman of the Ontario Provincial Division spoke briefly emphasizing service.

Replying to the toast of "The Branches of *The Institute*," proposed by Mr. C. E. Sisson, of the local branch, Walter J. Francis brought greetings from the Montreal Branch and mentioned the fact that one third of the members of *The Institute* had been at the front, every man having non-commissioned or commissioned rank. Mr. Francis referred to some of Montreal's water works problems in which Canadian Engineers had done good work, one result of which had been that the administration of Montreal had been placed in the hands of an Administrative Commission, of which R. A. Ross, President-elect of *The Institute* was a member. A. H. Harkness then spoke briefly conveying the good wishes of the Toronto Branch. W. Sangster proposed the toast of the "Sister Professions," which was replied to by Dr. J. A. Morgan on behalf of the medical profession.

The very enjoyable meeting concluded with God Save the King followed by Auld Lang Syne.

Aeroplane View of Trent Valley Canal Lift Dock.

Out of Town Guests

The following were present:—President, Lieut.-Col. Leonard, M.E.I.C., St. Catharines, Ont., Vice-Presidents, Professor Haultain, M.E.I.C., of Toronto, and Walter J. Francis, M.E.I.C., of Montreal, President-elect, R. A. Ross, M.E.I.C., of Montreal; Members of Council, Professor Peter Gillespie. M.E.I.C., Toronto, and James White, M.E.I.C., Ottawa; J. B. Challies, M.E.I.C., Ottawa, Chairman of the Ontario Provincial Division; Frank Barber, A.M.E.I.C., Toronto, Edward Francis, S.E.I.C., Toronto, Fraser S. Keith, Secretary of *The Institute*, Montreal, and D. M. Fraser, of Toronto.

The officers and members of the Engineers' Club included the following;—Hon. President C. E. Canfield, President G. Reid Munro, A.M.E.I.C., Vice-President R. H. Parsons, M.E.I.C., Directors, P. L. Allison, H. O. Fisk, G. R. Langley, James Mackintosh, A.M.E.I.C., R. B. Rogers, M.E.I.C., E. R. Shirley, Secretary, R. L. Dobbin, M.E.I.C., W. J. Armstrong, A.M.E.I.C., A. F. Bookhout, F. Bowness, B. L. Barns, J. B. Barness, W. B. Browett, W. M. Cruthers, R. B. Carson, G. O. Cameron, H. J. Dickenson, D. Easson, H. A. Fife, V. S. Foster, A. B. Gates, A. G. Grier, J. A. G. Goulet, A.M.E.I.C., T. E. Gilchrist, R. Grant, S. H. Holden, E. L. Holmgren, R. E. Hinton, J. E. Hess, S.E.I.C., A. L. Killaly, A.M.E.I.C., H. A. Morrow, M.E.I.C., N. C. Mills, W. Munn, A. H. Munro, S.E.I.C., L. D. W. Magie, E. Maybee, D. L. McLaren, W. H. Pretty, G. Perks, C. Rogers, M.E.I.C., W. Rose, J. H. Reid, C. Robertson, W. Sangster, R. E. Stavert, C. E. Sisson, A. W. Spence, N. D. Seaton, A. C. Stensfield, A. L. Sutherland, A. L. Tennyson, S.E.I.C., P. P. Westbye.

New Members of the Institute

The following engineers of Peterborough have recently been admitted to *The Institute:*— P. L. Allison, Industrial Control Engineer, Works Engineering Dept. C.G.E.Co., G. R. Langley, Engineer in charge of Switchboard, Eng. Dept., C.G.E.Co., E. R. Shirley, Electrical Engineer on Engineering Staff of the C. G. E. Co., C. E. Sisson, Engineer in charge of design and supervision of construction in testing of transformers, C. G. E. Co., P. P. Westbye, Vice-Pres. & Gen. Mgr., Wm. Hamilton Co., B. L. Barns, designer, alternators and synchronous motors, C. G. E. Co., A. F. Bookhout, Electrical engr., Switchboard Section C. G. E. Co., A. B. Gates, Asst. induction motor designer, C. G. E. Co., T. E. Gilchrist, Works engr. Dept., on switchboard estimates, C. G. E. Co., D. L. McLaren, Asst. engr. on design of alternating current generators, synchronous motors and condensers, C. G. E. Co., W. G. Perks, Asst. engr. City of Peterborough, C. Robertson, in charge of Trent watershed, hydrometric survey, N. D. Seaton, switchboard section, eng. dept. C. G. E. Co., A. L. Sutherland, transformer drafting and mechanical design, C. G. E. Co., R. E. Hinton, Asst. engr. engineering dept. C. G. E. Co., E. L. Holmgren, transformer design, C. G. E. Co., J. H. Reid, Students engr. course, C. G. E. Co., R. E. Stavert, Test course, C. G. E. Co.

Group Photograph at the Trent Valley Lift Lock.
Opening Meeting, Peterborough Branch E.I.C., November 6, 1919.

BOOK REVIEWS

Motor Vehicles and their Engines

By Fraser and Jones. Published by D. Van Nostrand—Price $2.00

This book is a simple, practical exposition of the internal combustion engine as used in all types of motor vehicles, and is intended for the owner-driver, or for any owner interested in the whys and wherefores of his car. The book is practical throughout and deals in theory only when absolutely necessary, as, for instance, in connection with the theory of the different types of ignition as found in the present day automobile.

An idea of the contents of the book may be gathered from the general arrangement. The early part of the book deals with the principles of operation of two and four cycle gas engines, and goes on to deal with balance, cooling systems, carburetion, ignition systems, clutches, transmission, etc. In every chapter the different types of mechanism found in the leading modern American cars and trucks, are thoroughly described and illustrated; for instance, the chapter on clutches takes up the external cone clutch, the internal cone clutch, and various types of disc and plate clutches. Although the authors of this reference book do not make their subject tedious by delving too deeply into the theory behind automobile design, it is quite evident that they are thoroughly conversant with their subject and one is impressed with the thoroughness of the joint authors.

The latter part of the book describes such features of car and truck construction as balance, differentials, running gears, lighting systems, tires, etc., concluding with two very practical chapters on engine troubles and car adjustment. The book is very thoroughly illustrated, having 280 diagrams of automobile construction features, and has a detailed index.

Lighting from Concealed Sources

By the Engineering Department of the National X-Ray Reflector Company, New York. Price $2.00

Published by the National X-Ray Company of New York primarily as a guide to the correct use of the lighting fixtures manufactured by the Company, this book is nevertheless an authoritative and detailed text-book on Indirect Lighting, and contains several features of value to all interested in correct illumination.

After dealing with the principles of concealed lighting and showing clearly the benefits obtained from this type of lighting both from the point of view of illumination and that of eye-strain, the question of planning and design of indirect lighting is taken up. In this section of the book a number of valuable tables are given by means of which the correct method of lighting can be worked out very simply for any installation. The usefulness of the tables can be gauged from the following list: Efficiency of Utilization, Illumination in Foot Candles and Wattage per Square Foot for Various Requirements; Lumen Data for Mazda Lamps, Chart for quick determination of lighting intensity, spacing of units, proper lamp size and watts per square foot required.

The second section of the book takes up in more detail the application of Indirect Lighting Systems to particular installations such as factories, churches and private residences. In each case described, the details of the installation are given in full.

Although indirect lighting is recommended to be used wherever possible, there are installations where direct lighting is absolutely necessary, and to make the book complete, tables and other details are given similar to those for indirect lighting in the earlier part of the book, making calculation for direct lighting as simple as that for indirect lighting. Practical examples of direct lighting design are given, and these are followed by a section on flood lighting as used for protective and decorative purposes.

The book concludes with a five page glossary of terms used in illuminating engineering, the Standard Wiring Symbols adopted by the American Institute of Architects, and a section of Miscellaneous Data, such as Tables of Absorption, Reflection, Effect of Colored Lights on Various Colors, etc.

It can be seen from the above description of "Lighting from Concealed Sources" that while the book leans distinctly in the direction of the products of the company whose engineering department supplied the information, the book is nevertheless a distinct addition to the library of illuminating engineering. The subject of artificial lighting using the Indirect System is discussed in great detail. The tables given are of considerable value, and direct lighting is also given its fair share of attention.

Asphalts and Allied Substances

By Herbert Abraham, Member, A.C.S., A.S.T.M. Published by D. Van Nostrand Company, New York. Price $5.00

"Asphalts and Allied Substances," is an exhaustive work of 600 pages. After a historical review of asphalts and bitumens the author takes up the chemistry and geology of bitumens. The second part of the book discusses semi-solid and solid native bituminous substances; part three is a valuable section dealing with tars and pitches and goes quite thoroughly into the distillation and manufacture of coal tar, lignite tar, shale tar, water-gas tar and pitch, etc. The fourth section of the book deals with manufactured products, bituminous paving materials, bituminised fabrics for roofing, etc.; the fifth and final section discusses methods of testing; physical, chemical and weathering tests being taken up in detail.

Location, Construction and Maintenance of Roads

By John M. Goodell. Published by D. Van Nostrand Company. Price $1.50

This book on road construction is a reprint from the Good Roads Year Book. The various types of road construction are dealt with in turn, each chapter having been submitted to an authority on that particular subject for criticism. From a discussion of sand-clay and gravel roads the author proceeds to water-bound macadam roads, concrete roads, brick roads, etc. Chapters are included on road-building rocks, specifications for Portland Cement, resistance of roads to traction, and tables are given of the production of broken stone, gravel and paving sand, etc. The subject matter is taken exclusively from the United States, and no mention is made of Canada, although the problems encountered in this country are of the same type as those found in the Northern States. Each chapter includes tables for the use of the highway engineer; for instance in the chapter on bituminous roads a table is given showing the gallons of bituminous material per mile or road for different rates of application. A very useful chapter is that on highway bonds.

Note.—Books reviewed above are to be found in the Library of The Institute, 176 Mansfield Street, Montreal.

CORRESPONDENCE

Editor, *Journal:—*

Dear Sir:

Am much interested in the September Journal.

Will you kindly order and forward to me, new certificate of membership, $1.25, gold badge as watch charm, $3.75.

I would be very much obliged if you could obtain designs and working drawings of frame buildings suitable for farm houses, one, one and half and two storey wooden bungalow buildings in timber from such firms as enclosed advertisements indicate. There is a big movement now taking place to adopt Canadian style of housing. I have delivered many lectures advocating their adoption. I had many plans and models in Canada but have been unable to obtain them and my time is so occupied in lecturing and demonstrating to one hundred and seventy-eight students, that I cannot find time to make fresh drawings. As they are offered for sale I might be able to obtain some drawings (working and designs) through your good offices. If you could make a small selection for me you would greatly assist me.

Also with regard to hot air heating for houses. I would like some trade catalogues with prices. Designs and any statistics available. People cannot realize here how simple and inexpensive such installations are in Canada.

Yours faithfully,

Hilder Daw, M.E.I.C.

South Eastern Agricultural College,
Wye, Kent, England., October 1st, 1919.

REPORT OF COUNCIL MEETINGS

Date: The regular monthly meeting of the Council was held at the rooms of the Institute, 176 Mansfield Street, on Tuesday, October 28th, at 8.15 P.M.

H.R.H. The Prince of Wales: The ballot for the election of His Royal Highness, The Prince of Wales, as an honorary member of *The Institute* was canvassed and was unanimously in favour of his election. The gracious acceptance of His Royal Highness of honorary membership had previously been given. It was left to President-elect Ross to arrange to have His Royal Highness notified and to have a gold badge of *The Institute* presented to him.

National Conference on Moral Education: Walter J. Francis, who, with W. M. Scott, E. P. Featherstonhaugh, J. G. Sullivan, and Geo. L. Guy, of Winnipeg, represented *The Institute* at the National Conference on Moral Education, presented his report. He believed that the gathering had been one of the most notable educational gatherings in the history of Canada, an outstanding result being that a national bureau is to be established under the direction of a national Council of the Conference for the purpose of educational investigations and as a clearing house for educational data, to be maintained by voluntary support and such financial assistance as may be given by Provincial and Dominion Governments without any restrictions as to policy. Mr. Francis advised that a transcription of the stenographic notes of all papers and discussions at the Conference would be sent to headquarters. Mr. Francis' report was received.

Peterborough Branch: An application for the establishment of a Branch of *The Institute* at Peterborough was presented as follows:—

Peterborough, Ont.

The Council of
The Engineering Institute of Canada.

Gentlemen:—

We, the undersigned, corporate members resident in Peterborough, being desirous of establishing a branch of *The Institute* at Peterborough, to be called the Peterborough Branch, request that you issue the necessary orders for that purpose. The area is to include a radius of twenty-five miles from the Peterborough Post Office.

Thanking you, we are,

R. H. Parsons,	C. H. Rogers,
R. B. Rogers,	J. A. G. Goulet,
R. L. Dobbin,	C. S. Whitney,
G. Reid Munro,	James Mackintosh.
W. G. Montgomery,	H. A. Morrow,
A. L. Killaly,	W. A. Logan.

On motion by R. A. Ross, seconded by Walter J. Francis, it was resolved that permission be granted. It was noted that it was proposed by the members in Peterborough to make the inauguration of the Branch on

November 6th an important engineering event in Peterborough, at which time it is hoped that many members of Council and representatives of the various Branches will be present. A number of Councillors signified their intention of being on hand.

Toronto Branch Salary Schedule: The salary schedule prepared by the Salaries Committee of the Toronto Branch and approved at general meeting of the Branch on October 16th, was presented. In view of the importance of this, it was decided that it receive fuller consideration at an early date.

Technical Education: The Secretary was instructed to write to Mr. Corless for information as to the present situation regarding the proposal to approach the Provincial Governments regarding technical education and to ask his opinion as to his idea of the policy which *The Institute* should adopt. Mr. James White's appointment to the Joint Committee in this matter was confirmed.

Branch By-Laws: The By-Laws of the Winnipeg Branch were presented and approved. A Committee consisting of the Chairman of the By-Laws Committee, Professor Brown, and the Secretary, was appointed to scrutinize all by-laws on hand and to be submitted. It was resolved that these be automatically approved if found by the committee to be not contrary to the regulations of the Institute, thus avoiding the delay in having branch by-laws approved. The Secretary was instructed to write immediately to the different Branches who had submitted by-laws advising that action is being taken.

By-Laws-Amendments: A proposed amendment submitted by a member of *The Institute* and signed in accordance with the By-Laws was received, but inasmuch as the By-Laws require that such proposals should be in the hands of the Secretary by October 1st, it was considered necessary that it be held over.

Western Meeting: A letter from the Calgary Branch suggesting that the Secretary and a delegation from Council go West in November to assist in connection with legislation was considered. It was decided that it is impossible for the Secretary or any of the officers to go West at the present time, and the Secretary was instructed to write advising the Western members to take the initiative in educating other engineers to the viewpoint regarding legislation.

Standardization in Municipal Work: A letter from Captain Durley, suggesting action on the part of Council to appoint a committee to co-operate with the Canadian Engineering Standards Association regarding standardizing the various pipes, fittings and equipments used in municipal works, was referred to R. A. Ross for his advice.

Affiliates of Branches: The suggestion of President Leonard that greater encouragement be given to the question of affiliates joining the branches was approved, the same to be published in *The Journal.*

Society of Chemical Industry: Approval was given to the arrangements made by the Secretary with the Secretary of the Society of Chemical Industry whereby the latter shall hold their meetings on the third Friday of each month at the rooms of *The Institute.*

Plummer Medal: The design submitted for the Plummer Medal was considered and the Secretary was instructed to confer with Dr. Stansfield regarding the design of the Plummer Medal and also to take the matter up with Mr. Sharpe of Caron Frères.

Suggested Reclassification: The suggestion from H. M. Morrow, A.M.E.I.C., regarding reclassification of the membership of *The Institute* was considered and held over for further discussion.

Finances: Approval was given to the arrangements made by the Treasurer and Secretary for transferring the account from the Bank of Montreal to the Canadian Bank of Commerce. The Secretary was instructed also to transfer the Savings Account amounting to $2302.81 and to invest same in Victory Bonds, less $296.00 taken from current account chargeable to this account, the balance owing on the Tobacco Fund to be charged to current account.

Honorary Members Badges: Approval was given to the securing of engraved gold badges for each of the honorary members, and the Secretary was instructed to write a letter, in conference with R. A. Ross, to accompany the badges of the honorary members when sent. The disposal of the badge for The Prince of Wales was left to Mr. Ross, to make arrangements, if possible, for presenting it in person.

Railway Bench Marks: The suggestion of W. C. McLaren, A.M.E.I.C., that railway bench marks be established by legislation, was considered, together with a letter from Mr. Fairbairn, and the Secretary was instructed to send Mr. McLaren a copy of the letter suggesting that he bring the matter to the attention of the railway commission if he considered it advisable.

Ballot: The ballot for the election and transfer of members was canvassed and the following elections and transfers affected:—

Members

Frank Lee Butler, of Winnipeg, Man., general supt., Winnipeg Electric Railway; William Laird Ketchum, of Temiskaming, Que., chief engr. of constr., Kipawa Co., Ltd.; Robert Lee Peek, of St. Catharines, Ont., supt. of constr., Coniagas Reduction Co., smelting and ref'g. work, Thorold, Ont.; Ambrose Harding White, C.E., B.C.E., (Univ. of Maine), of Brooklyn, N.Y., chief engr., International Paper Co., New York, and St. Maurice Lumber Co. of Canada.

Associate Members

Alfred Nepean Ball, B.Sc. (C.E.) (Queen's Univ.), D.L.S., S.L.S., of Regira, Sask., since 1916 with 9th Can. Rly. Troops; Francis Mountfort Barnes, D.L.S., of St. John, N.B., asst. engr., Department of Public Works; Harold Frederick Guild Barnjum, of Prince Rupert, B.C., instrumentman, i/c of res. engr's. office; Edward Herbert Beck, of Toronto, Ont., member of firm Beck & Poole, gen. contracting and engineering; Sydney Bowen, of Morrisburg, Ont., first asst. engr. on St. Lawrence River survey for Hydro-Electric Power Comm.; Loren Lewis Brown, Lieut., B.Sc. (C.E.) (Univ. of Idaho), and of Vancouver, B.C. supt., Forest Products Laboratories of Canada, University of B.C.; Alban W. L. Butler, Major, C.M.G., of St. Catharines, Ont., asst. engr., Welland Ship Canal; Neil Campbell, of Ottawa, Ont., production engr., shipbuilding dept., Imperial Munitions Board; Edmund Dean Wade Courtice, B.A.Sc. (Univ. of Tor.), of Chatham, Ont., engr., Dominion Sugar Co., Chatham, Wallaceburg and Kitchener; Haldane Rodger Cram, B.Sc. (McGill Univ.), of Ottawa, Ont., drainage engr., Reclamation Service, Ottawa; Frank A. Danks, C.E. (Univ. of Tor.), of Toronto, Ont., constr. engr., under F. R. Miller, British Forgings, Asbridges Bay, Toronto; Harvey William Lawrence Doane, B.Sc. (C.E.) (N.S. Tech. Coll), Major, of Halifax, N.S., asst. in city engineer's office; John Granville Dryden, of Halifax, N.S., asst. engr., Halifax Ocean Terminals; Roger Louis Fairbanks, Lieut., of Port Arthur, Ont., since 1918 with 11th Batt., C.R.T., demobilized 1919, at present unemployed; Kenneth Cameron Fellowes, of Niagara Falls, Ont., instrumentman, Hydro-Electric Power Commission; Andrew George Graham, C.E. (Royal Tech. Coll.), of Vancouver, B.C., with Vancouver Harbour Commissioners; Byron Hallock, of Winnipeg, Man., chief field engr., and supt. of constrn., under city engr., of Winnipeg; Secor Winslow Johnston, of Niagara Falls, Ont., ch. of party on surveys, Niagara Development, Hydro-Electric Power Commission; Grover Keith, of St. John, N.B., since 1915 with T. McAvity & Sons; Roderick Francis Macdonald, B.A. (St. Francis Xavier Univ.), of Sault Ste. Marie, Ont., field engr., Spanish River Pulp & Paper Mills; Richard H. Mather, B.Sc. (McGill Univ.), of Montreal, P.Q., 1916-19 with Sir W. G. Armstrong, Withworth & Co., Ltd., England, just returned; Harold Wilson McKiel, B.A., B.Sc. (Queen's Univ.), of Sackville, N.B., secretary and registrar, Faculty of Applied Science, Mount Allison University; John William McLelland, of New Glasgow, N.S., surveyor, Acadia Coal Co., Stellarton, N.S.; Douglas A. S. Mutch, B.A.Sc. (Mining) (Univ. of Tor.), works manager, Coniagas Reduction Co., Thorold, Ont.; Walter Frederick Oldham, B.Sc. (Manchester Univ.), of Winnipeg, Man., 1918, overseas with O.M.F.C., discharged July 1919; Edson Raymond Pease, Major, B.A., B.Sc. (McGill Univ.), of Montreal, P.Q., member of firm, McDougall & Pease, consulting engrs.; William Henry Stuart, of Hanna, Alta., resident engr., C.N.R.; Harry Story Tawse, of Aberdeen, Scotland, head of firm Tawse & Allan, civil engrs. and architects; William Caven Taylor, B.S.E. (Univ. of Man.), M.L.S., of Stonewall, Man., with Winnipeg Electric Rly.; Arthur Rivers Whitelaw, M. & E.E. (Univ. of Tor.), of Campbellford, Ont., plant engr., Northumberland Paper & Elec. Co.; James Robert Wood, A.R.T.C. (Royal Tech. Coll.), of Evesham, Sask., dist. engr., Nelson, B.C.; Earle Murray Wynn, of Niagara Falls, Ont., topographical and designing draftsman, Niagara Power Development; Arthur George Young, B.Sc. (C.E.) (Carnegie Inst. of Tech.), of Toronto, Ont., bridge work with Hydro-Electric Power Commission.

Juniors

Edward Willard Gordon Chapman, B.Sc. (C.E.) (N.S. Tech. Coll.), of Halifax, N.S., industrial surveyor, Dept. of Soldiers' Civil Re-Establishment; Leslie Harding Cookson, of Bathurst, N.B., res. engr., i/c of constrn., Bathurst Pulp & Paper Division; Kenneth Lockhart Dawson, B.Sc. (C.E.) (N.S. Tech. Coll.), of Halifax, N.S., chemical engr., and asst. supt., gas dept., N.S. Tramways & Power Co.; William Sutherland McDonald, B.A.Sc. (Univ. of Alta.), of Calgary, Alta., hydrometric engr., Comm. of Irrigation; John Maurice Poole, of Halifax, N.S., with Pickings & Roland, i/c of surveying party ; Edmund Gentry Timbrell, B.Sc. (London Univ.), of Ottawa, Ont., engr., Reclamation Service, Dept. of Interior.

Transferred from the Class of Associate Member to Member

Charles Brakenridge, of Vancouver, B.C., private practice; Philip Piggott Brown, of Vancouver, B.C., in private practice as conslt. & supervising engr.; John Cormack Craig, Major, D.S.O., of Vancouver, B.C., formerly draftsman, P.C.E.Rly., Vancouver. since 1915, Major, chief engr. and 2nd i/c of Rly. Troops (awarded D.S.O., three times mentioned in dispatches.) Awaiting demobilization; Walter Atkyns Ervine Grim, Captain, of Vancouver, B.C., formerly asst. engr., with Geo. H. Webster, consl. engr. and contractor, since 1914 on active service as Captain, Can. Engrs. Awaiting demobilization; John Chiene Holden, of Winnipeg, Man., Grad., R.M.C., engr., Manitoba district, C.P.R.; William Herbert Magwood, of Cornwall, Ont., member of firm Magwood & Stidwill, also town engr., for Cornwall, Alexandria, Maxville and other rural municipalities; Donald Milner Mathieson, Major, B.Sc. (C.E.) (McGill Univ.), of Toronto, Ont., since 1914 with 2nd Field Co., C.E., England & France, wounded, invalided to Canada. At present, O.C., Spadina Military Hospital, Toronto; Reginald George Saunders, Captain, of Toronto, Ont., member of firm Weddell & Saunders, Trenton and Toronto.

Transferred from the Class of Junior to Associate Member

Robert Scott Clemens Bothwell, B.A.Sc. (Univ. of Tor.), of Toronto, Ont., engr. i/c of dredging at Norfolk, Va., for Jas. Stewart & Co., New York.; Arthur Desrosiers, of Detroit, Mich., B.Sc. (McGill Univ.), in private practice as conslt. engr.; Arthur Douglas Fisken, Major, M.C., Grad., R.M.C., of Kerrisdale, B.C., owner of The Marine Garage & Repair Shop, Marpole, B.C.; James MacKendrick Gordon, of Toronto, Ont., supt., Warren-Bituminous Paving Co.; Clarence Earle Hogarth, B.A.Sc. (Univ. of Tor.), formerly of St. Catharines, Ont., since demobilization with The Austin Co., Berthierville, P.Q.; Frederic Carr Knight, B.E. (Dalhousie Univ.), M.Sc. (McGill Univ.), with G.T.P., valuation dept., in connection with U. S. Federal Valuation of railroads; Lawrence Paschal Macrae, of Victoria, B.C., engr. with the Pacific Construction Co., Port Coquitlam; William Paul Murray, Lieut., M.C., of Lachine, P.Q., B.A.Sc. (Univ. of Tor.), on bridge designing, Dominion Bridge Co.; Jean Baptiste Octave Saint-Laurent, B.A. (Laval Univ.), Grad., R.M.C., of Ottawa, Ont., engr. on constrn., The Foundation Co., Ltd.; Roy Aubrey Spencer, Major, B.Sc. (C.E.), M.Sc. (C.E.) (McGill Univ.), of Montreal, profession of engineering, Dalhousie Univ.; Clifford St. John Wilson, B.Sc. (McGill Univ.), of Halifax, N.S., office engr. Pickings & Roland.

Transferred from the Class of Student to Associate Member

Reginald March Calvin, Major, B.A., B.Sc. (Queen's Univ.), of Ottawa, Ont., in waters powers branch, Department of the Interior; Wilfrid Eben Pinkerton Duncan, Major, B.Sc. (Glasgow Univ.), of Milton, Ont., formerly asst. engr., Lake Erie & Northern Ry.; Robert R. Hepinstall, B.Sc. (Queen's Univ.), of New Orleans, La., emergency engr., Board of Port Commissioners for the Port of New Orleans; Albert Angus Richardson, Captain, B.A.Sc. (C.E.) (Univ. of Tor.), of Peterborough, Ont., previous to enlistment with the Canadian Stewart Co., since Mar. 1916, Lieut., Can. Infantry, promoted to Captain, C.E., received O.B.E., and mentioned in dispatches. Awaiting demobilization.

Transferred from the Class of Student to Junior

George Frederick Alberga, B.Sc. (McGill Univ.), of Montreal, P.Q., formerly ch. inspector, Canada Cement Co., 1916-19, on active service as Sergeant, 2nd Can. Construction Coy. Demobilized, at present unemployed; John Francis B-ett, Lieut., formerly with Glengarry Construction Co., Montreal. 1915-19, overseas with C.O.R.C.C., France, C.R.T., Broad Gauge Ry., i/c mechanical workshop with same unit; William McGregor Gardner, B.Sc. (McGill Univ.), Lieut. (McGill C.O.T.C.), of Montreal, P.Q., with Montreal Tramways Co., as track engr.; Bruce Alexander Johnston, B.C.E. (Man. Univ.), of Winnipeg, Man., formerly engr. on Manitoba highways. Overseas since 1916; George William Frederick Johnston, B.A.Sc. (Univ. of Tor.). of Ottawa, Ont., astronomical computer, Dom. Observatory; Geoffrey Francis Layne, B.Sc. (McGill Univ.), of Cheshire, Eng., Lieut., M.C., formerly with the C.P.R., since 1915, Lieut., Royal Field Artillery, instructional duty, at present unemployed; William George Mawhinney, B.C.E. (Man. Univ.), of Selkirk, Man. municipal engr., rural municipality of St. Clements, Selkirk, Man.; David Ewen McPherson, B.C.E. (Man. Univ.), of Winnipeg, Man., draftsman, C.N.R.

Adjournment: The meeting was then adjourned to the call of the Secretary at the earliest possible date.

* * *

The regular monthly meeting of the Council was held at the rooms of *The Institute*, 176 Mansfield Street, on Tuesday, November 25th, at 8 P.M.

Annual Meeting: It was resolved that the coming Annual Meeting be held in Montreal, January 27th, 28th and 29th. Approval was given to the holding of a professional meeting in conjunction with the Annual Meeting under the auspices of the Montreal Branch.

Ballot: It was decided that in sending out the ballot for the Election of Officers and Members of Council, the ballot should be segregated as to districts and the face of the ballot stamped "Vote here only" opposite President, Vice-President and the Councillors for the district in which the member receiving the ballot lives; the return envelope to be stamped on the outside with the number of the district.

Technical Education: Consideration was given to the endorsation of technical education and it was resolved that a letter be drafted by R. A. Ross and Professor Ernest Brown to the National Council of Education, endorsing technical education along the lines proposed by C. V. Corless.

American Waterworks Convention: The Secretary was instructed to write to the Secretary of the American Waterworks Convention, expressing Council's pleasure that their Convention was to be held in Montreal, and extending the use of our rooms and asking for suggestions where we could be of assistance.

Canadian Mining Institute Meeting: It was resolved that the felicitations of *The Institute* should be sent in a night-letter to the Secretary of the Mining Institute at Vancouver.

Joint Meeting with the American Institute of Chemical Engineers: The proposal that a meeting of *The Institute* be held in conjunction with the visit of the American Institute of Chemical Engineers to Canada, was discussed. The Secretary was instructed to write Mr. DeCew and Mr. Haanel stating that a professional meeting is being contemplated in Ontario and that the Ontario Branches are being asked to consider the proposal to hold the Annual Meeting of the American Institute of Chemical Engineers in conjunction with this meeting. The general proposal meets with the approval of the Council.

Peterborough Branch: The successful gathering at Peterborough for the inauguration of the Peterborough Branch was noted. The Secretary was instructed to send a cheque for $50.00 to the Branch as an advance.

Branch Charters: The suggestion that the Branches be presented with a form containing Council's authorization of their establishment was approved and a committee consisting of Messrs. H. H. Vaughan, Arthur Surveyer, Frederick B. Brown and the Secretary, appointed to draw up a form for this purpose and submit same to Council.

Changes in By-Laws: The suggestion of the Ontario Provincial Division that an additional district be added to Ontario was approved and referred to the By-Laws Committee to draft the By-Laws incorporating the suggested change.

(b) The suggestion that Section 60 of the By-Laws be changed, was discussed. It was resolved that Section 60 be changed by the inclusion of the words "and Vice-Chairman" after the word "Chairman."

(c) It was resolved, upon the suggestion of Mr. Decary, that Section 57 of the By-Laws be amended by the deletion of the words "except the Montreal Branch" after the twelfth word "Branch."

Finances: The Secretary presented a financial statement showing the situation and it was resolved that a meeting of the Finance Committee be called and that they be requested to report at the next meting of Council.

Journal: On motion by Mr. Francis it was resolved that an editing committee of three be appointed, H. H. Vaughan, Chairman, with power to complete his committee, and that the Journal be confined to the publication of papers of *The Institute*, news of *The Institute*, employment bureau and an engineering index.

A suggestion that $5.00 per column be allowed to the Branches for accepted Branch news, personals, etc., was approved.

Captain C. N. Mitchell, V.C.: The proposal of the Winnipeg Branch to have a dinner and presentation for Captain C. N. Mitchell, V.C., A.M.E.I.C., was presented and the Secretary was instructed to send the regrets of Council that none of the officers from the East would be present, and to send greetings to Capt. Mitchell and the Branch. It was resolved to ask J. G. Sullivan, past Vice-President, to represent the Council at this function.

Quebec Provincial Division: The request for the formation of a Quebec Provincial Division was received, and, on motion by A. R. Decary, it was resolved that Council approve of the formation of the Quebec Provincial Division, inasmuch as the By-Laws in that connection had been complied with, and that a committee consisting of A. R. Decary, Arthur Amos, B. Normandin, Walter J. Francis, Arthur Surveyer and Frederick B. Brown, be appointed to complete the formation of the Division.

American Society of Mechanical Engineers: The invitation of the American Society of Mechanical Engineers to attend their Annual Meeting, December 2, 3, 4 was presented, and the Secretary was instructed to send a cordial letter of appreciation of this invitation and to state that he personally would be present.

Kingston Branch: Approval was given for the re-establishment of the Kingston Branch of *The Institute*, The Secretary was instructed to lend every effort to that end.

Visit of Secretary to New York: The invitation of the Secretary of Engineering Council to the Secretary to visit New York next week was considered and the Secretary authorized to accept the invitation if his plans would permit.

Ballot

The following elections and transfers were effected:—

Members

Philip Livingston Allison, M.E. (Stevens Inst. of Tech.), of Peterborough, Ont., industrial control engr., works engr. dept., Canadian General Electric Co.; Charles William Dill (grad., S.P.S.), of Regina, Sask., supt of Highways, Saskatchewan; Gordon Russell Langley, B.E. (E.E.) (Union Univ.), of Peterborough, Ont., engr., i/c switchboard engr. dept., Canadian General Electric Co.; William Brodie Macdonald, of St. Catharines, Ont., designing mech. engr., Welland Ship Canal; William Oscar Marble, of Vancouver, B.C., i/c of construction for Hodgson & King, engrs. and contractors; John William Morrison, B.Sc. (M.E.) (Dalhousie Univ.), of Dane, Ont., manager, Argonaut Gold, Ltd.; Percy Bramble Roberts, of London, Eng., surveyer on staff in Royal Arsenal, Woolwich, Eng.; Ernest Roxford Shirley, B.A. (Univ. of N.B.), of Peterborough, Ont., elec. engr., Canadian General Electric Co.; Charles Everett Sisson, grad., S.P.S., of Peterborough, Ont., i/c of estimates, designing and supervision of constrn., Canadian General Electric Co.; Charles Winthrop Tarr, of Windsor, Ont., vice-president & general manager, Morris Knowles, Limited; Peter Pederson Westbye, M. & E. E. (Mittwida & Dresden, Saxony), M.E. (Porsgrund Tech. Sch.), vice-president & gen. manager, Wm. Hamilton, Co., Ltd.

Associate Members

George Benson Anderson, of Ottawa, Ont., asst. engr., Dept. of Public Works; Bird Lee Barns, Captain, B.Sc. (Univ. of Mich.), designer, alternators and synchronous motors, Canadian General Electric Co.; Charles Benjamin Bate, B.Sc. (Queen's Univ.), of Ottawa, Ont., since 1915, on active service as an engr. officer, recently demobilized; Charles Haliburton Blanchard, of Winnipeg, Man., engr. i/c, District No. 2, Public Works Dept. of Manitoba; George Blanchard, of Port Arthur, Ont., asst. and res. engr., C. D. Howe & Co.; Alden Ferris Bookhout, B.E. (Union Univ.), of Peterborough, Ont., elec. engr., switchboard section, Canadian General Electric Co.; John Sutherland Brisbane, Lieut., B.Sc. (C.E.) (McGill Univ.), of Montreal East, P.Q., with Imperial Oil Ltd.; Charles Foster Corbett, Lieut., of Cardston, Alta., district hydrometric engr., Cardston District, Reclamation Service, Dept. of Interior; William Frederick Coutlee, of Ottawa, Ont., i/c of hydrometric parties, Public Works Dept.; John Craig, B.A.Sc. (Univ. of Tor.), of Nelson, B.C., asst. engr., B.C. hydrometric survey; John Willard Crashley, B.A.Sc. (Univ. of Tor.), of Toronto, Ont., temp. Capt. and Adj., 9th Mississauga Horse and secretary of Mississauga Batt'ns., Home Assoc., France; John Bull Croly, of Vancouver, B.C., inspecting engr., Robert Hunt & Co., consulting engrs.; Samuel Laurence Decarteret, Ph. B. (C.E.), Yale Univ., of LaTuque, P.Q., i/c of constrn. of steel tugs, scows, etc., also operation and maintenance of private ry., etc., for Brown Corpn.; Philip Earnshaw, B.Sc. (Queen's Univ.), Major, D.S.O., M.C., of Toronto, Ont., previous to enlistment, first asst. on hydrographic survey, Upper Ottawa conservation, also resident on repair of Temiskaming dam; William Jessimen Fletcher, B.Sc. (Queen's Univ.), O.L.S., Lieut., of Windsor, Ont., while overseas with C.E., had charge of all engr. work, bridges, etc., at Gonostai Barracks, Siberia, at present engr. and surveying officer, on surveys, sidewalks, etc.; John Hunter Forbes, Major, B.Sc. (McGill Univ.), of Smith's Falls, Ont., div. engr., C.P.R.; Charles Allison DeWitt Fowler, B.Sc. (N.S. Tech. Coll.), P.L.S., of Armdale, N.S., asst. ch. engr., Halifax Shipyards, Ltd., Halifax; Archibald Bland Gates, B.Sc. (Queen's Univ.), of Peterborough, Ont., since 1917, asst. induction motor designer, Canadian General Electric Co.; Thomas Ernest Gilchrist, B.Sc. (E.E.), (McGill Univ.), of Peterborough, Ont., engineer's dept., Canadian General Electric Co.; Andrew Jack Gray, B.A.Sc. (Toronto Univ.), of Toronto, Ont., 1918, mechanical engineer and draftsman, Steel Co. of Canada; Erastus Kells Hall, B.A.Sc. (Toronto Univ.), of Edmonton, Alta., division engineer of construction, C.N.R.; Philip Charles Barnard Hervey, of Edmonton, Alta., chief superintendent, Dominion Parks; Thomas Marsden Jones, of Toronto, Ont., chief engineer and manager, Bawden Pump Co., Toronto; Samuel Sinnott Kennedy, of Winnipeg, Man., consulting heating, ventilating and sanitary engineer, Winnipeg; Silvio A. Lauzon, of Toronto, draftsman, Toronto Harbor Commission; J. Omer Martineau, B.Sc. (C.E.) (Queen's Univ.), of Quebec, P.Q., engineer, Dept. of Roads, Prov'l Govt. of Quebec; Duncan Lennox McLaren, B.A.Sc. (Univ. of Tor.), of Peterborough, Ont., since 1916, asst. engineer, Can. Gen. Electric Coy.; Herbert Tom Melling, of Regina, Sask., manager of Canadian branch of Willars Robinson, Rugby, Eng.; Frederick Herbert Palmer, S.B. (N.S. Tech. Coll.), Lieut., M.C., of Halifax, N.S., with N.S. Highways Commission; William George Perks, Lieut., of Peterborough, Ont., asst. engineer, city of Peterborough; William J. Pickrell, of St. John, N.B., district master mechanic, New Brunswick district, C.P.R.; Stanley Douglas Harold Pope, of Victoria, B.C., asst. engineer, Victoria; George Charles Reid, Lieut.,M.M., of Cobalt, Ont., resident engineer in charge of construction, Lucky Lake branch, C.N.Ry.; Charles Robertson, B.Sc. (McGill Univ.), of Peterborough, Ont., asst. engineer on staff of chief engineer, Dept. of Railways and Canals; Herbert Leslie Roblin, (B.A.Sc., Univ. of Tor.), Capt. M.C., resident engineer, C.N.R., construction dept.; Norman Dundas Seaton, B.A.Sc. (Univ. of Tor.), of Peterborough, Ont., switchboard section of eng. dept., Canadian General Electric Co.; Clifford Vier Stout, B.C.E. (Univ. of Man.), of Winnipeg, Man., since 1917, with C.E.F.; Angus Lynn Sutherland, B.A.Sc. (mech. eng.) (Univ. of Tor.), of Peterborough, Ont., transformer drafting and mechanical design, Canadian General Electric Co.; Harry Hollister Tripp, C.E. (Cornell Univ.), of Edmonton, Alta., division engineer, C.P.R.; James Atkinson Willis Waring, of St. John, N.B., draftsman, resident engineer and asst. engineer, C.P.R.; Abel Seneca Weekes, O.L.S., D.L.S., A.L.S., S.L.S., of Edmonton, Alta., in eng. dept. C.N.R.

Juniors

Maurice Cossette, of Montreal, engineer and supt., J. W. Harris Mfg. Co.; Clarence Thorne Evans, of Windsor; Ont., mechanical draftsman, Canadian Steel Corporation, Ojibway; Robert Edward Hinton, B.Sc. (Queen's Univ.), of Peterborough, Ont., asst. engineer, Canadian General Electric Co.; Eric Laurentius Holmgren, B.E.E. (Univ. of Man.), of Peterborough, Ont., transformer designer, Canadian General Electric Co.; Henry Arthur Lynch, Lieut., of Ottawa, Ont., draftsman, Marine Dept.; John Edward Lyon, Lieut., D.L.S., of Ottawa, Ont., 1917-19; Robert Dawson McKenzie, B.C.E. (Univ. of Man.), of Winnipeg, Man., junior asst. engineer and draftsman, highway commissioners office, Dept. Public Works; James Freebairn Patterson, B.Sc. (E.E.) (McGill Univ.), of Montreal, telephone engineer, Northern Electric Ltd.; John Herbert Reid, B.Sc. (McGill Univ.), of Peterborough, Ont., Canadian General Electric Co.; L. deBoucherville Roy, of Ottawa, Ont., 1918, asst. engineer, Dept. of Public Works; Stewart Schofield, of Winnipeg, Man., valuation engineer, C.N.Ry.; Charlie Berford Shaw, of Hawkesbury, Ont., engineer draftsman, Riordon Pulp & Paper Co.; Reuben Ewart Stavert, B.Sc. (McGill Univ.), of Peterborough, Ont., Canadian General Electric Co.; Robert Donald Texton, Capt., of Ottawa, Ont., engineer, eng. branch, Dept. Militia & Defence; Douglas C. Wills, Lieut., of St. Catharines, Ont., junior engineer, Welland Ship Canal.

Associate

George Clifford McAvity, of St. John, N.B., general manager of all manufacturing, T. McAvity & Sons Ltd.

Transferred from the Class of Associate Member to that of Member

John Norison Finlayson, B.Sc., M.Sc. (McGill Univ.), of Winnipeg, Man., professor of civil engineering, University of Manitoba; Seymour Jost Fisher, B.Sc. (McGill Univ.), of Montreal, P.Q., asst. mech. supt., Caron Bros., pistol plant; Alex. R. Greig, B.A.Sc. (McGill Univ.), of Saskatoon, Sask., professor of agricultural engineering, University of Saskatchewan; George Henry Herriot, B.Sc. (C.E.) (Queen's Univ.), D.L.S., M.L.S., A.L.S., of Winnipeg, Man., 1918-19, assist. professor in civil engineering, University of Manitoba, Garnet Burk Hughes, R.M.C., Major-General, C.B., C.M.G., D.S.O., F.R.G.S., of Derby, England, managing director, British Cellulose & Chemical Mfg. Co., Ltd., Spondon, near Derby; William George Swan, B.A.Sc., C.E. (Univ. of Toronto), Major, of Vernon, B.C., dist. engr., C.N.R., i/c of mainland constrn.; Frederick Byron Tapley, of Moncton, N.B., asst. engr. of maintenance, Can. Govt. Rlys.

Transferred from the Class of Juniors to that of Associate Member

J. N. Aggiman, B.Sc. (McGill Univ.), of Port Alfred, P.Q., ch. engr. and asst. supt., Ha Ha Bay Sulphite Co., Ltd.; Francis X. Amoss, of Corinth, Ont., Captain, track engr., C.G.Ry.; Douglas Stewart Ellis, M.A., B.Sc. (C.E.) (Queen's Univ.), D.L.S., O.L.S., Lieut.-Col., D.S.O., M.C., of Kingston, Ont., assistant professor of civil engineering, Queen's University; John McIntyre Gibson, B.A.Sc. (Univ. of Tor.), of Toronto, Ont., Major and chief engr., 2nd Bn., C.R.T.; Francis Henry Hibbard, of Sherbrooke, P.Q., asst. to ch. engr., Q.C.Ry.; George Matheson Hudson, B.Sc. (McGill Univ.), of Montreal, P.Q., asst. engr., Bell Telephone Co.; Basil Llewelyn

Nares, B.Sc. (C.E.) (McGill Univ.), of Montreal, P.Q., bldg. supt., i/c of constrn. for A. F. Byers & Co., Ltd.; Ernest Peden, B.Sc. (McGill Univ.), of Montreal, P..Q., designer, Purdy & Henderson ; P. Oakley Spicer, of London, Eng., 2nd Lieut., Royal Engrs. (Regulars); Gordon Robertson Taylor, Major, of Grafton, Ont., awaiting demobilization; Eric Edward Wells, of Toronto, Ont., ch. office asst , dept. surveys and location, C.N.R.; Walter Youngman, Capt., M.C.,of Winnipeg, Man., dist. engr., Manitoba Highways Dept.

Transferred from the Class of Student to that of Associate Member

Charles Bruce, of Ottawa, Ont., engr., Fisheries Branch, Dept. of Naval Service; Albert Lee Cavanagh, Capt., B.E.E. (Man. Univ.), of Winnipeg, Man., asst. engr., city engr's. dept., i/c of waterwork constrn; Edward Victor Gage, B.Sc. (C.E.) (McGill Univ.), of Montreal, P.Q., gen. asst., A. F. Byers Co.; Eric Percival Muntz. B.A.Sc. (Univ. of Tor.), of St. Catharines, Ont., asst. engr., No. 2. section, Welland Ship Canal; Edward Stanley Smyth, Lieut., B.Sc. (Queen's Univ.), of Kitchener, Ont., dist. vocational officer, Dept. of Soldiers' Civil Re-Establishment.

Transferred from the Class of Student to that of Juniors

Andrew Percival Black, C.E. (Univ. of Tor.), of Toronto, Ont., R. A. Medical Corps, awaiting demobilization; H. H. Bruno Loignon, B.A.Sc. (L'Ecole Poly, Laval), of Outremont, P.Q., with E. Loignon, civil engineer; James Alfred Vance, of Woodstock, Ont., structural draftsman, Hamilton Bridge Works.

BRANCH NEWS

Halifax Branch

F. R. Faulkner, M.E.I.C., Secretary.

Minutes of General Meeting, Halifax Branch, Engineering Institute of Canada, held at the Green Lantern, at 6.00 p.m., October 22, 1919.

Attendance 31, Chairman presiding.

The Chairman introduced new members recently admitted to *The Institute* and several members who have recently taken up their residence in the city.

The Chairman then gave a brief report of the Professional Meeting in St. John and made certain suggestions with regard to the meeting in Halifax next year:—

(a) To defer the meeting until October in order to enable Engineering students to attend.

(b) In view of an attendance of 100 at the meeting held in Halifax, 1918, and an attendance of over 125 at St. John, the object for the next meeting in Halifax should be an attendance of 200.

The Chariman discussed briefly the question of increase in the fee of Branch affiliates, the question of Branch By-laws and the question of legislature.

A paper was then presented by A. C. Brown, A.M.E.I.C., on the results of experiments of the effects of Ironstone on Cement and Lime Mortars. Following the paper a discussion participated in by Messrs. McKay, Dyer, Smith, Bowman, Morrison, Freeman, H. W. L. Doane.

After the discussion a vote of thanks was tendered to Mr. Brown and the meeting adjourned.

Nova Scotia Power Commission at New Glasgow

At the request of the Pictou County Light and Power Committee, a public meeting of the Nova Scotia Power Commission was held in New Glasgow, November 4th, in order that the citizens of Pictou County might have an opportunity of demonstrating to the Commission the necessity of some immediate action in connection with the power situation in Pictou County. It was shown that Pictou County, already a large and industrial community with great possibilities of expansion, was absolutely handicapped in competition with other parts of the country due to the present high cost of power in that vicinity even though it is a large coal mining district. It was further shown that there is at present available a guaranteed market of at least 10,500 h.p. and that the municipality of Pictou County being as it is, free from any bonded indebtedness whatever, is not only ready and willing, but able to undertake the distribution of any power which might be supplied to it by the Nova Scotia Power Commission in bulk either from hydro-electric or central steam plants.

Honourable Mr. Armstrong, Chairman of the Commission, assured the meeting that steps would be immediately undertaken to deal effectively with the situation as presented and pointed out that although the Commission had been in existence only some six weeks, it was already prepared to make a definite recommendation to the Provincial Government and to take immediate action upon receiving the necessary authority in regard to the power situation in the vicinity of Halifax.

St. John Branch

A. R. Crookshank, M.E.I.C., Secretary

The first meeting of the provincial executive of the New Brunswick Association of Professional Engineers took place on November 13th, when the draft of "Act Respecting Engineers" was discussed and arrangements made for the necessary minor revisions and for legal advice and assistance in preparing the bill for submission to the Provincial Legislature at its next session.

The first meeting of the St. John Branch of *The Engineering Institute of Canada* was held on the same evening with a record attendance. The report of the

Secretary showed that the affairs of the Branch are in a very encouraging condition, the total membership of all grades amounting to 62. Geoffrey Stead, A.M.E.I.C., District Engineer, P.W.C., then read a very interesting paper on: "Cape Bald Breakwater." This breakwater is situated on the south shore of the Northumberland Strait, twenty miles east of Point DuChene and is 624 ft. long with a pier-head 100 feet long extending at right angles to it. It is a round timber cribwork structure with the face timbers encased in concrete, which also extends one foot outside them, presenting a smooth wall surface to the frequent high seas occurring at that place and protecting the woodwork from the ravages of the Teredo. Great difficulty was experienced in keeping the forms for the concrete rigid and tight as the wave action is almost continuous. Depositing concrete in winter time from the ice was tried but the results were not uniformly satisfactory for either method and the concrete became eroded at the most exposed places. Repairs by filling the holes with concrete deposited in water were made but also did not give permanent results.

Concrete caissons of 1-2-4 mis, well-tamped, air seasoned and water-tight were built on shore, launched floated to and sunk in place in front of the damaged portions of the wall. The caissons vary in size up to 20 feet in length and 10 ft. in height, the base up to 8 ft. in width. The 8″ face batters at about 1 in 4; the cells are rectangular with 4″ partitions spaced 4 to 5 feet apart; the back is 4″ and the ends are 6″ thick. A concrete slab is secured to the top of the caissons after they have been filled with stone. This type of protection has proved satisfactory and it is expected that this type of construction will be used extensively for piers and breakwaters in this district in the future as it will be cheaper than creosoted timber. The discussion on the paper brought out much information re erosion of concrete in tidal waters.

B. M. Hill, M.E.I.C., Provincial Road Engineer then gave one of the most interesting addresses the Branch has listened to on, "The Highways of New Brunswick."

Mr. Hill took up the history of the development of road building in this Province in recent years and showed how the automobiles had forced the various governments to treat the matter at last from an engineering standpoint. Mr. Hill explained the system of classification adopted by his department for the system of trunk, secondary and by-way roads throughout the Province and told of the principle by which the department was carrying on the work of improvement. In general the plan is to bring all the roads up to a standard so that the rate of wear, expenditure and amount of traffic would give a rought approximate ratio constant for the three classes of roads. The immediate plans are for the gradual construction of about 1,600 miles of trunk roads at an average cost of $5,000. per mile, about 1,800 miles of secondary roads at an average cost of about $3.000 per mile, besides the repair of the numerous by-roads. An improved road was immediately subjected to an increase in automobile traffic, which Mr. Hill estimated would eventually amount to seven or eight times that of the original amount. The St. John-Rothesay road auto traffic increased from 500 to 2,500 cars per day in two years, while the St. Stephen-St. Andrews road traffic increased from an average of 100 to 700 cars per day, after these roads had been improved to allow of an increase in speed of from 15 miles to 40 miles per hour.

The meeting adjourned after a general discussion.

Montreal Branch

Frederick B. Brown, M.E.I.C., Secretary

The meetings of the Montreal Branch have been held regularly every Thursday evening, following out the programme outlined in last month's number of *The Journal.*

On the evening of October 30th a discussion was held on the paper by Mr. Jamieson on "Grain Dust Explosions" during which W. J. Francis, Chairman of the Branch, presided. John Murphy, of Ottawa, was present and took a prominent part in the discussion, showing a number of lantern slides. Among the Montreal members joining in the discussion were Messrs. Cowie, Holgate, James H. Hunter and Colonel Monsarrat. A full account of this discussion will be published in the next number of *The Journal.*

On November 6th, J. J. York, General Works Manager of the St. Lawrence Sugar Refinery, gave a very interesting illustrated talk on the mechanical processes and plant of his refinery, and was followed by Mr. Bardorf who dealt with the chemical processes of sugar refining. Samples of refined sugar and booklets on "The Story of Sugar" were distributed to the members. Mr. Busfield, Chairman of the Reception Committee, presided.

On November 13th, J. O. G. Cann, Chief Engineer of the Marconi Company, gave a very instructive and interesting address on recent progress in wireless telegraphy, which was illustrated with a number of lantern slides and also with various pieces of apparatus and dictaphone records by means of which the author demonstrated the reduction of speed of reception of wireless telegraph messages from seventy or more words per minute to a speed of twenty or twenty-five words per minute, at which rate the dots and dashes were distinctly audible. Mr. Cann dealt with the historical side of the question and then explained the different systems in use to-day, such as the Spark, the Poulsen Arc, the Dynamic, and the Valve. He also dealt with the subjects of direction finding, static elimination and high speed transmission. After his lecture a number of questions were asked by members and guests. Mr. Burnett, of the Papers and Meetings Committee, occupied the Chair. At this meeting also, R. L. Dobbin, Secretary of the newly formed Peterborough Branch, was present and told of the recent formation of this Branch.

On November 20th a paper was read by Major Percy Sims on "Automatic Fire Sprinkler Systems for Low Temperature Buildings," during which the author laid great stress on the very unsatisfactory conditions of fire risks in this country.

A noteworthy feature of the meetings of the Montreal Branch this season has been the very large attendance, in fact, the seating capacity of the hall has been frequently taxed to its limit. It has become a general rule to provide a short interval between a paper and the subsequent discussion in order to enable members to meet and chat with their friends, and occasionally coffee and sandwiches have been served during the intermission.

A special committee formed of members of the Executive Committees of the Montreal and Quebec Branches has been studying the question of the formation of a Quebec Provincial Division, and a ballot of the members resident in Quebec has been held, the result of which will shortly be announced.

Quebec Provincial Division

Some time ago a number of members of the Montreal Branch and the Quebec Branch of *The Institute* suggested the formation of a Province of Quebec Division of *The Engineering Institute of Canada.* Joint, as well as separate, meetings of the Executive Committees of the two Branches were held and a special Committee consisting of A. R. Decary, Arthur Amos and B. Normandin from Quebec, and Walter J. Francis, Arthur Surveyer and Frederick B. Brown from Montreal was appointed to take the necessary preliminary steps leading up to the formation of the Division. To this end a letter ballot was sent out to the 483 Corporate Members recorded at Headquarters as being resident in the Province of Quebec. 298 replies have been received, 278 of which requested the formation of a Quebec Provincial Division, 14 expressed themselves as not in favour of this Division, 6 declined to vote for one reason or another.

Under the by-laws of *The Institute* a majority of the corporate members resident in the Province must be in favour of a Provincial Division before it can be formed. A considerable majority having so expressed themselves, the Special Committee formally requested Council to authorize the formation of a Quebec Provincial Division, suggesting that the above six members forming the Special Committee be appointed by Council to carry out the formation of the proposed Division.

At a meeting of Council held on November 25th, authorization was given for the formation of a Quebec Provincial Division in the manner suggested by the special committee.

Ottawa Branch

M. F. Cochrane, A.M.E.I.C., Sec'y.-Treas.

The success of any Branch of *The Institute* is a function of the activity of its Executive. For all the Executive officers' success means untiring zeal on their part, but in particular the position of Honorary-Secretary must be one of real service.

During the years of 1915 to 1919, J. B. Challies, M.E.I.C., Director of Water Power, Department of the Interior, has held the position of Honorary Secretary-Treasurer. He has been the right man in the right place, bringing to the position his well-recognized ability for co-ordination and management, and much enthusiasm Mr. Challies resigned this year on his election to higher honors in *The Institute*, now being Chairman of the Ontario Provincial Division.

At the first luncheon of the fall session, held at the Chateau Laurier on November 4th his services as Honorary Secretary-Treasurer were recognized by an eulogy from the Chairman, the singing of "For He's a Jolly Good Fellow," and the presentation of a piece of silver plate. His real reward, as Mr. Challies himself expressed it in a brief but feeling reply has been the opportunity for closer association with his brother engineers.

After the presentation had been made J. Grove Smith of the Department of Insurance addressed the members on "Fire Prevention."

The programme for the rest of the year is now complete and will consist of one luncheon and one evening meeting each month.

Ontario Provincial Division

Geo. Hogarth, M.E.I.C., Secretary.

At a meeting of the officers of the Executive Committee of the Ontario Provincial Division in Toronto on the 24th of October, it was decided to call a special meeting of the members of the Provincial Executive in Toronto on November 22nd to consider among other questions the very important matter of the advisability of endeavouring to secure legislation to define the status of the engineers in the Province of Ontario. As the membership of *The Engineering Institute* does not for the moment comprise all the practicing professional engineers in the Province, it was considered essential that any action which *The Institute* may ultimately take should be freely communicated to representatives of other organized engineering bodies having members in the Province and it was also important that members of other engineering organizations be assured that no definite action to obtain appropriate legislation had been taken by *The Institute* or is contemplated to be taken by *The Institute* without consultation and it is hoped co-operation of members of other organized professional engineering bodies.

Letter to Executive, Ontario Provincial Division.

November 12th, 1919

Dear Sir,

In further reference to the letter of the Chairman of October 17th, and to my letter of October 27th, regarding a general meeting of the Provincial Division Executive of the Province of Ontario, I beg to report that the majority of the members of the Executive have signified their hearty support of the proposal to hold a meeting to consider the questions already called to your attention. I am, therefore, to inform you that a meeting will be held in the Engineers' Club, 96 King Street, East, Toronto, on Saturday afternoon, November 22nd, at 3 p.m., to which meeting your presence is particularly desired. The following questions will be considered:—

(a) Adoption of By-laws for the Division.

(b) The question of legislation and the initiation of appropriate action to secure the co-operation in this matter of professional engineers not members of *The Institute.*

(c) Classification and remuneration of engineers.

(d) Suitable action to bring before the undergraduates of the technical and engineering institutions in the Province, the aims and advantages of *The Institute.*

Other matters that may be brought forward by individual members.

Legislation is the most important question to be taken up at the meeting, but, unfortunately, it has not been possible in the brief time available to prepare such a digest, and in lieu thereof, it has been considered advisable to have prepared and sent forward to you, photostat copies of all the references to the question that have appeared in recent issues of *The Journal.*

Your particular attention is called to the resolution of Council passed on September 23rd, which reads as follows:—

> That the Council would further in every way the desire of the members regarding legislation, and, inasmuch as the actual application of such legislation is in the hands of the engineers of each province, it is desirable that the Branches and Provincial Divisions *in co-operation with other engineering organizations in each province,* take the initiative, and in which they are assured of the moral support of *The Institute.*

There are three outstanding phases of this Resolution,—First, the support of the Council of *The Institute* can be relied upon in any appropriate action that may be considered by the Branches and Provincial Divisions to be desirable in the interest of the engineering profession; Second, further action in respect of legislation is up to the Branches and the Provincial Divisions; Third, *co-operation with other engineering organizations* is suggested.

It will, therefore, be realized that further action in connection with legislation in the Province of Ontario, lies with the Provincial Division and the Branches, and so far as Provincial-wide action is concerned, the initiative in the last analysis rests with the Provincial Division. It must further be realized that a necessary preliminary to any action by the Provincial Division is the securing by and with the advice of the Branches, the co-operation of other engineering organizations within the Province.

Such co-operation should be sought in every possible way, and your officers feel that there are two principal methods of securing the advice and assistance of all engineers on the question of legislation,—Firstly, through the Branches, and, Secondly, through the individual members of the Provincial Division.

If at all possible in the limited time available between the receipt of this communication and the meeting of the Provincial Executive at Toronto on November 22nd, it is suggested that either a special meeting of the Managing Committee of each Ontario Branch, or a general meeting of the Branches, be called, to consider the question of legislation, with a view to having definite suggestions made for further consideration at the Provincial Division meeting, respecting the advisability or otherwise of an attempt to secure legislation, and also regarding the methods of securing co-operation of members of the engineering profession who are not now connected with *The Engineering Institute of Canada.*

It is hoped that the members of the Provincial Division will be in a position at the meeting on the 22nd, not only to gauge fairly well the opinion of the engineering profession at large, as to the general question of legislation in the Province of Ontario, but that they will be in a position to take appropriate action to provide suitable means of having the question considered by a General Committee properly representative of *The Institute* and of other engineering organizations in the Province, including, the Canadian Mining Institute, The Institution of Civil Engineers of Great Britain, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, etc.

It is essential that the question of legislation be considered in a constructive manner, and with a view of securing not only the friendly consultation but the active co-operation of other engineering organizations in the Province.

Yours very truly,

(Sgd.) Geo. Hogarth,

Secretary.

Meeting of Executive

On Saturday, November 22nd, a meeting of the Executive of the Ontario Provincial Division was held at the Engineers' Club at Toronto, J. M. Challies, M.E.I.C., Chairman of the Division in the chair. There were present:—Councillors, G. A. McCarthy, M.E.I.C., Bridge Engineer, Toronto; Peter Gillespie, M.E.I.C., Professor, Dept. of Applied Mechanics, Univ. of Toronto, Toronto; W. A. McLean, M.E.I.C., Deputy Minister of Highways, Toronto; Vice-President H. E. T. Haultain, M.E.I.C., Professor of Mining, Univ. of Toronto, Toronto; Representing the Branches:—J. B. Challies, M.E.I.C., Supt., Dominion Water Power Branch, Ottawa; Geo. Hogarth, M.E.I.C., Chief Engr., Dept. of Highways, Toronto; E. R. Gray, A.M.E.I.C., City Engineer, Hamilton; Frank Perry, A.M.E.I.C., Engr. Staff, Algoma Steel Corpn., Sault Ste. Marie; A. C. D. Blanchard, M.E.I.C., Hydro-Elec. Comm., Niagara Falls, Ont.; M. E. Brian, M.E.I.C., City Engineer, Windsor; G. Reid Munro, A.M.E.I.C., The Wm. Hamilton Co. Non-Resident Members:—

Major W. H. Magwood, M.E.I.C., Town Engineer, Cornwall; R. J. McClelland, A.M.E.I.C., City Engineer, Kingston; G. H. Bryson, A.M.E.I.C., Brockville; T. H. Jones, M.E.I.C., City Engineer, Brantford; J. L. Weller, M.E.I.C., Consulting Engineer, Welland Canal; James A. Bell, M.E.I.C., City Engineer, St. Thomas; R. L. Dobbin, M.E.I.C., Supt. of Waterworks, Utilities Comm., Peterborough. By invitation of officers, J. R. W. Ambrose, M.E.I.C., Toronto. A. H. Harkness, M.E.I.C., Toronto; Willis Chipman, M.E.I.C., Toronto; and Fraser S. Keith, A.M.E.I.C.

An agenda was presented dealing with various important matters to engineers of the Province of Ontario. It was moved by Mr. McCarthy, seconded by Mr. Lambe, and resolved:—"That this meeting of the Provincial Division Executive Committee should suggest to Council that steps be taken at once to form another District in Ontario, the dividing line being suggested as running approximately from Oakville to Owen Sound, the present line between Districts Nos. 4 and 5 being moved so as to put Peterborough in the same District as Toronto, leaving Kingston in District No. 4."

It was agreed that a Professional Meeting be held in Ontario during 1920, the representatives of the Hamilton, Border Cities, Peterborough, Toronto, Ottawa and Sault Ste. Marie Branches all agreeing, and providing the Branch at which the meeting was held was agreeable it should be combined with the proposed Annual Meeting of the Institute of Chemical Engineers.

The relation of *The Institute* to the various Universities was discussed and plans proposed for a closer contact. It was left to the officers to work out a programme of co-operation including drawing out of a plan to carry out affiliation of Student societies.

It was decided to ask the various Branches to exchange notices of meetings and confer regarding their programmes with a view to helping the newer Branches.

The meeting voiced its hearty approval of the constructive action of Toronto Branch in considering Legislation and in convening an informal meeting of representatives of the Toronto organizations of the American Society of Mechanical Engineers, Society of Chemical Industries, Canadian Mining Institute, and the Ontario Association of Architects.

By-laws were left to the officers of the Division to complete and ratify.

The meeting adjourned at 10.30, having discussed many important matters, it being the first time engineers from every part of the province had met to discuss matters of common interest.

Toronto Branch

W. S. Harvey, A.M.E.I.C., Secretary.

An open meeting of the Branch was held in the Lecture Room at the Engineers' Club, 96 King Street West, at 8 p.m., on October 30th, 1919.

The Chairman, A. H. Harkness, presided.

The minutes of the previous meeting were read and adopted.

The Chairman called upon Mr. Wynne-Roberts to read the Standard Branch By-laws as approved by the Council at Montreal together with the amendments as suggested by the By-laws Committee of the Toronto Branch.

Moved by Geo. T. Clark, seconded by Geo. A. McCarthy "that the fee for Branch Affiliates be increased to $10.00 " per annum." *Carried*

After the By-laws and the suggested amendments were read clause by clause it was moved by Mr. Wynne-Roberts, seconded by Geo. Hogarth "that the By-laws as amended by adopted by this Branch."

Carried

The remainder of the evening was given up to a Smoking Concert for which an excellent musical programme had been arranged by Mr. Wynne-Roberts. The evening was enjoyed by the fifty members who were present.

The items of the Smoking Concert were as follows:—

Piano and Violin Duets by Messrs. O'Brien Brothers, University of Toronto; Xylophone Solos by James Milne; Recitations by Linsey Crossley; Pianoforte Solo by Mr. Weicher, University of Toronto; Violin Solo by Mr. Burton from the Hambourg Conservatory of Music; Sleight of Hand Tricks by W. J. Blackburn.

A hearty vote of tanks was tendered by the Chairman to all those who took part and to Mr. Wynne-Roberts for his kindness in undertaking the work of arranging the programme.

Mr. Wynne-Roberts appealed to the younger members of *The Institute* to take an interest in the welfare of the Branch by giving their assistance in every possible way. He would like to see the younger members organizing one meeting every month.

The meeting adjourned at 11 p.m.

Niagara Peninsula Branch

R. P. Johnson, A.M.E.I.C., Secretary

Thirty members of the Branch enjoyed a trip over the Niagara Power Development works of the Hydro-Electric Power Commission of Ontario on Saturday afternoon, November 1st.

Members gathered early in the afternoon at the main construction office near Niagara Falls and listened to a short talk about the work by A. C. D. Blanchard, M.E.I.C., Chief Field Engineer.

After viewing a large general plan and profile of the work the party started out in motor buses furnished by the Commission and were conducted over the main part of the job now under construction. The first stop was made at one of the large electric shovels working in earth and equipped with an eight yard dipper and eighty foot boom. This shovel was loading cars standing on a track sixty feet above the rock surface on which the shovel was working. The next stop was made at a temporary bridge over the canal cut. From this bridge an excellent view of a long stretch of work was obtained. Another of the large type elec ric shovels was here seen working in the rock cut at canal grade and from this point the spectators were able to get a grasp of the dimensions of the finished canal. Batteries of channelers, tripod drills and submarine drills at this point gave the impression of big work.

The party then visited the machine shop, carpenter shop, blacksmith shop, storage yards, train yards, compressor plant, disposal railway junction and a newly completed concrete arch bridge, all of which are located near the Niagara River Whirlpool.

From this point the party proceeded to the forebay and power-house site near Queenston. Here was to be seen the large rock-crushing, conveying and stone storage plant as well as the canal rock cut which widens out to form the forebay. The excavation at this point is practically complete. The members got a good impression of the three hundred foot drop from the forebay to the power house by viewing the site of the latter from the top of the Niagara Gorge.

The gratitude of the members was freely expressed towards the Hydro and to J. B. Goodwin, M.E.I.C., Works Engineer, for providing motor bus transportation and every facility for inspecting the work.

New Minister of Public Works for Ontario

On the suggestion of one of the members that *The Institute* might take up with Premier-elect Drury the appointment of an engineer as Minister of Public Works in his new cabinet, the following wire was sent to the chairman of the Ontario Provincial Division:—

Nov. 8th, 1919

J. B. Challies,
52 McLaren Street,
Ottawa, Ontario.

Niagara Peninsula Branch suggest Ontario Provincial Division take up with E. C. Drury appointment of Engineer Minister of Public Works.

(Sgd.) R. P. Johnson.

Mr. Challies replied as follows:—

Nov. 15th, 1919.

R. P. Johnson,
Sec'y., Niagara Peninsula Branch,
Engr. Institute of Can.,
Niagara Falls, Ontario.

Your telegram Saturday, have conferred with Resident Members Provincial Division, and forwarded following message to Premier elect Drury. As the leader of the farmers interests have always rightly contended that the minister of agriculture should be a successful farmer so we the Ontario Provincial Division of *The Engineering Institute of Canada* point out the advisability of selecting a successful engineer for the portfolio of minister of public works and respectfully submit that such an appointment would not only greatly strengthen your cabinet but that no other should be considered.

(Sgd.) J. B. Challies.

*

A general meeting was held at the Engineers' Club in Thorold on Tuesday evening, November 25th. The meeting was called to discuss three questions of importance: to receive the report of the Salary Committee of the Branch, to receive the report of the Branch Representative of the Meeting of the Ontario Provincial Division held in Toronto on November 22nd, and to receive the report of the Committee on Branch By-laws.

Edmonton Branch

R. P. Graves, A.M.E.I.C., Sec'y.-Treas.

The following gentlemen were duly elected to office in the local Executive for the ensuing year:—

Chairman........R. J. Gibb, M.E.I.C.
Sec'y.-Treas......R. P. Graves, A.M.E.I.C.
D. J. Carter, A.M.E.I.C.
Hon. J. L. Cote, A.M.E.I.C.
L. B. Elliott, M.E.I.C.
A. W. Haddow, A.M.E.I.C.
R. Jones, M.E.I.C.
G. W. MacLeod, A.M.E.I.C.

*

It is proposed to hold a Provincial Conference of engineers on a date to be arranged with other organizations, engineers from other Western Provinces are to be invited. It is the present intention to hold this meeting in Edmonton, and it will be substituted for the proposed Western Professional Meeting ; in view of this proposal the secretary of the Edmonton Branch of the *E.I.C.* has written to the Calgary Branch suggesting co-operation in putting the project into force.

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Sec'y.-Treas.

J. N. Anderson, A.M.E.I.C., has been appointed Secretary of the Vancouver Branch. Mr. Anderson has been assistant engineer of the city, and has had considerable secretarial experience; Vancouver Branch is looking forward to having another successful year.

Vancouver Branch has arranged for a series of papers and lectures during the coming winter session. In order to secure funds to carry on the Branch affairs, it was decided to levy local dues of $3.00 for Members, and $2.00

for Associate Members; Juniors and Students to be exempt. No dues had been levied since 1915 and this step was necessary in view of the depleted condition of local funds. At the last meeting of the Branch Executive it was decided to appoint a committee of four members to meet a similar committee from the British Columbia Technical Association to discuss the question of Legislation.

A. E. Foreman, M.E.I.C., of the Victoria Branch was present and advised the members of the progress made by the special committee on Legislation of the Victoria Branch and asked for the co-operation of the Vancouver Branch in bringing together the engineers of the Province to discuss the Legislation issue. Another special committee was appointed to draft a letter replying to the Hon. W. J. Bowser's letter regarding his attitude towards the employment of technical engineers as against the "good old practical road superintendents."

A hearty vote of thanks was accorded to Mr. Brakenridge and Mr. Dalzell for their splendid work as Chairman and Secretary-Treasurer of the Branch, the members present speaking in the highest terms of praise of the splendid work which these gentlemen had accomplished in keeping the affairs of the Branch going during the trying period of the war.

In response to the vote of thanks to himself for coming over to address the meeting, Mr. Foreman struck a happy note in advocating close co-operation between the Victoria and Vancouver Branches. He promised to attend as many meetings of the Vancouver Branch as possible, and extended a hearty invitation from the Victoria Branch to all members from Vancouver, and the hope was expressed that Mr. Dalzell would soon be among them again to give the Branch the benefit of his advice and activity in directing the affairs of *The Institute.*

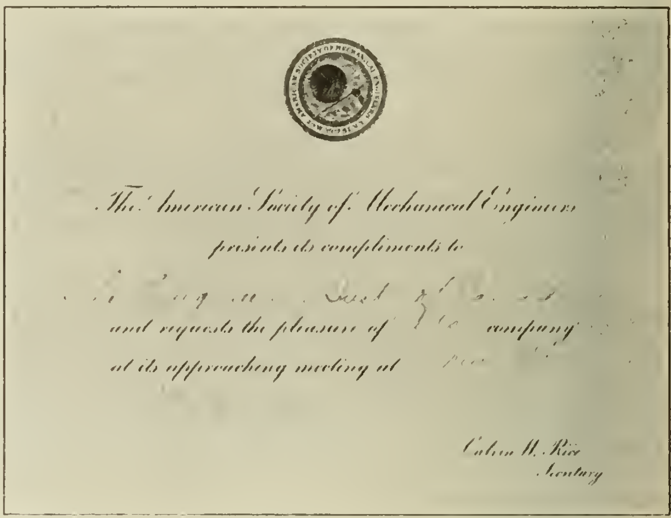
Victoria Branch

Horace M. Bigwood, A.M.E.I.C., Secretary

A. E. Foreman, M.E.I.C., has been travelling on the mainland, and visited the Vancouver Branch of the *E.I.C.* as reported in the Vancouver Branch section. While in Nelson, B.C., Mr. Foreman spoke to the Rotary Club on municipal work,—it is gradually becoming to be better realized that engineers should be more prominent in public affairs. A committee consisting of two members of each of the engineering societies which have members in Victoria met with Mr. Foreman in August and again early in October to discuss the proposed Bill in the British Columbia Legislature, and appointed a sub-committee consisting of D. O. Lewis, M.E.I.C., E. N. Horsey, and A. E. Foreman, M.E.I.C., to redraft the Bill and submit it to the committee of the whole. The intention is that this committee in Victoria will act in conjunction with a similar committee in Vancouver.

Mr. Foreman has recently been re-elected a member of the Executive of Convocation of B.C. University for a further period of three years.

The Victoria Branch had inaugurated steps to secure within its membership all eligible engineers coming within the jurisdiction of the Branch. Recently the Executive of the Branch had adopted the monthly meeting in the form of an informal reception to all engineers and their families. This reception is held on the fourth Monday of each month at the K. of C. Hall on Fort Street, the programme of which includes, dancing, music and refreshments.



A.S.M.E. Invitation to The E.I.C.

OBITUARIES

D. McD. Campbell, M.E.I.C.

The Institute has learned with deep regret of the death of D. McD. Campbell, M.E.I.C., of Halifax, N.S. Mr. Campbell was born near Truro in 1878 and received his early education in the public schools of that town. He then attended Dalhousie University graduating with the degree of B.A. in 1898, he took a Science course, graduating in that with the degree of B.Sc., in 1900, and also took a M.A. degree from the same University in 1904. After leaving Dalhousie he went to Sydney, N.S. and was Assistant City Engineer there for six years, and City Engineer for seven years. In 1913 he removed to Halifax and was in private practice for two years. When Major F. W. W. Doane, M.E.I.C., went overseas he entered the office of the City Engineer as Chief Assistant and was there for about two years. He then went with the Nova Scotia Highway Board and was with them up to the time of his death. He was Secretary-Treasurer of the N.S. Society of Civil Engineers from 1913 until that organization was disbandoned in 1918.

OUR ROLL OF HONOUR

The following members of our Roll of Honour have not reported to headquarters and there is no record on hand either of their definite return or of their present position. Any information that any member can supply regarding any of the names given herewith, will be much appreciated. There is no doubt that many of the men whose names are mentioned are now in Canada, and it is hoped that the members will co-operate most heartily in locating the addresses of all whose names appear on the following list:—

Adams, F. P.
Adams, W. D.
Adamson, E. K.
Adlard, L. S.
Allan, H. D.
Allen, L. E.
Alport, F.
Anderson, A. C.
Annereau, L.

Ball, J. C.
Ball, S.
Barclay, N. M.
Barms, L. P.
Barnes, H. F.
Bayne, C. MacV.
Beale, A. M.
Bennett, C. S.
Bennett, H. F.
Barry, B. C.
Bidwell, L. M.
Birchard, E. R.
Bishop, R. W.
Bishop, T. A.
Booth, C. D. G.
Bowie, Jas.
Bowman, E. P.
Bremner, F. E. A.
Brouse, E. D.
Brown, D. D.
Brown, Jas. C.
Brown, C. K.
Brown, L. B.
Browne, E. F.
Brunless, H.
Brunner, G. H.
Burnett, G. K.
Butler, G. A.
Byrne, T. H.

Caddell, J. P.
Cahan, J. F.
Cameron, J. A.
Cameron, O. L.
Cameron, J. R.
Campbell, W. I. H.
Canniff, C. M.
Carnsew, C. N. T.
Chadwick, F. G.
Chambers, H. D.
Chappell, F.
Charles, H. H.
Charton, P.
Child, C. G.
Chivers, C. W. U.
Clark, C. R.
Clarke, F.
Clendinning, J.
Collier, E. V.
Collingwood, C.
Collins, W. S.
Cooper, H.
Cosgrove, J. R.
Cressman, H. B.
Culshaw, J. G.

D'Abbadie, C. A.
Dawson, J. K.
de Cardaillac G.
de Lestang, Paul L. G.
de Paul, M. J.
Derrer, L. H.
Deverall, E. V.
Dimsdale, H. G.
Dixon, G. B.
Dobbin, W. L.
Doherty, C. A.
Donaldson, J. M.
Doncaster, P. E.
Donnelly, C. O'C.
Dorsey, J. W.
Down, E. E.
Draper, W. H.
DuCane, C. G.
Duff, P. B.
Duncan, E.
Dunlop, H. J.
Dupre, H. A.
Dyke, H. F.
Dynes, W. W.

Eaton, H. T.
Edgar, J. H.
Edward, A. J.
Ellis, J.
Ells, S. C.
Ewart, D. M.

Fairn, A. S.
Farrow, J.
Ferrier, T.
Ferris, C. B.
Fessenden, C. V.
Fife, W. M.
Fleming, G. O.
Forbes-Mitchell, W. J.
Fowlds, E. S.
Fowler, F. S.
Fraser, C. E.
French, W. G.
Fuller, C. H. R.

Gage, C. E.
Gagnier, O. J.
Geale, C. N.
Gear, G.
Gervan, C. F.
Gilley, J. R.
Gillies, A.
Glanville, J. C.
Glover, F. W.
Godwin, B.
Gooderham, G. A.
Graham, D. A.
Graham, D. S.
Grant, LeR. F.
Greenlees, A. H.
Greening, E. C.
Grieve, John
Guy, R. W.

Hall, T. E. A.
Hall, J. S.
Hamilton, Geo. M.
Hammersley-Heenan, J.
Hancock, H. S.
Handley, J.
Harris, A. Dale
Harrison, E. H.
Hawkins, E. V.
Hawkins, S. H.
Hayman, L. T.
Hayward, J. G.
Hewson, J. H.
Hodgins, F. O.
Hodgins, H. M. T.
Holloway, E. S.
Hoshal, G. C.
Houliston, J.
Hughes, C. A.
Hughes, B. H.
Hughes, J. T.
Hunt, W. H.
Hunter, W. H., Jr.

Irving, J. C.

Johnson, G. Allan
Jones, J. H.
Junkin, R. L.

Kennedy, H. C.
King, W. W.
Kingston, L. B.
Klingner, L. W.
Knight, A. G.
Kortright, F. H.

Lamb, S. R.
Lamontagne, Y.
Laurence, W. S.
Lawledge, F. M.
Lawson, W. S.
Leach, F. E.
Lindsay, G. A.
Lindsay, R. E.
Livingston, D. A.

Lockhart, M. D.
Lowden, N.
Lyell, D.

MacArthur, F.
Macaulay, C. A.
MacDonald, A. C.
Macdonald, John
Macdougall, Alex.
MacGregor, J. G.
Macheras, J. P.
MacKenzie, J. A.
MacKinnon, M. A.
Macklem, O. T.
MacLachlan, J. S.
MacLachlan, J. B.
MacLean, T. A.
MacLennan, A. L.
Macpherson, O. C.
Macreath, C. M.
Mansity, H. S.
Marchbank, O. J.
Mason, John
Mathewson, C. H.
McCaghey, N. F.
McClintock, G. A.
McDiarmid, S. S.
McDonald, H. F.
McDonald, J. N.
McDougall, A. L.
McFarlane, M. L. D.
McInnes, W. A.
McIntosh, W. L.
McKillop, R.
McKnight, R.
McLenna, R. A.
McMordie, H. C.
McNeil, O. M.
McNiven, Jas.
McPhee, M. N.
McPherson, A. J.
McRae, J. P.
Meikle, A. U.
Merston, W. C.
Mignault, L.
Miller, A. P.
Miller, W. M.
Mills, L. G.
Milne, J. E.
Mitchell, J. C.
Mitchell, R. W.
Mitchell, G.
Monds, Wm.
Money, K. E.
Monkman, G. H. N.
Montgomery, C. S.
Moody, F. H.
Moorhouse, W. N.
Moran, P. J.
Morrisey, H. F.
Morrison, J. R.
Morrison, H. K.
Morton, K. W.
Morton, H. A.
Moxon, G. B.
Muirhead, T.
Mulock, R. H.
Muntz, E. P.
Murray, Jas.
Mutton, J. C.

Naish, T. E.

Oborn, S. M.
Otty, C. D.
Oxley, A. C.

Paris, John
Parker, S. D.
Parks, J. H.
Parsons, C. S.
Patterson, A. L.
Patterson, R. G.
Pearse, W. G.
Pelletier, H. B.
Pense, E. H.
Perkins, H. W.
Perley, G. W. H.
Perry, C. V.
Peterkin, S. MacC.
Peters, H.
Pickering, F. A.
Pike, E. R. B.
Pitts, C. M.
Plant, W. A.
Pook, R. O.
Porte, W. B.
Powell, A. T.
Powell, R. W.
Probst, E.
Pullen, E. F.
Pym, J. S.

Rankin G.
Reid A. C.
Reid J. G.
Reid, R. H.
Reynolds, G.
Richards, C. C.
Richardson, W. H.
Riddell, A. G.
Ritchie, A. B.
Ritchie, W. W.
Robertson, A. K.
Robinson, T. E.
Rogers, C. S. G.
Rose, J. T.
Rosenorn, P. E. M.
Rounthwaite, F. G.
Rowan, J. E.
Rowley, H. G.
Ruggles, T. D.
Rust, F. C.
Ryan, C. C.

Saunders, B. J.
Scammell, J. K.
Scott, A. N.
Scott, G. D.
Scott, M. A.
Scott, N. M.
Scott, W. D.
Searancke, F. K.
Seymour, E. R. W.
Shannon, R. E.
Shearer, G. W.
Shepherd, H. W. R.
Sherwood, H. L.
Sill, A. J.
Sime, A. W.
Sims, H. B.
Simpson, R.
Smith, A. P.
Smith, R. S.
Sneath, R. G.
Sneath, T. D.
Sothier, R.
Spears, D. C.
Stalker, D. A.
Staples, G. J.
Starr, H. G.
Stavert, W. D.
Stevenson, W. J.
Stewart, A. G.
Stewart, A. M.
Stewart, A.
Stewart, H. W.
Stewart, A. E.
Stirling, J. B.
St. Laurent, A. A.
Stirrett, G. P.
Storms, D. H.
Sutherland, J. R. S.
Sutherland, Dan. M.
Symes, J. A.

Theriault, A.
Tillson, L. B.
Tilston, J. A.
Timbrell, A.
Tooker, Guy
Tremblay, T. L.
Tweedie, A. G.
Tyrrell, W. J.

Urie, Roy H.

Van Norman, C. P.
Van Wart, F. W.

Walker, T. M.
Walker, W. J.
Wallace, Hugh
Walley, C. S.
Wallis, N. J.
Warren, P. R.
Watts, A. D.
Welby, A. E.
West, C. W.
Wetmore, F. W. C.
White, J. A. G.
Wickham, J. T.
Wilkin, F. A.
Williscroft, G. M.
Willrich, E. G.
Wilson, W. T.
Wilson, A. L.
Wood, H. A.
Woodlatt, D. H.
Worthington, A. N.
Young, A. A.

PERSONALS

Lieut. J. A. G. Wilson, R.E., A.M.E.I.C., is returning to Vancouver from service in Egypt.

*

F. G. Aldous, S.E.I.C., Lieut. R. E. is returning to British Columbia, and sailed from Liverpool on the "Baltic" on October 31st.

*

Lieut. H. E. Bates, B.Sc., A.M.E.I.C., who returned recently from service overseas, has accepted a position with the Laurentide Company, Limited, Grand Mere, P.Q.

*

Lieut. Thomas Mortimer Montague, A.M.E.I.C., McGill Sc., 1909, who served overseas with the Third Tunnelling Company, Canadian Engineers, has been awarded the Belgian Croix de Guerre.

*

J. A. Duchastel, M.E.I.C., City engineer of Outremont, Que., and past pres. of the Canadian Good Roads Assoc., has been nominated as one of the Vice-Pres. of the American Road Builders' Assoc.

*

Major P. J. Jennings, A.M.E.I.C., has returned from service in German East Africa, and is now in Calgary with the Department of the Interior, Reclamation Service, Irrigation Branch. His address is 513-8th Ave. West, Calgary.

*

Major R. Stephenson Smith, A.M.E.I.C., has returned to Canada from service overseas; his present address is c/o D. E. K. Stewart, Madoc, Ont. Before going overseas Major Smith was with the Transcontinental Railway, Quebec.

*

C. N. Mitchell, V.C., A.M.E.I.C., is being tendered a banquet by the Winnipeg Branch on the evening of December 9th, at which time he will be presented with an address showing the appreciation of his fellow engineers for his glorious record at the front.

*

Messrs F. H. Leonard, Export Manager of Siemens Bros., Co., Limited, and W. B. Hopkins, one of the Company's engineers are at present visiting Canada as part of the final stage of a fourteen months world tour, which has included South Africa, South America, Australia, India and China. These gentlemen report that there is a wide demand for electrical apparatus in practically all of these countries, particularly in South America.

*

Capt. Timothy D. Ruggles, Jr.E.I.C., who returned from service overseas in November 1919, enlisted with the 94th Battalion in 1916 In September 1916 he proceeded to France and was transferred to the Canadian Corps Tramway Co., Canadian Engineers. Previous to enlisting M . Ruggles was employed as Resident Engineer, C.P.Ry. Kenora, Ont., and has again taken employment with the C.P.Ry. as Divisional Engineer with headquarters at Kenora, Ont.

Capt. Gerald M. Hamilton. B.A.Sc., M.C., A.M.E.I.C., was given a commission in the 44th Regiment, Canadian Militia, August 1915, and was transferred the same month to the Engineers Depot at Ottawa. In March 1916, he sailed for England and was in training at Shornecliffe, Kent. In October 1916, Capt. Hamilton crossed the channel with the 7th Field Company Canadian Engineers and was promoted to Captain in the 7th Battalion, C.E., in May 1918. In October 1918, Captain Hamilton was awarded the Military Cross and was placed on the reserve of officers, C.E.F., March 3, 1919.

*

Capt. A. L. Cumming, A.M.E.I.C., who returned to Canada in February 1919, sailed for overseas in March 1916, and went to France in September 1916, being attached to the 3rd Field Company 1st Division, where he served until he was wounded at Passchendale in November 1917. He was then given the acting rank of Captain and was placed on the permanent staff of the 2nd Canadian Engineers Reserve Battalion at Seaford, England. He is now Surveyer in charge of the Dominion Land Survey party subdividing land in the Porcupine Forest Reserve for soldiers' settlement.

*

Cadet F. E. Weir, R.A.F., S.E.I.C., who is at present with the Soldiers' Civil Re-establishment Commission, Brantford, Ont., enlisted in June 1916, in the 67th Battery as a gunner. He sailed for overseas in July 1916 and went to France in September 1916. He served with the 11th Brigade, C.F.A., until that unit was broken up in the spring of 1917. He was then on the strength of the 3rd Artillery Headquarters as Chief Draughtsman until the spring of 1918 when he left for England as a cadet in the R.A.F. He arrived in Canada in January 1919, and was demobilized in February 1919.

*

Gunner E. E. H. Hugli, B.A.Sc., S.E.I.C., enlisted in the 1st Depot Battalion, Volunteer Co., at London, Ont., in December 1917. He was transferred to the 67th Battery, C.F.A., in January 1918, and sailed for England in April 1918. He arrived in France in August 1918, and was put on the strength of the 31st Battery, C.F.A., 9th Brigade, 3rd Division, taking part in the engagements at Arras, Monchey, Canal Du Nord, Bouilon Wood, Cambrai, and Mons, being the first Battery to enter Mons on November 11th, 1918. Gunner Hugli arrived in Canada in March 1919.

*

Major Geo. Alex Walkem, A.M.E.I.C., went to England in the Spring of 1916, was given a commission as Second-Lieutenant and sent to Longmoor in Hampshire. He was given charge of the 2nd half of the 52nd Railway Company. He went to Egypt in September and was gazetted Captain and second in command of the 52nd Company Railway Troops. Lieut.-Col. Walkem stayed in Palestine until the last advance was finished and General Allenby cleaned up the country, when he got a month's leave to Canada, during which time the Armistice was signed, when he returned to England for his discharge.

Major G. W. F. Ridout Evans, M.C., A.M.E·I.C., writes that he has just been demobilized. Like many of our members who have seen distinguished service in the war Major Evans is very reticent about his career in the army. He served for over four years, gained the rank of Major in the Corps of Royal Engineers, that he gained the Military Cross and was mentioned in despatches in November 1918. Major Evans is at present at Newton Abbott, Devonshire, England, taking a well earned holiday. He expects however to take up his profession again shortly.

*

Lieut. L. B. Tillson, M.C., S.E.I.C. enlisted in January 1915 with the Eaton Machine Gun Battery. In March 1915 he was promoted to the rank of bombadier and in June 1915 sailed with the Battery to England. After training with the Eaton Machine Gun Battery at Shornecliffe, Lieut. Tillson was transferred in November 1915 to the Canadian Cavalry Brigade and went to France with them at the end of 1915, when he was promoted to Corporal. In June 1916 Lieut. Tillson gained a commission in the Field Artillery, and after serving as Lieutenant with the 16th Battery, C.F.A. was awarded the Military Cross for service at Lens in August 1917. In March 1918, Lieut. Tillson was sent to hospital on account of internal injuries from an explosion in a dug out. He was finally discharged from hospital in April 1919 after service of four years and three months. Lieut. Tillson has a record in the war of which he can be proud. He worked his way up from Gunner to Lieut. and gained the final honor of the Military Cross, one of the highest honors awarded for valor in war.

*

Capt. L. W. WYNNE-ROBERTS, R.E., A.M.E.I.C.

Capt. L. W. Wynne-Roberts, A.M.E.I.C., has just returned to Canada. Capt. Wynne-Roberts enlisted in England in 1915. In 1916 he was ordered to India and was attached to the 2nd (Queen Victoria's Own) Sappers and Miners at Bangalore, S. India, where he carried out the duties of instructor in military engineering to newly joined officers of the Indian Army Reserve of officers. A few months later he was sent to Mesopotamia and joined No. 9 Field Company of the 2nd (Queen Victoria's Own) working on road reconnaissance and construction on the South Euphrates. In June 1918, Capt. Wynne-Roberts was ordered to North Persia as field engineer on the new road to be constructed from Ruz to Hamadan, an important link in the route to Baku. The R. E. officers were informed that they had from eight to ten weeks in which to make 370 miles of road passable for Ford convoys 24 hours after rain. This work entailed a new alignment, easement of gradients, repair of masonry arches, and the construction of a macadamized road. After this work was completed while Capt. Wynne-Roberts was on his way to England he was detained for four months for sapper work in connection with the Afghanistan Frontier operations, before final demobilization.

EMPLOYMENT BUREAU

Situations Vacant

Electrical Draftsmen

Two electrical draftsmen experienced in transmission line and switchboard detail, desired. Apply Mr. C. H. Speer, Works Engineer, Algoma Steel Corporation, Limited, Sault Ste. Marie, Ont.

Graduate Engineer

Graduate engineer wanted for Eastern College, capable of teaching surveying of the first and second year, freehand drawing, materials of construction, carpentry and wood turning. Apply Box 66.

Position Open in Mexico

Wanted for an oil corporation in Mexico:— One mechanical draftsman, one topographical draftsman, two experienced surveyors. Box 65.

Electrical Engineers

Electrical Engineers required for design and inspection work on wires and cables. Apply W. S. Vipond, Northern Electric Co.

Civil Service Examiner

Engineer who has had practical experience, besides being a graduate in science from a recognized university and who is thoroughly conversant with both French and English, is required to take full charge of the examinations which will include those of all employees of the city, with the exception of medical and legal. Must be able to give highest references. Salary $200 per month. Address box No. 67.

Director of Statistics

Young man, preferably an engineer, required to take charge of the statistical branch of a municipality. Should have had experience in collecting and collating of data. Box No. 68.

An Engineering Clerk, Department of Interior, Calgary

An Engineering Clerk for the Topographical Surveys Branch, Department of the Interior at Calgary, at an initial salary of $1,260 per annum. Candidates must have education equivalent to high school graduation and preferably university graduation in civil engineering. They must have a knowledge of levelling and of the Dominion Lands Survey system, and at least one year's experience in levelling or draughting. The appointee will be required to plot plans from surveyors' field notes and profiles from field notes of levels; to enter elevations on plans; to draw contour lines on plans after plotting elevations; to prepare plans and sketches in connection with levelling work. Candidates should be not more than forty years of age and must be residents of the Province of Alberta.

Candidates will be examined in the following subjects, which have the relative weights indicated: Education and Experience, 400; in this connection a special questionnaire will be sent to the applicants; Theory of Levelling and of the Dominion Lands Survey System, 300; Plotting from field notes, 300. As the work of this office is done to a great extent in English, a knowledge of English is an essential qualification and the examination will be held in the English language only. Candidates will be notified later of date and place of the examination. This position was advertised August 21 and is now re-advertised.

An Inspector in Physics

An Instructor in Physics at an initial salary of $1,800 per annum, to assist in the Royal Military College, Kingston, in teaching and instructing in physics. Candidates should be not more than 25 years of age, and should be graduates in civil, mathematical or electrical engineering, or in honour physics with mathematics as a minor subject from a university of recognized standing.

The examination will be held on Education, Training and Experience along the lines indicated above. An oral examination of the best qualified candidates will be held, if necessary in the opinion of the Commission. This position was advertised August 14, and October 16, and is now re-advertised.

A Custodian of Surveying Equipment, Department of Interior

A Custodian of Surveying Equipment for the Topographical Surveys Branch of the Department of the Interior at an initial salary of $1,320 per annum. Candidates must have education equivalent to high school graduation; perferably a two years' course in engineering at a university of recognized standing or two years of experience in engineering work; thorough familiarity with engineering instruments; knowledge of the methods of receiving, storing, and issuing scientific instruments; good physical condition. The successful candidate will be required to carry on correspondence with surveyors with regard to instrument equipment and with manufacturers and dealers with regard to the purchase of instruments; to equip field parties in the spring with instruments and during the summer to fill requisitions from the field; to supervise repairs, alterations, and improvements to instruments; and to perform other related work as required. Candidates must not be more than 35 years of age.

Candidates will be examined in the following subjects which have the relative weights indicated:— Education and Experience, 300; A written test on the care of Instruments, 200; A written paper on technical correspondence, 200; Oral Examination of the best qualified candidates, if necessary in the opinion of the Commission, 300. As the work of this office is done to a great extent, in English a knowledge of the English language is an essential qualification for the position, and the examination will be held in the English language only. Candidates will be notified later of the date and place of the examination.

ENGINEERING INDEX

On account of the printers' strike in New York the Engineering Index for December has been delayed, and will be published as a special supplement immediately on arrival.

Members of Council for 1919

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* For 1919 † For 1919-20 ‡ For 1919-20-21

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Preliminary Notice

of Applications for Admission and for Transfer

20th November, 1919.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in December, 1919.

FRASER S. KEITH, Secretary.

*The professional requirement are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BARNES—JOHN, of Peterboro, Ont. Born at Radcliffe, Eng., Aug. 25th, 1884. Educ., Mechanics Inst. and Tech. School, Horwich; 1st class certificate in mech. eng., City & Guilds Inst., London, Eng., 1905. 1899-1905, apprenticeship, Lancashire & Yorkshire Ry., Horwich; 1906-07, with R. Hadfields, Sheffield; 1907-08, Beyer, Peacock, locomotive engrs., Manchester; 1910-11, Allis-Chalmer-Bullock, Montreal; 1911-13, engr. and draftsman with Can. Iron Corp., Midland, Ont., hoisting engine design and gen. eng.; 1913-14, with P. Payette & Co., Penetanguishene, Ont.; 1914-16, asst. to chief inspector of ammunition, Ont. dist.; 1916-17, engr. and supt., Napanee Iron Works, mfg. ammunition; Feb. 1917, to date, designer and draftsman, Can. Gen. Elec. Co., Peterboro.

References: R. L. Dobbin, J. A. G. Goulet, J. Mackintosh, G. R. Munro, R. B. Rogers.

BIDDELL—CECIL HENRY (Lieut.), of Regina, Sask. Born at London, Eng., July 1st, 1887. Educ., Christs Hospital, Horsham, Eng. (classical side). D.L.S., 1919. May-Nov. 1912, with E. W. Murray, D.L.S.; Mar.-Aug. 1913, rodman with W. T. Daniel, res. engr., C.P.R., Regina; 1913-15, asst. to O. F. Conmans, of Dept. of Highways, on drainage work in Sask.; 1915, asst. and inst'man to W. T. Thompson, Dept. of Highways, on road work in Sask.; 1916-18, military service; at present, draftsman and plan-checker in surveys branch, Dept. of Highways, Regina.

References: J. N. deStein, E. Markham, E. W. Murray, W. T. Thompson, M. B. Weekes, S. Young.

CARNIEL—CARLO ANTONIO, of St. John, N.B. Born at Vedelago, Italy, Sept. 24th, 1885. Educ., high school, Venice, one yr., Tech. School, Milano, Italy. 1906, timekeeper, C.P.R. coalyard, Outremont; 1906-10, engr. and supt., Cavicchi & Pagano, on N.T.C. Ry.; 1910, engr. and supt., same firm, on A.C.Ry.; 1910-17, subcontractor as follows:—1910-11, on Eastern A.C.Ry.; 1911-12, C.P.R., Sortin yards; 1912-13, shore line; 1913-14, Halifax Terminals with Cook Constrn. Co. and Wheaton Bros.; 1914-16, Montreal and Quebec Highway; 1917, Que. & Sag. Ry.; 1917-19, with Bedford Constrn. Co., at present as manager, for constrn. of St. John Dry Dock and Shipyard.

References: A. E. Doucet, G. Grant, A. Gray, H. E. Huestis, F. S. Keith.

COLE—WILLIAM STANLEY (Capt.), of Montreal. Born at Brockville, Ont., Apr. 30th, 1892. Educ., undergrad., 4th yr. civil eng., McGill Univ.; prelim. D.L.S., 1913 (5 mos.), rodman, etc., C.N.R.; 3 mos., prospecting; 1914 (3 mos.), mucker and helper on machine, Algoma Steel Corp.; 1914-15 (6 mos.) asst. D.L.S., Manitoba; 1916-19, Can. Engineers, 2 yrs. service in France; 1919 (3 mos.) asst., stadia survey, Ontario.

References: E. Brown, R. DeL. French, H. M. MacKay, J. M. Robertson, A. R. Sprenger.

CRUTHERS—WILLIAM MAURICE, of Peterboro, Ont. Born at Manitou, Man., March 16th, 1889. Educ., B.A.Sc., Toronto Univ., 1912. 2 yrs. in testing dept., Can. Gen. Elec. Co.; 6 mos. in direct current section of works eng. dept., 6 mos., as asst. inspector of gas and electricity, Dept. of Inland Revenue, Belleville Dist.; 3½ yrs. as engr. on Hydro-Elec. Power Comm. contracts for Can. Gen. Elec.; at present, engr. on hydro contracts with C. G. E. (production work).

References: R. L. D9bbin, J. A. G. Goulet, A. L. Killaly, G. R. Munro, R. H. Parsons, R. B. Rogers.

CUDWORTH—WILLIAM OSWALD, of North Bay, Ont. Born at Darlington, Eng., Oct. 25th, 1885. Educ., Bootham School; Leighton Park School, reading eng.; private course in chemistry, physics and maths., Manchester Univ., 1906-09, articled to H. J. Rudgard, on constrn. and maintenance, N.E.Ry.; 1909-15, with C.P.R., as follows:P1909, draftsman, etc., double track, Smiths Falls sec.; 1910, rodman, pile inspector, inst'man, constrn., Georgian Bay & Seaboard Ry.(C.P.R.); 1911, transitman, Laurentian subdiv. resurvey; 1912, res. engr., constrn., Campbellford, Lake Ont. & Western Ry. (C.P.R.); 1914-15, res. engr., constrn., Glengarry & Stormont Ry. (C.P.R.); 1915-17 constracting (small work); at present, draftsman, dist. engr's office, C.P.R., North Bay.

References: T. B. Ballantyne, C. T. DeLamere, J. M. R. Fairbairn, C. L. Hervey, S. B. McConnell, C. W. P. Ramsey.

DAYNES—LEONARD STARLING (Capt., D.C.M.), of Beynon, Alta. Born at N. Walsham, Eng., Jan. 24th, 1886. Educ., grammar school. 1904-11, with C.N.R., as follows:—1904-06, rodman on location surveys; 1906-08, topog'r and inst'man; 1908-09, res. engr. in charge of constrn., Moose Jaw Branch; 1909-11, inst'man and res. engr.; 1911-14, res. engr. in charge of constrn. at Grand Brook, B.C., C.P.R.; 1914-19, with Imperial Forces; awarded D.C.M. and Cross of Kara George, Serbia; O.C. of section 240th Light Rly., Forward Coy., R.E., B.E.F.; railroad location constrn. and maintenance with Royal Engrs. in B.E.F.; at present, res. engr. in charge of tunnel constrn., C.N.R.

References: E. Brydone-Jack, W. Burns, H. A. Dixon, T. Turnbull, W. Walkden, T. W. White.

DICKIESON—ARTHUR LOGAN, of Peterboro, Ont. Born at Ottawa, May 1st, 1888. Educ., B.Sc., 1909; M.Sc., 1910, McGill Univ., 1910-15, with Can. Gen. Elec. Co., as follows: 1910-12, apprentice course; 1912, asst. induction motor designer; 1912-15, motor sales engr., Toronto; 1916, electrician, Hollinger Gold Mine, Timmins, Ont., on design of bldgs. and layout of elec. equipment, later shop foreman on consrn. work; 1917-18, engr. in chg. of a survey party with 7th Batt., C.R.T., in Belgium and France; at present, induction motor designer, C.G.E. Co.

References: R. L. Dobbin, J. A. G. Goulet, A. Killaly, G. R. Munro, R. H. Parsons, R. B. Rogers.

DOUGLAS—GEORGE VIBERT (Capt.), of Montreal. Born at Montreal, July 2nd, 1892. Educ., at present, a member of graduating class in mining eng., McGill Univ. 1 summer, G.T.R. shops, Montreal; 1 summer in machine shops of Skinner & Co., Gananoque, Ont.; 3 yrs. with a Pioneer Batt. in France, work included field defences, trench tramways, forward sapping for mining and observation, light ry. location and constrn., etc.; at present, attending McGill Univ.

References: C. Batho, H. M. Lamb, H. M. MacKay, J. B. Porter, A. Stansfield.

ENGLISH—WILLIAM CAMPBELL, of Peterboro, Ont. Born at Peterboro, Aug. 31st, 1892. Educ., public and high school. 1907-14, with Can. Gen. Elec. Co., as follows:—4 yrs. apprentice course in mech. dept.; 2 yrs. 4 mos., in office; 1913-14, in factory; 1914-15, tool designing and mech. drafting, DeLaval Dairy Supply Co.; 1915-16, gen. mech. drafting, Ross Rifle Co.; July 1916 to date, charge of design of tools and machines for induction motors, meters and registers, Can. Gen. Elec. Co., under Mr. J. A. G. Goulet.

References: R. L. Dobbin, J. A. G. Goulet, G. R. Munro, R. H. Parsons, C. H. Rogers.

FOSTER—VERNON SIMONS, of Peterboro, Ont. Born at Parsons, Kansas, Jan. 17th, 1888. Educ., B.Sc., Univ. of Kansas, 1910; M.Sc., Penn'a State Coll., 1916. 1911 (4 mos.) in testing dept., Gen. Elec. Co.; 1910-12, laboratory instructor in elec. eng., Mass. Inst. of Technology, Boston; 1912-15, asst. to works engr., Sprague Elec. Works of Gen. Elec. Co., Bloomfield, N.J.; 1915-16, lab. instructor in elec. eng., Penn'a State Coll.; 1916, to date, engr. in chg., D.C., machine design, Can. Gen. Elec., Peterboro.

References: R. L. Dobbin, J. A. G. Goulet, A. L. Killaly, G. R. Munro, R. H. Parsons, R. B. Rogers.

GILMOUR—WILLIAM ANDREW, of Montreal. Born at Edinburgh, Scotland, Aug. 15th, 1889. Educ., M.A. & B.Sc., Edinburgh Univ. 1911. 1911-12, contractor's agent, with Jackson & Anderson, Scotland, on constrn. of Lower Annandale Waterworks 1912-17, asst. tunnel engr., Montreal Tunnel & Terminal Co., on constrn. of Mt. Royal Tunnel; 1917, to date, asst. engr., Montreal Water & Power Co.

References: J. L. Busfield, A. Gray, W. E. Joyce, F. H. Pitcher, W. H. Sutherland.

GORDON—KENNETH, of Moncton, N.B. Born at London, Eng., Dec 2nd, 1884. Educ., Madras Coll., St. Andrews, Scotland; 2 yrs. course, Armstrong Coll., Newcastle-on-Tyne, Eng.; 1899-1904, apprentice, shops and drawing office, Philip & Son Ltd., marine engrs., Dartmouth, Eng.; 1906-08, junior watch keeping engr., Royal Mail Steam Packet Co.; Apr.-Oct. 1909, rodman and asst. on ry. constrn., New Canadian Co., Gaspe, P.Q.; 1909-10, asst. power house engr., McGill University; 1910-13, designing engr. and draftsman, Railway Signal Co. of Canada, Lachine; Feb.-Aug. 1914, signal inspector, C.G.Ry., Moncton; Aug. 1914-Oct. 1917, in ranks, C.E.F., 1st Field Co., Can. Engrs., 1917-Mar. 1919, 2nd lieut., Royal Field Artillery, at present, signal inspector, C.N.Ry., Moncton.

References:—J. Blizard, C. B. Brown, E. S. Malloch, V. I. Smart, R. B. Stewart.

GOULET—SIFROY, of Peterboro, Ont. Born at Holyoke, Mass., May 8th, 1891. Educ., grad., Mount St-Louis scientific course, 1910. 1910-16, draftsman in mech. engr's office, Can. Gen. Elec. Co., Peterboro, designing mach'y, tools and transmissions; 1916, to date, chief mech. draftsman and asst. to mech. engr., same firm.

References: R. L. Dobbin, J. A. G. Goulet, G. R. Munro, R. H. Parsons, C. H. Rogers.

GRAFFTEY—WILLIAM ARTHUR (Major), of Westmount, P.Q. Born at Montreal, Aug. 27th, 1891. Educ., B.Sc., McGill Univ., 1914. 3 mos., John McDougall machine shop; 3 mos., Can. Steel Foundries; 3 mos., town eng'g., Westmount; 18 mos., eng. dept., C.P.R.; 4 yrs. coy. commander in H.M.O.F., 42nd Batt., R.H.C.; at present, engr., wood dept., Riordon Pulp & Paper Co. Ltd.

References: E. Brown, F. B. Brown, C. L. Cantley, G. G. Gale, J. A. Jamieson, C. M. McKergow, E. H. Pacy, C. B. Thorne.

GREGORY—PHILIP STANCLIFFE, of Montreal. Born at Fredericton, N.B., July 25th, 1888. Educ., B.A. (hons. maths.), Bishops Coll., Lennoxville, 1908; B.Sc., McGill Univ., 1911. Summer work with Montreal Tramways Co.; 8 mos., eng. apprentice, Can. Westinghouse Co., Hamilton; 18 mos., designing street cars, under supt. of rolling stock, Montreal Tramways Co.; 2½ yrs., chief draftsman, Elec. Service Comm. of Montreal; at present, elec. engr. of subsidiary distribution companies. Shaw. Water & Power Co., also in chg. of 30 to 60 cycle change over work at Three Rivers.

References: R. H. Balfour, C. V. Christie, L. A. Herdt, R. S. Kelsch, J. C. Smith, S. Svenningson, R. M. Wilson.

HEBERT—HENRY FRANCIS, of Toronto, Ont. Born at Ipswich, Eng., Oct. 16th, 1873. Educ., Crystal Palace Eng'g Coll., London, Eng.; student, Inst. of civil eng. (England). 1895-7, articled to Sir Wm. Shelford, M.I.C.E.; 1897-8, chief asst. engr.. Brechin & Edzell Ry., Scotland; 1898-1900, asst. engr. for Imperial Govt. on Lagos Ry., W. Africa; 1900-02, asst. in offices of Sir Wm. Shelford and Sir Benjamin Baher: 1905-07, asst. in office of Sir Wm. Shelford; 1907-08. asst. engr. in London office for Para, S. America, Harbor Improvements; 1912-14, chief asst. in chg. of office work, to div. surveyor, Ont. div., C.P.R., Toronto; 1915-18, asst. in office of Govt. for Toronto Harbor Improvements; Feb. 1918, to date, asst., Hydro Elec. Power Comm.

References: H. G. Acres, W. Harland, T. H. Hogg, J. R. Montague, A. E. Nourse, M. V. Sauer.

HERD—CHARLES EDWARD, of Montreal. Born at Crewe, England, July 12th, 1875. Educ., Crewe Academy; evening classes, Mechanics Institute, Horwich; private tuition. 1889-93, apprentice, Lancashire & Yorkshire Ry., Horwich; 1895-97, fitter and asst. to chief draftsman, C.P.R., Hochelaga; 1897-98, draftsman, Royal Elec. Co. Ltd., Montreal; 1898-99, draftsman, C.P.R.; 1899-1910, draftsman to asst. supt., Laurie Engine Co., in latter years had direct charge of design, preparing estimates and specifications for Corliss engines, etc.; 1910-11, asst. draftsman, Allis-Chalmers-Bulloch, on hydraulic turbines, also chief draftsman with responsible charge of mech. design of elec. apparatus, etc.; 1911-14, chief engr., Dom. Safe & Vault Co., Farnham, P.Q., direct charge of equipping and installing plant to mfr. safes, pull-up and flour mill mach'y.; 1916-17, asst. chief draftsman, Montreal Ammunition Co.; at present, engr in design and estimate dept., Dom. Bridge Co.

References: G. P. Cole, G. H. Duggan, E. T. Mug, F. Newell, P. L. Pratley, H. H. Vaughan.

HOOPER—VICTOR C., of Port Arthur, Ont. Age 35. 1911-12, res. engr., constrn., G.T.P.; 1912, res. engr., constrn., C.N.R.; 1913, track centres, T.C.Ry.; 1914-15, res. engr., constrn., A. & G.W.Ry.; 1916, res. engr., maintenance, E.D. & B.C. Ry.; 1919, track centres, C.N.R.

References: C. Ewart, R. W. Jones, L. E. Silcox, W. R. V. Smith, T. Turnbull.

JOHNSTON—BRUCE HENRY (Lieut.), of Toronto. Born at Port Stanley, Ont., Jan. 4th, 1894. Educ., at present, in 2nd year, elec. engr., S.P.S., Toronto Univ. 4 yrs., apprentice course in testing dept., Can. Gen. Elec. Co., Peterboro; 2 yrs., power plant and elec. ry. constrn., Hydro-Elec., London, Ont.; Feb. 1916, enlisted in Can. Engrs., Signal Coy., 1916-18, in France with 4th Can. Div. Signal Coy.; at present, attending Toronto Univ.

References: J. R. Cockburn, P. Gillespie, H. E. T. Haultain, T. R. Loudon, C. R. Young.

KER—MERLE, FRANKLIN, of Niagara Falls, Ont. Born at Niagara Falls, May 23rd, 1894. Educ., B.Sc., Queen's Univ., 1918. Summers 1913-14-16, asst. city engr., Niagara Falls; 1915, maintenance work, G.T.R.; 1917, land surveying and railroad work, Hydro-Elec. Power Comm.; at present, field draftsman, H. E. P. C.

References: A. C. D. Blanchard, H. L. Bucke, J. C. Gardner, J. B. Goodwin, R. P. Johnson, W. L. Malcolm, T. S. Scott, E. A. Stone.

MacEWEN—EWEN, of Montreal. Born at Toronto, Oct. 11th, 1893. Educ., at present undergrad., McGill, 4th year civil eng. Grade separation, G.T.R., Toronto; rodman, etc., B.C.L.S.; material clerk, etc., Anglins, Ltd., Montreal; draftsman, eng. dept., Ross & Macdonald, architects; 3½ yrs. overseas with Can. Engineers and Artillery.

References: E. Brown, J. M. R. Fairbairn, R. DeL. French, H. M. MacKay, W. McNab.

MACFARLANE—DONALD HENRY (Capt., M.C.), of Montreal. Born at Sherbrooke, P.Q., Mar. 9th, 1894. Educ., at present in 3rd year mech'l eng., McGill Univ. 13 mos. with C.P.R. survey section; 4 mos. with Loomis, McBean & Williams, on repair, Ottawa Intake Pipe; Feb. 1915-March 1919, military service; at present attending McGill Univ.

References: E. Brown, C. M. McKergow, J. T. Morkill, J. B. Porter, A. R. Roberts.

MAGIE—LOUIS DEWITT, of Peterboro, Ont. Born at East Orange, N.J., Apr. 8th, 1872. Educ., special high school course; private tuition. 2 yrs. in test dept., Leo Duft Mfg. Co.; 4 yrs., in chg. of test dept. in laboratory work and constrn., Stanley Elec. Mfg. Co.; 6 yrs., works engr., in chg. of all eng. work of mfg. end, Royal Elec. Co. of Montreal; 19 yrs. (to date), works engr., Can. Gen. Elec. Co., Peterboro, in direct charge of all eng. work.

References: R. L. Dobbin, J. A. G. Goulet, A. L. Killaly, G. R. Munro, R. H Parsons, R. B. Rogers.

McCURDY—LESLIE BRIGGS (Capt.), of Truro, N.S. Born at Truro, Feb. 22nd, 1891. Educ., C.E., N.S. Tech. Coll. 1913. Summers 1906-09, bldg. constrn; 1910, base line and gen. survey work, Dom. Iron & Steel Co., Sydney, N.S.; 1911, location survey, hydro elec. dvelopment at Indian River, N.S.; 1912, asst. engr., town of Truro, installing water and sewage systems, paving etc.; 1913, sup'g eng. for towu of Lunenburg, N.S., during installation of complete sewer system; 1913-15. drafting, designing and gen. eng. office work, Halifax Ocean Terminals; 3 yrs. military service, Can. Engrs.; at present, industrial surveyor, D.S.C.R., Halifax.

References: A. C. Brown, O. S. Cox, F. W. W. Doane, J. R. Freeman, J. McGregor, J. W. Roland.

McGHIE—WILLIAM GORDON (Major), of St. Catharines, Ont. Born at St. Catharines, Aug. 13th, 1891. Educ., B.A.Sc., Toronto Univ. 1911; postgrad. 1912. 6 mos. machine shop and elec. repair work, Can. Steel Foundries, Welland, and Jenckes Machine Co., St. Catharines; 1911 (3 mos.)-1912-14, elec. engr., testing and designing depts. Can. Crocker-Wheeler Co.; 1914-15, asst. to chief engr., same firm; Mar. 1915-May 1919, military service, 3 yrs. in France with eng'g units; 1918-19, coy. commander, Can. Engineers; at present, sales engr., Can. Crocker-Wheeler Co. Ltd.

References: J. C. Ball, H. B. Dwight, C. J. Ingles, R. W. Leonard, R. G. Saunders.

McKINNEY—JAMES HAROLD, of St. John, N.B. Born at St. John, N.B., March 5th, 1889. Educ., St. John High School. 1910 (3½ mos.), on Valley Ry.; later till 1912 on sewer work with Deputy Land Surveyor, inst'man, etc.; April 1912 to date with D.P.W., St. John Harbor, N.B., inst'work, estimates, planning cribwork, etc.; at present, asst. engr. on constrn. of Courtenay Bay Drydock and breakwater.

References: E. G. Cameron, A. R. Crookshank, A. R. Dufresne, A. Gray, H. D. Macaulay. F. L. Richardson, A. R. Sprenger, C. McN. Steeves.

MELROSE—ROBERT, of St. John, N.B. Born at St. John, Mar 8th, 1892. Educ., certificate, special course, forest eng., Univ. of N.B., 1915. Inst'work with British American Constrn. Co., St. John; chief of party with N.B.Ry. and Prov'l Govt. on forest surveys; at present, deputy land surveyor, Prov. of N.B.

References: A. R. Crookshank, W. C. Ewing, F. G. Goodspeed, G. G. Hare. G. G. Murdoch, C. McN. Steeves, J. A. Stiles.

MILLS—NATHANIEL CHILD, of Montreal. Born at Boston, Mass., Nov. 20th, 1872. Educ., B.Sc., C.E., E.E., Tufts Coll., 1902; 2 yrs. Harvard Univ.; 1 yr. Union Univ., post grad. work; member, A.I.E.E. and A.S.M.E. 1903-05, chief engr., Espluts River Lumber & Pulp Co., Nfld.; 1905-09, designing engr., Gen. Elec. Co.; also constrn. engr., Stanley Co.; 1909-19, chief designing engr., on all induction motor work, Can. Gen. Elec., Peterboro; at present, conslt. engr., Montreal; vice-pres., and gen. mgr., Montreal Armature Works Ltd.

References: W. A. Burke, J. A. Burnett, G. R. Monro, M. A. Sammett, R. L. Dobbin, J. A. G. Goulet, R. H. Parsons, R. B. Rogers.

PENNEY—EDGAR, of Montreal. Born at Carbonear, Nfld., Jan. 20th, 1889. Educ., at present a member of graduating class, McGill Univ., 1908-09 (6 mos.), miner Can. Copper Co.; 1909-10 (10 mos.), miner, Dom. Coal Co.; 1910-14, with Reid-Newfoundland Co., on ry. location and constrn., 1913, as engr. on constrn.; 4 yrs. on active service as an officer, 3 yrs. with Corps of Royal Engrs., responsible for constrn., reconstrn. and demolition of main lines, bridges, etc.; at present, attending McGill Univ.

References: C. Batho, H. M. Lamb, H. M. MacKay, J. B. Porter, A. Stansfield.

PROCTOR—WILLIAM DOUGLAS (Lieut.), of Toronto, Ont. Born at Sarnia, Ont., July 25th, 1895. Educ., student, 3rd yr. Faculty of Applied Science and Eng'g., Univ. of Toronto. Vacations 1913-15, municipal work at Sarnia, Ont.; 1915-16, with Can. Inspection Co., on shell inspection; 1916-19, military service; 1919, res. engr., James, Loudon & Hertzberg Ltd., Toronto, on pavement constrn. at Strathroy, Ont.; at present, attending Toronto Univ.

References: P. Gillespie, E. A. James, C. H. Mitchell, E. M. Proctor, C. R. Young.

REDFERN—WESLEY BLAINE, of Toronto. Born at Owen Sound, Ont., Dec. 11th, 1886. Educ., B.A.Sc., Toronto Univ., 1909. 2 Summers on railroad maintenance; 1 summer on power development work, Niagara Falls; 1909-12, res. engr., on municipal work in Orillia, Dunnville, Steelton, Weyburn and Dauphin, Man., with Willis Chipman; 1912-15, town engr., Steelton, Ont.; 1916-May 1919, military service; at present with E. A. James Co. Ltd., conslt. engrs., Toronto.

References: J. R. W. Ambrose, F. A. Dallyn, T. H. Hogg, A. A. Kinghorn, E. M. Proctor.

SMITH—NEVILLE HERBERT FRANCIS, of Ottawa. Born at Quyon, P.Q., Aug. 31st, 1889. Educ., D.L.S., 1914. 1906, rodman on precise levelling party; 1907-10, recorder; 1911-16, surveyor in charge of precise levelling party; 1917-to date, in charge of subdiv. of adjusting div., Geodetic Survey of Canada.

References: L. O. Brown, M. F. Cochrane, H. F. J. Lambart, J. J. McArthur, N. J. Ogilvie, J. L. Rannie, F. B. Reid, W. M. Tobey.

THURBER—GEORGE HENRY, of Chatham, N.B. Born at Harcourt, N.B., Feb. 25th, 1892. Educ., 2 yrs. in Arts, with eng'g. at Kings Coll., Windsor, N.S.; 4 yrs., civil eng., N.S. Tech. Coll. April 1911-Sept. 1912, student asst., Sept. 1912, to date, asst. engr., P.W.D., Canada, Chatham, N.B.; had charge of various small works, including dredging, wharf constrn., repairs, etc., under supervision of dist. engr.; Apr. 1915-Aug. 1919, overseas with Can. Field Artillery, signaller and draftsman.

References: W. C. Ewing, T. S. Hewerdine, H. R. Logie, G. E. Martin, G. Stead.

TRAILL—JOHN JAMES, of Toronto. Born at Hamilton, Ont., Oct. 13th, 1884. Educ., B.A.Sc., 1906; C.E., 1919, Toronto Univ. 1903-04 (9 mos.), 1905-06 (5 mos.), land and drainage surveys; 1907 (5 mos.) city of Toronto sea-wall surveys and bridge constrn.; 1913 (4 mos.), cost data on sewers, Toronto; 1914 (5 mos.), 1916 (4 mos.), Hydro Elec. Power Comm., hydrographic investigations; 1915 (5 mos), Lake of the Woods Tech. Board, storage investigations; 1910-19, lecturer in hydraulics, Univ. of Toronto; 1917-18-19 (13 mos.), hydraulic investigations and design, H.E.P.C.; at present, asst. prof. in hydraulics, Univ. of Toronto.

References: H. G. Acres, L. M. Arkley, P. Gillespie, T. H. Hogg, C. H. Mitchell, M. V. Sauer, W. Storrie.

TUCK—LEON S., of Kenogami, P.Q. Born at Lee, Maine, Mar. 23rd, 1891. Educ., B.Sc., Univ. of Maine, 1913. 1913-15, surveyman, U.S. Reclamation Service; 1915, to date, with Price Bros. & Co. Ltd., 2 yrs. as asst. engr., 2½ yrs. as engr.

References: J. S. Bates, E. A. Evans, J. F. Grenon, G. F. Hardy, J. McCarthy, F. O. White.

WARNER—JOHN EDWIN ARCHIBALD (Lieut.), of Cape Madeleine, P.Q. Born at Kentville, N.S., Jan. 31st, 1892. Educ., B.Sc., McGill Univ., 1912; special mention, 1st Army Bridging School, France, 1918. 12 mos. (before graduation), mechanic, bench fitting and operating machine tools; 1912-13, asst. to supt., Can. Fairbanks-Morse, Toronto Plant, as engr. in chg. of extensive new plant constrn.; 1913-14, designing engr., Lloyd Mfg. Co. Ltd., Kentville, N.S., in complete chg. of design of new gas engines; 1914-16, asst. engr., Dom. Water Power Branch, Ottawa, in chg. of investigations and reports and general analysis; Mar. 1916-Mar. 1919, Lieut., Can. Engrs.; In England in chg. of purchase and operation of Aerodrome constrn. plant; in France in chg. of heavy bridging, 4th A.T.Co., C.E., since July 1919, asst. engr., St. Maurice Paper Co. Ltd., in chg. of plant design and efficiency investigations.

References: C. H. Atwood, J. B. Challies, J. T. Johnston, R. S. Lea, J. H. McLaren, J. B. McRae.

WILLSON—ARTHUR GEORGE, of Calgary, Alta. Born at London, Eng., July 12th, 1885. Educ., eng'g., City & Guilds Inst. (London, Eng.,) certificated 1907. 1907-11, asst. to R. F. Grantham, M.I.C.E., F.G.S., London; 1911-13, chief asst. to A. Havelock Case, M.I.C.E., engr. to Essex Sewers Comm., looking after various works of constrn. and maintenance; Apr.-Nov. 1913, on eng. staff of Calgary Power Co., during constrn. of hydro elec. plant at Kananaskis, Alta.; 1913-14, on eng. staff of C.P.R. Western Irrigation Block, in chg. of survey party during season; Aug. 1914 enlisted in 1st Can. Div., went to France Feb. 1916, returned, Apr. 1919; at present, res. supt. for Alta. of eng. branch, D.S.C.R., in chg. of all structural work and maintenance for hospitals and instutions in Alta.

References: A. S. Chapman, G. W. Craig, W. J. Gale, H. S. Johnston, G. Romanes.

WINSLOW—EDWARD SPRAGGE, of Westmount, P.Q. Born at Montreal, Nov. 23rd, 1886. Educ., B.Sc. (M.E.), McGill Univ., 1908. 1 yr. inspector, Robt. W. Hunt & Co.; later with Can. Ingersoll Rand Co.; at present asst. to gen. mgr., Can. Ingersoll Rand and Jenckes Machine Co.

References: A. A. Bowman, N. M. Campbell, W. B. Dawson, R. J. Durley, T. M. Fyshe.

WOFE—SYLVESTER CUTHBERT, of Montreal. Born at West Medford, Mass., Sept. 2nd, 1883. Educ., B.S., M.I.T., 1906. 1906-08, field bridge inspector, Rhode Island Co.; 1908-11, Stone & Webster, structural design; 1911-12, estimating engr., Minneapolis Steel & Machy Co.; 1912-14, concrete design, Purdy & Henderson; 1914-15, engr., Truscon Co.; 1915, to date, engr. in chg. of all design, Lockwood, Greene & Co. of Canada Ltd.

References: G. S. Baxter, E. G. Horne, F. S. Keith, C. M. Morssen, H. W. B. Swabey.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

GILLIATT—JOHN BURTON, of Wabana, Nfld. Born at Granville Centre, N.S. Educ., B. Eng., Dalhousie Univ., 1907; mech. drawing, I.C.S. Summers 1904-06, land surveying and street paving work; 1907-08, official plan and survey, city of Halifax; 1908-09, draftsman, N.T.C. Ry., St. John, N.B.; 1909-11, inst'man, constrn., T.C.Ry. in N.B.; 1911- draftsman, T.C.Ry., Ottawa; 1912-13, res. engr., T.C.Ry., Dist. E., Ont.; 1913-15, res. engr., Dist. D., Ont. and C., Quebec; 1915 (6 mos.), field engr., road comm'rs. office, Halifax; 1 mo., Dom. Iron & Steel Co., Sydney; Jan. 1916, to date with N.S. Steel & Coal Co., as follows:—Jan.-May 1916, draftsman, New Glasgow; 1916-17, asst. on surveys, new shops, Wabana; June 1917, to date, in chg. submarine surveys and surface constrn., Wabana.

References: C. B. Archibald, T. S. Armstrong, A. R. Chambers, R. E. Chambers, A. S. Cook, F. W. W. Doane, D. H. McDougall.

GOULET—JOSEPH AIME GODEFROY, of Peterboro, Ont. Born at St. Eustache, P.Q., Oct. 22nd, 1868 Educ., McGill Univ. and Ecole Poly., M.E., 1890; private tuition in higher maths. 1890-91, in chg. of testing dept., Deane Steam Pump Co., Holyoke, Mass.; 1891-92, sounding of Saguenay River and relocating buoys, etc.; 1892-93, mech. engr. and supt., Northey Mfg. Co. of Toronto; 1893-94, engr., representing Canada at Chicago Columbian Exposition, having chg. of erection, mach'y, etc.; 1894-96, asst. supt. of dredging and mech. engr. in chg. of designing and constrn., Govt.s hipyard at Sorel, P.Q.; 1896-99, mech. engr. and chief designer, Northrop Loom Co. of Canada, Valleyfield; 1899-1900, mech. engr. and chief designer, Draper Corp., Hopedale, Mass.; 1900-01, master mechanic, Isaac Mautner & Sohn, Vienna, Austria, and Buda Pesth, Hungary; 1902-04, designing draftsman, Can. Gen. Elec. Co., Montreal plant; 1904 to date, mech. engr., Can. Gen. Elec. Co., Peterboro, in chrge. of mech. eng. work.

References: R. L. Dobbin, F. S. Keith, J. Mackintosh, G. R. Munro, R. H. Parsons, R. B. Rogers.

HARE—GEORGE GRAY, of St. John, N.B. Born at Kaarsloof, South Africa, July 22nd, 1870. Educ., B.A.Sc. (civil), McGill Univ., 1896. Summers 1894-95, rodman, etc., 1896-97, asst. engr., Dept. Marine Tidal Survey; 1897-98, asst. to H. B. Smith, C.E., Rossland, B.C., surveys for townsites, etc.; 1898-99, draftsman on location, inst'man, on constrn., C. & W.Ry.; Mar.-Sept. 1899, draftsman on prelim. and location, G.N.Ry.; 1899-1900, asst. surveyor, British American Corp., Rossland, B.C., underground surveys, etc., various mines; Feb.-Sept. 1900, draftsman on location. C.P.R.; 1900-01, inst'man on location, A.C.Ry.; 1901-03, asst. engr., Waddell & Hedrick conslt. bridge engrs., Kansas City, Mo., surveys, detailing, etc.; 1903-17, with C.P.R. as follows:—1903-07, res. engr., Woodstock, N.B.; 1907-12, engr., Kingston & Pembroke Ry.; 1912-13, asst. engr., in chg. reconstrn. bridges, Dom. Atlantic Ry.; 1913-17, engr., Dom. Atlantic Ry., Kentiville, N.S.; Feb.-Dec. 1917, asst. engr.; 1918, asst. engr., C.G.Rys.; May 1918, to date, city engr., St. John, N.B.

References: C. B. Brown, W. B. Dawson, C. E. W. Dodwell, J. M. R. Fairbairn, A. Gray, J. C. Gwillim, C. C. Kirby, H. M. MacKay, P. B. Motley.

HARVIE—EBEN NASMYTH, of Cambridge, Eng. Born at Bellshill, Scotland, July 3rd, 1883. Educ., C. E. course, Royal Tech. Coll., Glasgow. 1898-1907, apprentice and asst. with Maccall & Findlay, surveyors, also Syson & Midgeley, C.E., Glasgow; 1907-08, draftsman and inst'man, G.T.P.Ry., Wpg. and B.C. 1909-11. municipal engr., South Vancouver, all road constrn., bridges, water scheme, etc., and constrn. engr., Burnaby, B.C., superintendence and constrn. of road, etc.; 1912-14, engr. and surveyor, Vancouver School Board; 1915, to date, Imperial Ministry of Munitions of War, on constrn. of standard and narrow gauge rys., factory passenger stations, etc., since July 1917, res. engr., later chief engr., at Cambridge Coprolite Workings, Trumpington, Cambridge, England.

References: C. Brakenridge, A. G. Dalzell, F. L. Macpherson, F. Silverton, L. E. Wilson.

HENRY—ROBERT ALEXANDER CECIL, of Ottawa. Born at Montreal, Sept. 20th, 1884. Educ., B.A., B.Sc., McGill Univ. 1912. 1904-06, rodman, leveller, etc., C.P.R.; 1907-08, asst. engr., C.P.R.; June-Dec. 1909, asst. engr., water power investigation, Dept. of Interior; 1909, private work, reinforced concrete; May-Nov. 1911, supt. on concrete constrn., Jago Co., Montreal; 1912-13, inspecting engr., Dept. Rys. & Canals, North Bay and Ottawa; Dec. 1913, to date, asst. engr., Dept. Rys. & Canals, Ottawa.

References: W. A. Bowden, H. M. MacKay, J. Murphy, L. Sherwood, A. F. Stewart.

KIRBY—CHARLES CONYERS, of St. John, N.B. Born at Newport, England, Mar. 8th, 1880. Educ., Welsh Intermediate School and Newport Tech. Coll. 1898-1907, articled pupil and asst. to civil engr. in private practice; 1907-08, inst'man on location survey, G.T.R.; June-Nov. 1908, contractors supt. on re-inforced concrete constrn., Ottawa; 1909 to date with C.P.R. as follows:—1909-10, transitman, Ottawa; 1910-11, res. engr. in chg. Quebec dist.; 1911-12, res. enr., in chg. Montreal Terminals; 1913-15, asst. engr., office of ch. engr. and gen. mgr., Montreal; Dec. 1915, to date, dist. engr., N.B. dist.

References: A. Gray, G. G. Hare, P. B. Motley, G. G. Murdoch, J. W. Orrock.

LONGLEY—FRANCIS FIELDING, of New York, N.Y. Born at Chicago, Ill., Oct. 23rd, 1879. Educ., grad. and commissioned in Corps of Engrs., U.S. Army, U.S. Mil. Academy, West Point, 1902 1903-04, special student, sanitary eng'g., Mass. Inst. of Tech. Sept. 1902-Oct. 1903, asst. on constrn. of paper mill and hydraulic works; 1904, operation and test of mech'l filter plant, Moline, Ill.; 1904-05, in chg. of operation of mech. filter plant, Watertown, N.Y.; 1905-08, chief chemist and asst. supt. in chg. of Washington, D.C., Filtration Plant; 1908-09, responsible chg. of surveys, investigations and design of extensions to water supply system of Washington, D.C.; 1909-13, responsible chg. of constrn. of Toronto Water Filtration Plant; Feb. 1913, to date, member of firm, Hazen, Whipple & Fuller. conslt. engr., N.Y.C.; Aug. 1917-July 1919, military service in France in charge of water supply service, A.E.F.

References: G. W. Fuller, A. Hazen, R. Hering, H. W. Hodge, M. Knowles, C. H. Mitchell, C. H. Rust, W. Storrie, R. S. Weston.

MALCOLM—WILLIAM LINDSAY (Lt.-Col.) of Kingston, Ont. Born at Mitchell, Ont., Feb. 2nd, 1884. Educ., M.A. 1905, B.Sc. 1907, Queen's Univ., O.L.S.; D.L.S., 1907, city engr., Stratford, Ont.; 1909-11, assoc. city engr., Guelph, Ont.; 1912-14, private practice, Guelph; 1907-14, asst. prof. civil eng., Queen's Univ.; 1914-19, overseas, 1917-19, Lt.-Col., Can. Engrs.; Sept. 1919, to date, prof., municipal eng., Queen's Univ.

References: L. W. Gill, J. C. Gwillim, A. Macphail, T. S. Scott, W. P. Wilgar.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

BUNTING—HARRY LAWRENCE (Lieut., M.C.), of Norwood, Man. Born at Carlisle, Eng., Oct. 25th, 1888. Educ., B.Sc. (eng'g), Birmingham Univ., England, 1909. 1910-12, draftsman and designer, gen. eng. work in England; 1913, in engr's office, C.N.R.; 1914-16, asst. engr., Munic. of St. Vital, Man., in chg. of constrn. of waterworks, sewers, etc.; Mar. 1916-Aug. 1919, with C.E.F., Nov. 1917-Mar. 1919, with 5th Army Troops Coy. in France, 4 mos. in chg. of this coy., awarded M.C.; Sept. 1919, to date, instructor in eng. drafting at Wpg. Re-Training Schools, S.C.R.

References: T. W. Clarke, E. P. Fetherstonhaugh, F. H. P. Parr, A. W. Smith, W. Walkden.

RUGGLES—TIMOTHY DWIGHT (Capt.), of Kenora, Ont. Born at Paradise, N.S., Feb. 11th, 1886. Educ., B.Sc., Univ. of N.B., 1908. 1908-10, draftsman, level-man and transitman, H. B. Ry.; 1910-12, inst'man, C.P.R.; res. engr., C.P.R., Kenora, Ont., double track main line, Winnipeg to Fort William; 1915, enlisted, Sept. 1916 transferred to France, held various responsible positions; capt., 2nd Tramway Coy., Can. Engrs.; at present, div. engr., C.P.R.

References: G. W. Coburn, C. H. Fox, J. M. Gilchrist, J. C. Holden, W. E. Joyce, F. Lee, H. W. McLeod, M. J. Rutledge.

SPRENGER—HAROLD, of Winnipeg, Man. Born at Leamington, Eng., Aug. 20th, 1889. Educ., Brewood Grammar School; Stafford Tech. School; Wolverhampton School of Art; Board of Education, S. Kensington, England. 1909-11, articled to H. M. Whitehead, engr. to Cannock Urban District Council, England; 1911-12, on sewage disposal work, water supply, roads and gen. municipal eng.; 1912-13, draftsman, C.N.R., Winnipeg; 1914-15, asst. munic. engr., rural munic. of St. Vital, Man.; 1915-Feb. 1916, acting munic engr.; 19 mos. service in France and Belgium with Can. Engrs., 7 mos., engr. officer to Can. Corps Heavy Artillery, discharged Aug. 1919; at present, in charge of work. Carter-Halls-Aldinger Co.

References: T. W. Clarke, E. P. Fetherstonhaugh, E. G. Goldie, A. McGillivray, F. H. P. Parr, S. Wilkins.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

AUSTIN—FRANK DOUGLAS, of Sault Ste. Marie, Ont. Born at Brockville, Ont., Sept. 14th, 1890. Educ., B.A.Sc., S.P.S., Toronto Univ., 1915. Summers 1912-13-14, rodman, etc., finally in responsible chg. of laying out and drawing up plans of subdivs., J. W. Fitzgerald, O.L.S., Peterboro; Nov. 1914-Apr. 1919, military service; May 1919, to date, asst. to city engr., Sault Ste. Marie, in chg. of laying out sewers, etc.

References: L. R. Brown, R. L. Dobbin, P. Gillespie, W. L. McFaul, N. L. Somers, A. G. Tweedie.

LONGWORTHY—WILLIAM EARLE (Lieut. M.C.), of Regina, Sask. Born at Regina, June 21st, 1891. Educ., B.A.Sc., Toronto Univ., 1915. Summers 1912-13-14, bridge inspector, Sask. Board of Highway Comm'rs; May-Oct. 1915, with Sask. Water Comm.; Mar. 1916, lieut., 60th Battery, C.F.A., wounded Oct. 1918; awarded M.C., Dec. 1918; experience in constrn. of gun pits, bldg. of observation posts and dugouts; at present, asst. engr. on sewage, city of Regina.

References: H. S. Carpenter, J. N. deStein, A. P. Linton, H. R. Mackenzie, H. N. Macpherson, D. A. R. McCannel.

MUNRO—ALAN HUGH (Lieut.), of Severn Falls, Ont. Born at Peterboro, Ont., Aug. 18th, 1889. Educ., B.A.Sc., Toronto Univ., 1911. Summers, 1909 with C.P.R. on maintenance and hydro elec. power development, with Smith, Kerry & Chace; 1910, rodman on line surveys, H. E. P. Comm. of Ont.; 1911-12, rodman, inst'man, Smith, Kerry & Chace, on constrn. of Auburn Power Co., Peterboro; 1912-14, inst'man, Rice Lake Div., Trent Canal; 1914-19, with Can.Div. of Engrs., C.E.F., as sapper and lieut.; Apr. 1919 to date, inst'man on Severn Div., Trent Canal.

References: P. Gillespie, A. J. Grant, F. S. Lazier, J. B. McRae, R. B. Rogers.

SCHELLENS—EUGENE LEVERING, of Montreal. Born at Petropolis, Brazil. Aug. 9th, 1892. Educ., B.Sc., McGill Univ., 1916. 1916-17, transportation student, C.P.R.; May 1917, enlisted in U.S. Army; Aug. 1917-Apr. 1919, engaged in constrn. and operation of light rlys. in various capacities; June 1919 to date, mech'l. representative, Franklin Rly. Supply Co. of Can. Ltd., in charge of company's interests at Angus Shops, Montreal Loco. and Canadian Loco., Kingston.

References: C. Batho, E. Brown, H. O. Keay, C. M. McKergow, V. I. Smart.

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The Van Sicklen Tachometer consists essentially of two parts, a set of gears which moves the indicating hand over the scale, and an accurate watch mechanism which measures off the hand moves. This is merely an application of the simplest type of speed measuring device, a stop-watch and a speed counter.

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No. 1. The indicating hand is driven directly, by means of gears, by the shaft whose speed is to be measured.

No. 2. The period of time through which the hand moves is measured off by an Elgin watch movement. A consideration of these two facts makes it plainly evident that the Van Sicklen Tachometer is a precision Tachometer, because its accuracy depends only upon the accuracy of the timing mechanism, and the name ELGIN is a sufficient guarantee of that. A study of these same two facts, in the light of scientific principles of the Chronometric Tachometer designs, reveals the absence of the following defects fundamentally in the design of other types.

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No. 4. There is no central pivot, the wear of which can displace any of the parts with relation to each other, and thereby affect the accuracy of the readings.

No. 5. The instrument has no period of its own which must accommodate itself to an oscillation impressed upon it.

No. 6. Accuracy of the instrument is not affected by external vibration.

No. 6. The instrument is universal in application, being adapted to any purpose for which speed counters are employed.

The first reading is given in one second. The indicating hand is held at its reading point for one second, then released and a new reading is given, showing whether the speed of the moving member has either increased or decreased. When the instrument is taken off the moving member, the indicating hand fall back to zero.

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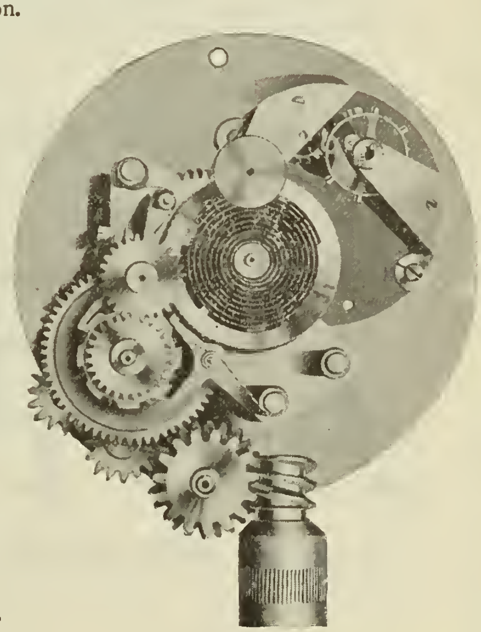

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